SELF-STUDY REPORT

OF THE

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

AT

THE UNIVERSITY OF TEXAS AT DALLAS

Prepared by the Faculty of the Department of Materials Science and Engineering

March 2013

http://www.mse.utdallas.edu/

PREFACE

This document provides background information for the April 2013 external review of the Department of Materials Science and Engineering (MSE) at the University of Texas at Dallas (UT Dallas). The report contains a brief overview of the university, an outline of the Materials Science and Engineering Department history, a review of department accomplishments over the last five years, and a summary of strategic and sustainability issues, operational procedures, budget, and personnel.

Based on the needs of North Texas and the United States, the main goal of the UT Dallas MSE department is to produce a highly-qualified workforce for industry (including established and start-up companies), government laboratories and universities in areas of microelectronics, energy, and bioengineering, which are all based on advanced materials. Such a workforce can only be trained within a thriving and cutting-edge research environment. Therefore, the mission of the department is two-fold: i) to devise the best curriculum and research environment to educate graduate students for the workforce described above, and ii) to excel in materials research for the applications mentioned above. This report will describe how the relatively new department has been accomplishing these goals.

The MSE department has in recent years recruited faculty with the interdisciplinary expertise necessary to implement an integrated education and research program that will accomplish the vision presented above. In designing a far reaching program, it has been important to anticipate the hurdles and design a plan for overcoming them. The main challenges encountered by the Department have been to develop i) a culture, as defined by its strategic goal, assessment metrics, and interaction with other departments, and ii) a strong and efficient support system, led by the staff. Increasing the quality and diversity of incoming students has remained challenging. Despite tangible progress on the faculty side, the number of students from groups traditionally underrepresented in MSE is still low. This report discusses some of the steps taken to improve the quality of students and the number of domestic students that better reflects Texas demographics.

CONTENTS

1. INSTITUTIONAL OVERVIEW

The University of Texas at Dallas (UT Dallas) is a young institution that has evolved rapidly since its creation 1969. The initial institution, established in 1961 as the Graduate Research Center of the Southwest (GRCS) and later renamed the Southwest Center for Advanced Studies (SCAS), began as a research arm of Texas Instruments. In 1969, the founders bequeathed SCAS to the State of Texas and Governor Preston Smith signed a bill passed by the Texas State Legislature, officially creating the University of Texas at Dallas, becoming part of The University of Texas System.

The focus and the student profile of the institution have changed over the past half century. Initially the institutional emphasis was solely on research and only graduate students were enrolled in the programs offered by the university. In 1975, the institutional mandate broadened and enrollments were expanded to include upper-division undergraduate students, most of them drawn from local community colleges. In 1990, lower-division students were included and UT Dallas became a full-service institution. Student enrollment grew gradually as instructional and research activities were reconciled until the 2000s when student numbers exploded with annual increases of up to 10%. The recent growth spurt greatly increased recognition of UT Dallas as both a graduate and undergraduate institution and has been an important basis for sustained growth. At this time, the student population is stabilized at about 20,000 students, including graduate and undergraduate students. The Carnegie Foundation classifies UT Dallas as a "comprehensive doctoral research university" and a "high research activity institution". For instance, the Materials Science Department ranked 3rd in Research Expenditures in the 2011 ASEE survey.

In July 1985, UT Dallas and the UT System had received approval from the Texas Higher Education Coordinating Board to start a School of Engineering and Computer Science and offer Bachelor's and Master's degrees in Electrical Engineering. In October 1986 the Regents of the UT-System approved naming the school after J. Erik Jonsson "in recognition of Mr. Jonsson's unique role as nurturer and supporter of excellence in science in the Dallas area."

With the inclusion of an existing suite of degree programs in Computer Science, the Jonsson School had an initial enrollment of over 600. Graduate classes in Electrical Engineering began in the fall of 1986. Upper-level undergraduate Electrical Engineering classes were first offered in 1987. With the arrival of the first freshmen on campus in the fall of 1990, the Jonsson School began to offer freshman and sophomore classes in Electrical Engineering and Computer Science.

Since 2008, the Jonsson School has added four new departments (Materials Science and Engineering and Mechanical Engineering in 2008, Bioengineering in 2010, and System Engineering in 2011) to the original departments of Computer Science and Electrical Engineering. In the fall of 2012, the School had 130 tenured/tenure-track faculty and an enrollment of 4081 students. The School's strategic plan envisions more than 160 tenured/tenure-track faculty and an enrollment of more than 5,000 by 2020.

In 2003, Texas Instrument lobbied the State for funds to accelerate the growth in ECS. Project Emmitt provided state and local incentives for Texas Instruments to build a $4 billion wafer fabrication facility in Metroplex. Texas Instruments agreed to keep its facility in the area provided it would receive certain tax abatements, and UT Dallas receive an enhancement package of $300 million from the state, local and private section. The injection of capital from this program was used for (i) $50M for research project in the science and technology that

demonstrated promise for economic development; (ii) $85M to finance a new high-tech building, named the Natural Science and Engineering Research Laboratory (NSERL), (iii)) $50M for research space and equipment, (iv) $15M for new faculty positions in science and technology to attract new faculty members with interest in developing the reputation of ECS and UT Dallas, and (v) funds for graduate fellowships to increase the PhD pool and student quality. The Emmitt Program had an immediate and long-term effect. The NSERL building opened in the summer of 2006 with laboratories, clean room and key instrumentation. The school has seen a marked increase in PhD graduation rates (80% increase from 2005 to 2011), external funding (124% increase from 2005 to 2011), and number of new faculty members (51% increase from 2005 to 2012). The current Dean of Engineering, Dr. Mark Spong, joined UT Dallas from the University of Illinois at Urbana Champaign in the summer of 2008.

Mission Statements:

The mission of The University of Texas at Dallas is as follows[1]:

> The University of Texas at Dallas serves the Metroplex and the State of Texas as a global leader in innovative, high quality science, engineering, and business education and research. The University is committed to:
>
> - producing engaged graduates, prepared for life, work, and leadership in a constantly changing world,
> - advancing excellent educational and research programs in the natural and social sciences, engineering and technology, management, and the liberal, creative, and practical arts, and
> - transforming ideas into actions that directly benefit the personal, economic, social, and cultural lives of the citizens of Texas.

The mission of the Erik Jonsson School of Engineering and Computer Science is to[2]:

- Deliver state-of-the-art, high-technology engineering degree programs for Dallas and Collin Counties, the DFW Metroplex and the State of Texas.
- Produce versatile students infused not only with technical skills, but also with innovative and entrepreneurial skills.
- Address problems of critical societal need through research aimed at the creation of new engineering knowledge and technology transfer to industry.
- Develop partnerships with government and the private sector to apply new knowledge for economic growth and high-tech job creation in order to strengthen existing regional firms, promote the growth of new regional firms and create new high-paying private sector jobs.
- Provide leadership and outreach to nurture tomorrow's leaders in science, mathematics and high-technology education and business.

The mission of the Department of Materials Science and Engineering is:

- Initiating highly collaborative endeavors and using the diversity of our department as a source of innovation and technical excellence, we will bring the scientific breakthroughs necessary for industry and government initiatives, making us a global leader in educating our students and exceeding our stakeholders' expectations.

[1] http://www.utdallas.edu/strategicplan/index.php
[2] http://www.utdallas.edu/dept/eecs/welcome/schoolmission.html

2. DEPARTMENTAL HISTORY

The Materials Science and Engineering (MSE) Department was initiated by a cluster hire within the Electrical Engineering department. In 2003, three Full Professors, Bruce Gnade, Robert Wallace and Moon Kim, were recruited from the University of North Texas, with strong backgrounds in Chemistry, Physics and Materials Science, respectively. These faculty members, two of them (BG and RW) former Texas Instruments employees, initiated a vibrant program of research to address the needs of Microelectronics. They developed new instrumentation, notably a unique cluster tool, which helped attract Dr. Jiyoung Kim in 2005 from Kookmin University in Seoul, who added more synthesis and materials growth capabilities. They also attracted Eric Vogel from NIST in 2006 to include device expertise into the program, a critical capability for microelectronics. They also recognized the importance of first principles modeling of interfaces and helped recruit in the Physics department K. Cho from Stanford University in 2006, who had co-founded while at Stanford a successful start-up company (Nanostellar). This was the highly productive and collaborative group of six faculty members in place in 2007, with strength in surface characterization and devices. Yves Chabal was recruited as program Head in January 2008, thanks to Emmitt funding. The program in Materials Science was formally established as an independent Department of Materials Science and Engineering in September 2008. The department offers two degree programs, a Master's and a PhD in Materials Science and Engineering.

Upon the creation of the department, Cho was transferred from Physics to MSE, bringing the number to core MSE faculty members to seven, with marked strength in growth and synthesis capabilities (molecular beam epitaxy, atomic layer deposition, wet chemistry), in materials and device characterization, and in first principles materials modeling.

To determine the vision and mission of the new department and to establish a culture appropriate to the existing faculty members, a two-day intensive retreat was organized in July 2008 led by two faculty members (Jerry Hoag from the School of Management and Doug Kiel from Public Administration) experienced in such processes. Out of this retreat came the vision and mission, and the essence of the culture.

> **Vision:** The MSE department seeks to be the best program in the Southwest, and among the top twenty in the nation within a decade (i.e., by 2018).
>
> **Mission:** Initiating highly collaborative endeavors and using the diversity of our department as a source of innovation and technical excellence, we will bring the scientific breakthroughs necessary for industry and government initiatives, making us a global leader in educating our students and exceeding our stakeholders' expectations.
>
> **Culture:** We are a cohesive and results-oriented team of innovative individuals who exceed our own expectations by creating an exciting, collaborative, supportive and welcoming environment for all. We believe that both risk and reward come from promoting a good life/work balance.

With this aggressive vision and the realization that excellence comes from diversity of expertise and backgrounds, the department looked at research areas most urgently needed. It identified **nanoelectronics** (its core strength), **energy harvesting and storage**, and fundamental aspects of **bioengineering** as main targets, seeking a balance in fundamental and applied research and

expertise portfolio among i) materials synthesis/growth, ii) characterization, and iii) modeling. The department also developed its by-laws and a policy for merit, tenure and promotion.

A strategic plan was initiated in July 2008, leading to an aggressive recruiting effort. The results are summarized below:

2009: **Amy V. Walker**, Associate Professor without tenure, coming from Washington University in St. Louis (Chemistry) with strong surface chemistry background and expertise in SIMS.

2009: **Christopher Hinkle**, Assistant Professor, coming from UT Dallas (postdoc of Eric Vogel) with interest in Molecular Beam Epitaxy for III-V and group IV materials, and associated expertise in devices (strong connections with TI and other industries).

2010: **Lev Gelb**, Associate Professor with tenure, coming from Washington University in St. Louis (Chemistry) with expertise in molecular modeling and simulation, computational statistical mechanics and thermodynamics.

2010: **Walter Voit**, Assistant Professor, coming from Georgia Institute of Technology (Materials Science) with expertise in polymers and shape memory materials, and interest in biomedical applications. Walter also created a start-up company (Syzygy Memory Plastics) that is about to commercialize an insert for hearing aids.

2010: **Manuel Quevedo-Lopez**, Associate Professor without tenure, with expertise in materials and integrations issues for flexible electronics, including both organic and inorganic materials. Manuel worked at Texas Instruments, then as a research professor in MSE, before joining the rank of faculty member.

2010: **Massimo** (**Max) Fischetti**, Texas Instrument Distinguished Chair in Nanoelectronics, coming from IBM and later the University of Massachusetts at Amherst (EE department), with international recognition for his work on transport and device modeling (recipient of the 2011 IEEE Cledo Brunetti award).

2010: **Julia P. Hsu**, Texas Instrument Distinguished Chair in Nanoelectronics, coming from University of Virginia, Bell Labs and later Sandia Labs, with international recognition for her work in nanoscale materials physics (Fellow of the American Physical Society, American Association for the Advancement of Science, and the Materials Research Society). Importantly for the department, she brings expertise in nanoscale materials synthesis and characterization of hybrid inorganic/organic materials and interfaces.

2012: **Chadwin Young**, Assistant Professor, coming from Sematech with strong expertise in device characterization, was recruited to replace Eric Vogel who joined Georgia Tech in 2011.

2012: **Orlando Auciello**, a Distinguished Engineering Professor and opportunity hire, coming from Argonne National Laboratory (2013 MRS President) with expertise in multicomponent oxide thin films and novel ultrananocrystalline diamond films for electronics, MEMs, energy and biomedical applications. He also started two companies, Advanced Diamond Technologies and Original Biomedical Implants. He is jointly appointed in both the MSE and Bio-engineering departments, with MSE as his home department.

These hires have helped the department achieve its main goals in terms of field coverage, as schematically illustrated in Fig. 1:

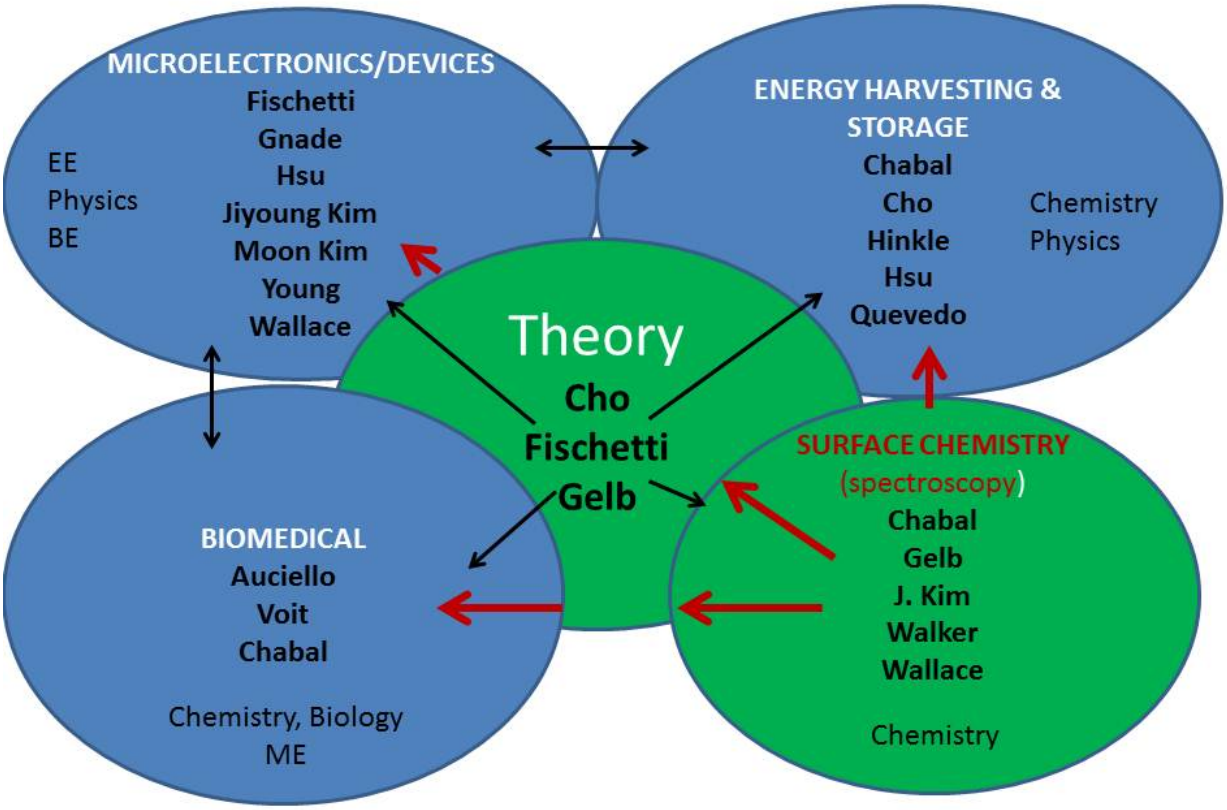
1. **Nanoelectronics and devices** (Fischetti, Gnade, Hsu, J. Kim, M. Kim, Wallace, and Young)

2. **Energy** (Chabal, Cho, Hinkle, Hsu, and Quevedo)
3. **Biomedical** applications (Auciello, Voit, and Chabal)
4. **Surface and interfacial chemistry** (Chabal, Hsu, Walker) and **molecular modeling and simulations** (Cho, Gelb) to provide the glue necessary for all these fields.

There is also a good balance between:

- **Theoretical modeling** (Cho, Fischetti, Gelb),
- **Materials synthesis/growth** (Auciello, Chabal, Gnade, Hinkle, Hsu, J. Kim, Quevedo, Voit and Walker)
- **Characterization** (Hsu, M. Kim, Walker, Wallace, and Young),
- **Combined growth** and ***in-situ* characterization** (Auciello, Chabal, Gnade, Hinkle, Hsu, J. Kim, Quevedo, and Wallace).

Fig. 1: *Pictorial representation of the department composition in terms of application areas.*



During the recruiting process, the Department was able to interview exceptional candidates but soon realized a fundamental challenge of the two-body problem. Consequently, part of the hiring was dictated by spousal hires and opportunity hires, all selected from excellent candidates. The resulting diverse and complementary academic credentials of the faculty is noteworthy: **7 physicists** (Auciello, Chabal, Cho, Fischetti, Hinkle, Hsu, and Wallace), **3 chemists** (Gelb, Gnade, and Walker), **4 materials scientists** (M. Kim, J. Kim, Quevedo, and Voit), and **1 electrical engineer** (Young), providing more options for the students. Approximately 60% of the

faculty has industrial experience (Auciello, Chabal, Fischetti, Gnade, Hsu, J. Kim, Quevedo, Wallace, and Young), ~ 40% purely academic experience (Cho, Gelb, Hinkle, M. Kim, Walker and Voit) and two with experience in government laboratories (Auciello, Hsu).

The broader diversity goals were also advanced with the hiring of five new faculty members from groups traditionally underrepresented in Science and Engineering and in particular MSE. Out of nine new hires since the creation of the department, two women (Walker, Hsu), two Hispanics (Quevedo, Auciello) and one African American (Young) were recruited, constituting more than 50% of these hires. These faculty members serve as a nucleus and role models for students in these underrepresented groups.

With its diverse background and strong collaborative culture, another function of the department has been to connect with and serve other departments, notably Physics, Chemistry, EE, Bioengineering, and Mechanical Engineering, through teaching and research. Many of our faculty members are jointly appointed, teaching, advising and supporting PhD students, collaborating with faculty, and serving in committees ***in other departments***.

With these hires and the corresponding increase in funding from $6.9M in 2008 to > $12M in 2012 (see Appendix 1), the department has been enrolling more students, currently 58 PhD and 14 MS students. In addition, 10 PhD students from other departments (Physics, Chemistry, EE) are fully supported and advised by our faculty, bringing the total to 68 PhD students. Our students' training is centered on a strong core curriculum and rigorous research experience, including the development of communication skills and professional attitude.

One metric for the overall success and impact of the department in a variety of fields is the number of awards received by students and faculty and the number of Fellows in Professional societies. Our students have all won major students awards at the IEEE, MRS, AVS, APS, MSA, TECHCON and ACS meetings. Our faculty have won awards in IEEE (Cledo Brunetti), APS (Davisson-Germer), AVS (Medard W. Welch), ACS (Encouraging Women), ACS Progress Lectureship, DuPont Young Faculty Award, and are Fellows (13 in total) in seven societies (IEEE, APS, AAAS, AVS, MRS, MSA and IOP). Three have served on the MRS Board of Directors, one is currently AVS Director, and one is currently the President of the Materials Research Society.

The activity of the department is discussed in the next section, but some indicators of its recognition, engagement and productivity over the past five years are summarized below:

- number of invited reviews: 20
- number of books or book chapters: 29
- number on technical or program committees: 47
- number of societies committee chairs: 21
- number of associate editor or on advisory editorial boards: 15
- number on other advisor boards: 11
- number of conference chairs or co-chairs: 15

3. MSE ACTIVITY IN FISCAL YEARS 2008-2012

3.1 Research and scholarship

As articulated in our mission statement, the MSE department seeks to best serve the needs of industry (large and small), government laboratories and the nation in general. This goal is best achieved by high quality and flexible research that leverages the departmental strengths – characterization facilities and expertise, materials growth and synthesis, and materials modeling – to address issues in nanoelectronics, energy and bioengineering. Several metrics can be used to better assess our performance over the past five years: i) amount and origin of research funding; ii) number and quality of publications and invited presentations; iii) number of PhD students graduated within these fields, and iv) development of facilities to carry out the research.

Funding: Table 1 shows the funding generated by the department from 2008 to 2012. Keeping in mind that the number of faculty members was 7 in 2008, it is clear that the original MSE program was highly successful, in part because of a $14.4M grant, called FUSION (Future Semiconductor Commercialization) secured in February 2008 from the Korean government ($6M), the State ($5M) and federal and industrial matching ($3.4M), and in part from high industrial funding through nanoelectronics programs (e.g. SWAN). The growth afterwards is the result of federal funding (DARPA, DOE, NSF, AFOSR), increased industrial funding (Intel, IBM, Texas Instruments, SRC), and some subcontracts from government labs. The current portfolio is balanced between Federal and National Government (20.5%), State government (21.5%), Private/Non-profit organizations (20.5 %) and Local government (32%) funding. Such diversification is highly encouraged within the department to help ride difficult fiscal times, such as the current budget crisis in federal agencies. Table 2 shows that more proposals are submitted as PI than co-PI, which is a measure of activity, leadership and excellence among the faculty.

Table 1: *Summary of external funding generated by the department, classified by types of funding. Because this is generated funding instead of research expenditures, there are some fluctuations from year to year. A breakdown by faculty expenditures for 2011-12 is provided in Appendix 1.*

Category	2008-09	2009-10	2010-11	2011-12	Average	Average %
Number of Contracts and Grants	49	55	72	76	63	
Federal & National Government	$2,839,975	$3,014,623	$3,592,416	$3,486,832	$3,233,461	25.99%
State Government	$2,008,490	$2,494,723	$3,808,892	$2,338,402	$2,662,627	21.41%
Private & Non-Profit Organizations	$1,042,866	$3,450,793	$3,457,879	$2,236,266	$2,546,951	20.48%
Local Government	$1,036,684	$4,605,670	$6,490,748	$3,850,119	$3,995,805	32.12%
External Instruction Grants	$0	$0	$0	$0	$0	0.00%
Total	**$6,928,015**	**$13,565,809**	**$17,349,935**	**$11,911,619**	**$12,438,845**	

Active research is a core value of the department, which is embraced by junior faculty members, as evidenced by the relatively high research funding level derived from strategic diversification. Such funding provides more independence and flexibility to all faculty members, fostering strategic collaborations. Furthermore, as noted later, funding is critical for our department because we have not yet developed an endowment fund. Consequently, graduate students need to be supported from the time they start their first semester, even though they have a full course load for two years, which represents a serious burden for PIs.

Communication: Table 2 shows the number of publications generated by the department since 2008 (also listed in Appendix 5). With an average of ~10 publications per faculty member per year in high impact journals (Applied Physics Letters, Physical Review Letters, Journal of Applied Physics, Journal of Physical Chemistry C, Journal of the American Chemical Society, Chemistry of Materials, Nature journals, Science) and ~ 7 invited presentations per faculty per year in international venues, the Department stands among the best in the country. Importantly, publications (and presentations) with student co-authors have grown from 34 (44) in 2008 to 102 (180) in 2012 with a 10-fold increase in student awards. As summarized on page 9, our faculty members have been recognized through major awards, hold 13 Fellowships (3 MRS, 3 APS, 2 AVS, 2 AAAS, 1 IEEE, 1 MSA, 1 IOP), have served as issue guest editors and contributed to feature articles in the MRS Bulletin, Langmuir, and Proceedings of the IEEE, and to invited reviews in their fields (e.g., the Journal of Vacuum Science and Technology and the MRS bulletin), and have authored or co-authored a number of book chapters and books.

Table 2: *Summary of the departmental scholarly productivity.*

Faculty Publications	**2008**	**2009**	**2010**	**2011**	**2012**
Refereed Articles	66	115	150	165	155
Books	3	2	3	1	5
Scholarly Presentations (Talks & Posters)	62	123	134	171	165
Invited Presentations	40	50	67	88	106
National/International Awards, Offices	8	16	25	45	47
Research Proposals Submitted as PI	29	33	68	62	90
Research Proposals Submitted as CO-PI	30	23	49	33	39

Student Publications/Presentations/Awards	**2008**	**2009**	**2010**	**2011**	**2012**
Publications	34	69	94	111	102
Presentations	44	67	106	166	180
Awards	1	3	9	10	9

MS and PhD graduates: Table 3 summarizes the number of PhD and MS graduates since 2008 for each fiscal year (9/1-8/31). The growth is continuous, tripling from 8 to 24 from *FY* 2008 to *FY* 2012. This is a competitive number for a faculty only recently increased to 15 members, and is consistent with an average of ~5-6 PhD students per faculty member, including recent and junior faculty members. Details of students' enrollments, demographics and other characteristics of the MS and PhD programs, such as the UT System-defined "18 Characteristics for MS and PhD Programs" are given in Appendices 7 and 8.

Table 3: *Number of MS and PhD graduations per academic year for MSE and non-MSE students that are fully supported and advised by MSE core faculty.*

Academic Year	**MSE**		**Non-MSE**		**Totals Per AY**
	MS	PhD	MS	PhD	
2005 - 2006	0	3	0	0	3
2006 - 2007	0	0	1	0	1
2007 - 2008	3	0	0	0	3
2008 - 2009	7	1	6	1	15
2009 - 2010	3	4	2	3	12
2010 - 2011	12	1	2	4	19
2011 - 2012	7	12	1	4	24
2012 Fall	4	2	0	3	9
TOTALS	36	23	12	15	**86**
	59		**27**		

Research Facilities: As summarized in Appendix 2, the research facilities within or accessible to the MSE department are impressive. They include a fully equipped and manned clean room that is still free of charge to internal users with the support of the Office of Vice President for Research, and facilities for general access such as an advanced characterization lab featuring a new JEOL ARM200F aberration corrected TEM, in addition to a JEOL 2100F (200keV field emission) TEM, a FEI Nova 200 NanoLab SEM/FIB, an XRD facility, and an advanced electrical characterization laboratory (AECL) that enables almost any electrical test for nano-scale materials and device characterization including: various I-V and C-V techniques, reliability methodologies, as well as novel and/or customized characterization approaches. Furthermore, the instrumentation and expertise acquired and developed in individual laboratories is extensive, covering most techniques for surface and interface characterization (XPS, LEED, AES, LEIS, Mass spectrometry, PL, Raman, IR, ellipsometry, internal photoemission, C-V and I-V measurements) and imaging techniques (STM, AFM). Students have full access to this portfolio of techniques, with experts to teach them.

A note about a new instrument that is not included in Appendix 2. A PHI VersaProbe (Physical Electronics Inc.) has been recently ordered to replace the PHI 5600 X-ray Photoelectron Spectrometer, which is considered "end-of-life" since service and maintenance is no longer available. The PHI VersaProbe is a state-of-the-art, user friendly instrument capable of performing high-resolution micro-area x-ray and ultraviolet photoelectron spectroscopy (XPS

and UPS), depth profiling, angle-resolved XPS, two and three dimensional chemical imaging on a wide range of materials and sample sizes. The new instrument will enable cutting-edge materials research and training, especially in the areas of semiconductors, organic electronics, sensing, biomaterials, photovoltaics and other energy applications. The VersaProbe is expected to be delivered in August 2013.

Promotions: During the past five years, all promotion requests and three-year reviews were successful. They include Cho (to Full Professor), J. Kim (to Associate Professor with tenure, and currently under review for Full Professor), Vogel (to Associate Professor with tenure), Walker (to Associate Professor with tenure), and Wallace (to endowed Chair Professor).

3.2 Graduate Curriculum and Program

The Department offers an MS degree in Materials Science and Engineering (with or without thesis) and a PhD in Materials Science and Engineering.

Our curriculum reflects the research focus and strengths of the Department. As described in Appendix 3 (Admission and Curriculum Requirements), most students take "MSEN 5300: Introduction to Materials Science" and a required Core of four courses, "MSEN 6319: Quantum Mechanics for Material Scientists", "MSEN 5310: Thermodynamics of Materials", "MSEN 6324: Electronic, Optical and Magnetic Materials", and "MSEN 5360: Materials Characterization". Prior to 2009 MSEN 5360 which was a standalone course which significantly overlapped "MSEN 5361: Fundamentals of Surface and Thin Film Analysis". In 2010 the curriculum of MSEN 5360 was re-written to be the first semester of a two semester sequence (to be followed by MSEN 5361), providing expanded introductory material and treating many new topics. The new course takes into account the varied background of MSE graduate students, who come from materials science, physics, chemistry, electrical engineering and mechanical engineering. Additional courses are then taken from two areas:

a) Advanced courses, which broadly develop ideas from the Core classes in greater depth;
b) Specialized courses, which are narrower in focus.

Advanced courses are offered on a one- or two-year rotating schedule, to strike a balance between courses available to students and satisfying the minimum enrollment requirements. Many Specialized and some Advanced courses are cross-listed with (or from) other Departments at UT-Dallas and taken by students from other disciplines. Appendix 3 summarizes the curriculum requirements for MSE students.

In the past five years, the following courses have been added:

Advanced courses:

- Nanostructured Materials: Synthesis, Properties and Applications
- Semiconductor Device Characterization
- Diffraction Science
- Electronic Devices based on Organic Solids
- Materials Science for Sustainable Energy

Specialized courses:

- Advanced Physics of Semiconductors
- Chemistry of Materials

- Advanced Functional Materials and Devices

(Note that the Introduction to Materials Science course is formally classified as Specialized, and that its status as a *de facto* requirement was established in 2012.)

Organization, oversight and tracking of graduate students have been developed over the past five years to deal with the increasing number of graduate student and to ensure their success.

Admissions

In 2011 an Admissions policy which formalized the admissions process for graduate students was adopted. Briefly, it states that a student applies to the program by completing all required application forms, and providing current test scores, academic transcripts and three letters of recommendation. The applicant's file is then reviewed by two members of the Admissions committee and finally by the Chair of Admissions. Reviewers complete a form we developed that ensures all necessary criteria for admission are addressed in a consistent manner. In 2012, a database was developed that tracks student progress through the MSE Program. The database is being used to correlate incoming students' background and academics with subsequent performance, and will thus help us to improve both our admission and advising processes. In 2013, the minimum GRE requirements based on the new scoring system were revised in the admission policy.

Currently there are 58 PhD and 14 MS students enrolled in the MSEN program. Organization, oversight and tracking of graduate students have been developed over the past five years to deal with the increasing number of graduate students and to ensure their academic success. The number of students who "Applied, Accepted and Enrolled" as well as their demographics are listed in Appendix 7 and 8 for MS and PhD programs, respectively.

Graduate Program Advising and Tracking

For new students (both MS and PhD) starting in Fall and Spring semesters, there is a New Students' Orientation for the MSEN department in August and January, in addition to the orientation meetings offered by UT Dallas. The MSEN Department's New Students' Orientation was overhauled in Fall 2012 after noting issues in both i) course performance and Qualifying Exam success rate, and ii) attitude towards research. The slides in Appendix 4 show how we describe the learning process through formal coursework and the research process, outline the difference between undergraduate and graduate education, and emphasize the expectations of being a graduate student and research assistant. This initial orientation, delivered by the Curriculum Chair, the Graduate Director, the Department Head and other faculty is meant to set the tone and establish a culture of work and professionalism among the students. Additionally, the Orientation covers the functional aspect of the work in the Department, including Environmental, Health and Safety (EH&S), travel reimbursement, and purchasing.

During the MSE New Students' Orientation, the students also meet with the Graduate Director (currently Julia Hsu) to enroll in classes. Subsequently, students who have a Research Advisor meet with the Graduate Director yearly (usually in the summer) until they fulfill the Core (12 semester credit hours (SCHs)) and Advanced (9 SCHs) course requirements. The Graduate director is the Advisor for students who do not belong to a research group, e.g. MS students, and meet with these students every semester. In addition, students who do not meet the minimum GPA requirements set by UT Dallas (average GPA of all classes above 3.0) and by MSE (average GPA 3.0 for the 4 Core courses) also meet with the Graduate Director every semester,

regardless of whether or not they have a Research Advisor. Each student on academic probation and his/her Research Advisor receive a letter from the Graduate Director outlining their situation.

After passing all 4 Core courses i.e. with an average GPA of 3.0, PhD students are required to take the Qualifying Exam (offered annually at the end of Spring semester) at their earliest possible chance. There are 4 sections of the Qualifying Exam, corresponding to the 4 Core courses. The students have two opportunities to pass the Qualifying Exam. If the student fails one section, they are only required to re-take that section. If the student fails two or more sections they are required to re-take the entire Qualifying Exam because it is considered by the faculty of that the student has not demonstrated enough fundamental knowledge to pursue a PhD degree. Approximately 50 % of the students pass the qualifying exam on the first attempt, and nearly all pass it on the second attempt. Since 2007 when the MSEN Qualifying Exam was first administered (in the MSE program within the EE department), only one student did not pass the Qualifying Exam after two tries. Once the students pass the Qualifying Exam, they form their Dissertation Committee and must pass a Research Proposal defense before completion of 60 SCHs (approximately 2 ½ years after starting at UTD). With the drive to minimize educational costs and increase program productivity, the UT system has recently issued a new requirement that mandates that students finish their PhD within 99 SCH (approximately 4 years), which will be challenging for most students, particularly those without an MS degree. All PhD students entering after Fall 2012 are subject to this new requirement.

A Degree Plan Evaluator assists the Graduate Director in tracking i) the courses taken by the students, their grades, the Qualifying Exam results, ii) whether they have formed their Dissertation Committee, and iii) whether they have passed the Research Proposal Defense. She also enrolls students in classes, assists students with paperwork, and keeps a permanent record of students' academic status (e.g. notification from the Graduate Director on Academic Probation). She also prepares a yearly progress report for each faculty that includes credit earned, GPA, Qualifying Exam results, Committee and Proposal status, and courses left to take if any, for all the students under their research guidance.

A student seminar series was also initiated in 2009. It was instrumental in fostering a collaborative atmosphere among students and has been continuing with varying degree of intensity. In this series, students present their research, occasionally invite faculty to give tutorial or research talks, and sometimes outside speakers. With a supply of pizza, this series has been successful over the years, although less during the current academic year.

In January 2013, the AVS Dallas Metroplex student chapter was formed, led by a student Tatiana Peixoto and faculty advisor Amy Walker. The goals of this chapter are to introduce undergraduate and graduate students to materials research and related opportunities, and to facilitate and support them in their research accomplishments. These goals are accomplished by regularly holding chapter meetings, presenting research at the Regional Chapter Symposium and/or at the AVS International Symposium, hosting guest lecturers, providing up-to-date research information through the society web site, and participating in a variety of science and engineering related activities throughout each semester.

Graduate Program Assessment

The Student Outcomes (SOs) for the MSEN program are as follows:

A. Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise.

B. Develop solutions to practical problems: Students will apply their knowledge and analytical skills to create effective and novel solutions to practical problems.

C. Communicate effectively and work collaboratively: Students will communicate effectively and work both collaboratively and independently.

The SOs broadly define the abilities that students should possess at the time of their graduation. The faculty assessment process is direct, based on quantitative data collected through the assessment of Course Learning Outcomes (CLOs) of the courses. The main instrument used for assessment is the Program Assessment Report prepared by the Office of Assessment. To compile this report, the Office of Assessment gathers quantitative data from the course assessment forms (CAF) completed by the faculty each semester. At the end of every semester, each instructor is required to fill out a CAF for each of the courses that were taught. The CAF carries quantitative information via direct measures on the extent to which the students have attained each CLO that has been defined for the course. The course instructor is also required to provide information on what rubrics, e.g. exam and homework questions, are used to assess the performance on each CLO. The information used to evaluate a CLO can vary from one CLO to another, but is never based on the final grades in the course. The information used for assessment and evaluation of the CLOs is only a subset of the information used to determine the final course grade. For each CLO, there are four possible performance outcomes: below expectations for the CLO, progressing to the criteria, meeting the criteria, and exceeding the criteria. Assessment of the SOs is performed by using the mapping from CLOs to SOs in Table 4. For each SO, we calculate the number of students at each one of the four attainment levels (e.g., meeting criteria) using data from the CLOs that contribute to that particular SO. Only the four core courses are used for the program assessment. This program assessment report (see Appendix 10) shows for each SO, the number of times and the percentage of students who fall in each of the following categories: below expectations, progressing to criteria, meeting criteria, and exceeding criteria.

Note that the SOs are low for some CLOs in MSEN 6319: Quantum Mechanics (QM) and MSEN 6324: Electronic, Optical, and Magnetic Materials (EOM). These relatively low assessment results have been discussed in a Faculty Meeting. To improve performance in MSEN 6319 (QM), students in need will be asked to take the undergraduate Physics Quantum Mechanics or Modern Physics course and possibly a Math course, preferably Linear Algebra, although this will add time to graduation (a serious problem with the new 99 SCH requirement, see page 16). Also, the presence of a proper background in these subjects will be given utmost attention when considering students seeking admission in our Graduate Program. For MSEN 6324 (EOM), a new textbook will be adapted in Fall 2013 with a major focus in electronic, optical and magnetic materials. In the case of MSEN 5360 Materials Characterization, a new set of CLOs has been implemented to reflect the change in the class during the recent years (see p. 14). In addition, the Curriculum Committee has been in a discussion of offering Thermodynamics and Quantum Mechanics in the fall semester, so that the students will be exposed to the fundamental knowledge needed for the two more applied courses, Materials Characterization and Electronic, Optical, and Magnetic materials. The benefit of this curriculum order is that Quantum mechanics part currently covered in MSEN 6324 will be covered in the Quantum Mechanics core class (MSEN 6319) during the preceding semester. The downside of this curriculum change is two-fold: (1) heavy course load during fall semester (Thermodynamics,

Table 4: *Course Learning Outcomes from Core Courses mapping to Student Outcomes*

Course Number and Name		Student Outcome		
MSEN 5310	**Thermodynamics of Materials**	**A**	**B**	**C**
	Demonstrate knowledge and the application of the laws of thermodynamics	x	x	
	Demonstrate knowledge and the application of reaction equilibrium	x	x	
	Demonstrate knowledge of and explain phase diagrams	x	x	x
	Demonstrate knowledge of chemical reactions	x	x	
MSEN 5360	**Materials Characterization**	**A**	**B**	**C**
	Understand when to apply the techniques of atomic and structural analysis	x	x	x
	Understand probe radiation	x	x	
	Understand emitted radiation or particles	x	x	
	Understand the physics/chemistry of the absorption process	x	x	
	Understand the physics/chemistry of the emission process	x	x	
	Understand the production of probe radiation	x	x	
	Understand the detection of the emitted radiation/particles	x	x	
	Understand volume sampled by the technique	x	x	
	Understand the sensitivity of the techniques of atomic and structural analysis	x	x	
	Understand quantification of elements/species detected	x	x	
MSEN 6319	**Quantum Mechanics for Materials Scientists**	**A**	**B**	**C**
	Understand the historical needs for a quantum mechanical description of Nature	x		x
	Understand the wave-like properties of matter and their description by Schroedinger equation	x		x
	Know how to apply and solve Schroedinger equation in one dimension	x		
	Understand the quantization process: From Hamiltonian to Quantum Mechanics	x		
	Understand theory of measurements, hermitean operators, state vectors, Hilbert spaces, and their physical meaning	x		x
	Understand the atomic structure and periodic table	x	x	
	Understand approximation methods (perturbation theory, WKB)	x		x
	Understand the structure of crystals and their quantum mechanical description	x	x	x
	Understand the basic of quantum mechanical calculation applied to nanometer-scale structures	x	x	x
MSEN 6324	**Electronic, Optical and Magnetic Materials**	**A**	**B**	**C**
	Describe and explain the Thermal and Electrical Conduction Mechanisms in Solids	x	x	
	Describe and apply Elementary Quantum Physics	x		
	Describe and apply the Modern Theory of Solids	x		
	Describe, explain and calculate Semiconductor Materials Properties	x	x	
	Describe simple semiconductor devices from a materials perspective including capacitors, pn junctions, and transistors	x	x	
	Describe, explain and calculate Dielectric Materials Properties	x	x	
	Describe, explain and calculate Magnetic Materials Properties	x	x	
	Describe, explain and calculate Optical Materials Properties	x	x	

Quantum Mechanics and Intro to Materials Science and Engineering) when the students are adjusting to a new environment, and (2) very limited course offering for students entering in the spring semester. The ultimate success of this change is not clear. The Curriculum Committee and the Faculty will continue to work through this challenge.

Beginning in the spring of 2013, the assessment process will be automated using the assessment software tool AEFIS (Academic Evaluation, Feedback and Intervention System). In 2009, the Erik Jonsson School contracted with UNTRA Corporation to become a partner in the development and application of the AEFIS software platform to meet the evolving requirement of ABET as well as SACS.

3.3 Undergraduate Research Experience and Minor in Nano Science and Technology

From its inception, the MSE department provided research experience for undergraduate, either through participation of existing programs (Clark and LSAMP) or by attracting undergraduates directly by the faculty. Competition for an NSF Research Experience for Undergraduates grant was initiated by Amy Walker resulting in successful funding last year (2012). Each summer, ten undergraduate Fellows engage in a 10-week summer research Program focused on surface engineering with applications in energy, electronics, nanotechnology and sensing. Recruitment focuses particularly on women, under-represented groups, and students from institutions where research opportunities are limited. In addition to an immersive research environment, the REU experience includes: an introductory short course in surface engineering and materials science; research seminars from faculty and outside experts; visits to local high tech industries; seminars on the ethics and business of science and engineering; career planning presentations; informal discussions with speakers; and a half-day symposium concluding each summer Program.

In 2008, a Minor in Nano Science and Technology (NST) was initiated with the creation of three courses, “NANO 3301: Introduction to Nanoscience and Nanotechnology”, “NANO 3302: Microscopy, Spectroscopy, and Nanotech Instrumentation”, and “NANO 3310: Introduction to Materials Science and Engineering”. To complete the NST minor, students take three core courses, NANO 3301, NANO 3302 and NANO 4V95 (Undergraduate Research in Nanotechnology), and complete at least 9 credit hours chosen from a variety of courses depending on their major. In 2011, a substantive review of the NST minor was undertaken. Feedback from discussion with students exposed issues of scheduling, pre-requisites and insufficient elective options that made it difficult to complete this minor. To address these issues, the pre-requisites for the required classes (NANO 3301 and NANO 3302) as well as an elective class (NANO 3310) were revised to include only a single semester of general chemistry. This allows more engineering majors to take these classes. The number of elective classes allowed for the NST minor was also substantially increased. The program has generated interest, despite difficulties in inclusion into the catalog and proper advertisement. To address these issues, faculty have been visiting sections of “ENGR 3300: Advanced Engineering Mathematics” (taken by all engineering majors), general chemistry and general physics to give presentations on the NST minor, designed fliers and work with student advisors in the School of Engineering and the School of Mathematics and Sciences to promote this course of study. These efforts have led to a steadily increasing enrollment in the NST minor.

3.4 Student Recruiting Efforts

To date most (~80 %) of the applicants to the MSE Program are from overseas. There is therefore a critical need to recruit US domestic students. Challenges in the recruitment of

graduate students to the MSE program include the uncertainty in the funding of students and the identification of qualified applicants. At present, nearly all graduate students need to be supported by a grant when they enter the program, which makes it difficult to plan the incoming class size. This year, the Dean has generously provided a fund of $50k for domestic students, which will support 2 students, and is willing to support 1-2 highly qualified students from under-represented groups.

The MSE department has been actively working on several fronts to substantially increase the number and quality of graduate students. Recruitment efforts are focused in three directions:

a) Domestic students
b) Underrepresented minority students
c) International students

a) Domestic students: To improve the recruitment of domestic students, the department is working in several directions. A key effort involves an active REU-NSF program entitled Surface Engineering for Sensing, Energy & Nanoelectronics (Amy Walker, PI). In this program, students are exposed to surface engineering with applications in areas including nanoscale electronics, photovoltaics, catalysts, batteries, fuel cells, thermoelectrics, heat transfer systems and sensors. In addition to an intense 10-week immersion research experience, the program offers an Introductory short course in surface engineering and materials science, and give students access to state-of-the-art instrumentation, cleanroom, characterization and microscopy facilities. In addition, the students are exposed to research seminars and informal discussions with faculty and outside experts. Visits to local high-tech industries in the nearby "Telecom Corridor" are also arranged.

In addition to the REU-NSF program, the MSE faculty members also actively promote the MSE department at national meetings and other universities. Most of our domestic students are recruited by using this particular method. Typically, any MSE faculty presentation involves a couple of slides promoting our unique facilities, which is important to attract the best domestic students. For this purpose, we have a set of slides describing the research areas for each of the MSE core faculty. These slides are available for the all the faculty to use as recruitment materials.

Another important effort to attract domestic graduate students is the involvement of UTD undergraduate students with individual MSE faculty. This is accomplished through summer research and individual research credits. Each MSE faculty has an average of about one undergraduate student working in their labs at all times during the academic year. The department is developing a program to target the *top* URM undergraduates at UT Dallas (with a GPA >3.5) and provide them with a tour of NSERL and a description of its programs with the goal to retain them at UT Dallas for graduate studies. MSE also participates in the Fast Track program that allows undergraduate students to obtain a MSE MS degree in five years.

b) Underrepresented minority students: MSE has been actively recruiting URM by having faculty presence and booths in national meetings for organizations such as the Society of Hispanic Professional Engineers (SHPE) and the Society for Advancement of Chicanos and Native Americans in Science (SACNAS). During the last SHPE national meeting MSE organized a “SHPE day” at UTD (November 2012), with the help from the Office of Diversity and Community Engagement (ODCE). This event exposed and introduced potential URM graduate students to several academic departments. Chadwin Young, Orlando Auciello and

Manuel Quevedo have been particularly active in reaching out to Hispanic and African American students.

In addition, the department is participating in two important proposals. One is the NSF-AGEP that would fund programs and activities to train URM graduate students for the Professorate. The proposal is led by the graduate Dean, with the MSE Head as co-PI. The other is the Bridge-to-Doctorate program that would fund LSAMP students from undergraduate serving institutions to attend graduate programs in research universities like UT Dallas (a full two-year funding for each selected student). The proposal is led by the ODCE and involves some MSE faculty as co-PIs. Both programs are aimed at increasing the enrollment of URM students in graduate programs.

A formal program is being developed by the ODCE to target the *top* URM undergraduates at UT Dallas (with a GPA >3.5) and provide them with information sessions, tour of facilities, mentoring, and opportunities for undergraduate research. The MSE department is poised to kick off this program with a tour of NSERL and a description of research opportunities.

The MSE faculty participated in a two day visit by UT Pan Am faculty, organized by the ODCE, aimed at developing ties between the UT system Universities to provide a pipeline from undergraduate and minority serving institutions to UT Dallas. This initiative resulted in several applications to the MSE program. The department is also exploring developing collaborations with faculty and undergraduate students from non-PhD granting institutions in the DFW area, which typically have the largest Hispanic and African American student body. Students have already been hosted during the past year in our labs. Those students are currently considering joining MSE for their PhD studies. A successful mechanism has been to organize summer research program for a K-12 teacher and one or two of their students selected from one of the Independent School Districts in the DFW Metroplex. A school is usually chosen because one mission of the school is to educate a diverse student population of various ethnicities. The program focuses on introducing the teacher along with the selected students to our research programs. It is also meant to help the teacher with the development of classroom materials suitable for instructing future scientists, engineers, and technologists. We have already hosted several students under this program and we are planning to bring two students every summer.

c) International students: MSE has been very successful recruiting international students. In particular, students from Korea and Mexico. The success for Korean and Mexican student recruitment is largely due to existing programs with Korea and Mexico. A Korea-UTD funded program, named FUSION (Future semiconductor commercialization), was created in 2008 under the leadership of Moon Kim and Jiyoung Kim. This program exposed MSE-UTD to Korean students and resulted in increased numbers of Korean student applications and enrollment in the MSE department. The program with Mexico, led by Manuel Quevedo, has resulted in an enrollment increase from zero students in 2007 to 13 in 2013. The Mexican students are partially supported by Conacyt (the Mexican science foundation), which makes it possible to increase the total of students and PhD graduation in our department. Furthermore, the presence of a critical size for the Hispanic culture is stimulating our department in learning about and taking steps in making the department a more supportive place for domestic Hispanic students. Last year, Chabal visited Huazong University for Science and Technology (HUST) in Wuhan to establish a pipeline to UT Dallas with help in selection by colleagues in HUST, and opportunities for MSE students to perform research at HUST. Three current MSE students are from HUST.

4. DEPARTMENTAL GROWTH, SUSTAINABILITY AND CHALLENGES

The department has now reached a steady state size in terms of faculty (15 faculty members)[3]. However, it is expected to grow in terms of i) graduate students as the new faculty members begin to take on more students and ii) funding as the new synergies will create new large scale funding opportunities. The goal is to educate ~100 PhD students (including students from outside the MSE department), ~15-20 MS students (MSE only), and to provide research opportunities for ~ 25 undergraduates per year (including summer or academic year). These numbers, enhanced by students from other departments, will lead to an increase in enrollment in graduate MSE courses. With the inclusion of undergraduate courses, courses taught in other departments, research credits for all supported students, the MSE department is generating substantial educational income in addition to the overhead income, which already with the current enrollment far exceeds its salary and operational costs.

The focus of instructional and research currently includes micro/nano-electronics (e.g. with novel 2d-materials), energy harvesting and storage (electrical and chemical), and biomedical applications (sensors and probes), in good synergy with the new Bioengineering Department. With the creation and direction of the Mechanical Engineering Department, we expect that our expertise in materials and surface processing will also contribute to applications in viscous and heat flow optimization (drag reduction/hydrophobicity/bonding) important for the aerospace and oil & gas industries, MEMs and nanofluidics. The ability of the department to leverage its expertise and facilities to respond to new challenges and applications will ensure the diversification of its funding and thus its sustainability by making it more relevant for students and industry alike. Table 5 and 6 summarize the main figures related to faculty teaching load and student/faculty ratio.

The main challenge of the department is to develop sustainable funding for entering graduate students. At present, virtually all graduate students need to be supported as Research Assistants when they enter the program, although they have a full time course load for at least one year, hence the strong recruiting effort described in section 3.4 above.

Table 5: *Semester Credit Hours, Number of Core Faculty, Faculty Teaching Load (=Semester Credit Hours/Number of Core Faculty).*

Teaching	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**Fall 2012**
Semester Credit Hours (PhD & MS)	682	1152	1351	1590	667
Number of Core Faculty	7	9	14	13	15
Faculty Teaching Load	97.43	128.00	96.50	122.31	44.47
Instructional FTE	100%	100%	100%	100%	100%
Total Unit Research FTE	100%	100%	100%	100%	100%
Number or % of SCH taught by:					
Tenure Track Faculty	100%	90% *	95% *	100%	100%
Non-Tenure Track Faculty	0%	10%	5%	0%	0%
Graduate Assistants	0%	0%	0%	0%	0%

[3] Strategic hires are still possible, space permitting, thanks to our contribution to teaching in other departments.

Table 6: *Student/Core Faculty Ratio*

Student-Core Faculty Ratio	2008-09	2009-10	2010-11	2011-12	Fall 2012
PhD program	2.57	3.00	2.14	3.77	3.60
MS program	2.29	2.11	1.93	1.38	1.27

Student/Core Faculty Ratio = Number of enrolled student/Number of Core Faculty

5. PERSONNEL, ADMINISTRATION, AND BUDGETS

5.1 Personnel

A list of all MSE personnel as of Fall 2012 is provided in Appendix 5, including the organizational charts of the University, School, and Department.

Faculty

There are fifteen core (tenured or tenure track) faculty members in MSE, consisting of eight full professors (Auciello, Chabal, Cho, Fischetti, Gnade, Hsu, M. Kim, and Wallace), three associate professors with tenure (Gelb, J. Kim, and Walker), one tenure-track associate professor (Quevedo), and three tenure-track assistant professors (Hinkle, Voit, and Young). There are 21 affiliated faculty members (reviewed and voted every year) that either work in close collaboration with MSE core faculty or advise MSE students, and 16 adjunct faculty (reviewed and voted every year) that closely collaborate with or support the MSE department. The brief CVs of each core faculty members are given in Appendix 6.

Administrative and Technical Staff

The administrative staff is composed of two Administrative Services Officers (Tonya Griffin and Diane Griffith), one Accountant (Nithya Ramachandran), one Administrative Assistant (Julieta Terry) and one Degree Plan Evaluator (Ashley Willess) organized as follows:

Tonya Griffin is our head administrator, responsible for supervising the staff. She handles all aspects of HR functions for the MSE department in processing new hire paperwork, building access forms, computer access requests, funding allocation changes, and payroll (for >250 personnel in total). She also provides administrative assistance to the department Head, coordinates monthly faculty meetings and conducts monthly meetings with the staff.

Diane Griffith is in charge of coordinating graduate admissions and managing the procurement needs of the department. As the Graduate Admissions Coordinator, Diane works with the Recruiting and Admissions Committee to facilitate the graduate admissions process. Her knowledge of Microsoft Access is a plus in creating and maintaining the graduate database used to track statistical data for new and former students. She is also responsible for processing eProcurement (purchasing) requests for the department through the online portal and working with other departments for prompt approvals.

Nithya Ramachandran manages the budget and reconciliation for 170+ cost centers, totaling yearly research expenditures of $12M. Her responsibilities include tracking expenses and balances in Quicken and Microsoft Excel, preparing reports for reconciliation of all cost center accounts and P-card accounts, approving purchase invoices, and processing auto journal entries for service center accounts. She also assists with budget revisions, interdepartmental transfer of

funds, and other matters related to both internal and external grants received by the faculty, through interface with pre- and post-award departments.

Julieta Terry is in charge of all department and guest travel (averaging more than one trip per day!). As the Travel Coordinator, Julieta contacts the travel agency to book all domestic and international flights, prepares travel authorizations, confirms conference registrations, secures hotel reservations, submits business expenses and travel reimbursements. She is also responsible for overseeing the event planning functions of the department (e.g. colloquium and student seminars, meetings, retreats, socials). Julieta manages the P-card purchases and assists with additional procurement requests as needed.

Ashley Willess, our Degree Plan Evaluator, manages all student administrative services once they are admitted. This includes preparing offer letters for graduate research assistants, coordinating orientation, processing registration, tracking student progress, and assisting students with graduation. She works closely with the Graduate Advisor (Julia Hsu) and Curriculum Committee (Lev Gelb) to update the graduate catalog and department academic policies, as well as the Graduate Studies Office for graduation requirements and deadlines. In addition, she and Diane Griffith work on tracking our graduates.

This current team has been recognized as a model for the school, due to its smooth operation and high performance. The functional efficiency of this team is the result of a number of innovations, briefly listed below:

1. **Logs** to manage data for employee personnel, students, purchasing, travel, and financial accounts. These logs serve as useful tools to quickly filter data for internal and external reporting.
2. **Concise and thorough forms** to streamline information and processes (e.g. new team member form, travel form, purchasing form, shipping form). This allows for clear communication between the faculty, staff and students to promptly address the needs of the department.
3. **Cross training** Tonya has delegated backup responsibilities to various staff functions to implement cross training and ensure a smooth operation when one staff is out, or during staff turn-over. This has proven very useful over the past few years and will remain an ongoing focus for further development.
4. **Checklists** are used as a step-by-step guide and workflow system to properly gather information and route documents internally without error. This ensures the accountability for all documents that affect the financial status of the department.

The team has also developed a close personal connection, thanks to Tonya Griffin's leadership, that allows everyone to thrive despite challenges, such as the implementation of PeopleSoft. Tonya works with the staff to discuss and research problems. Together, she and the staff are able to identify the correct course of action and contact the proper personnel to solve the problem. Tonya demonstrates her ability to plan and accomplish objectives by carrying out regular meetings with the department head and the staff to identify new objectives or discuss areas of concern and improvement. She displayed great leadership in the organizational planning for the 72nd Physical Electronics Conference that was hosted by the department last summer in June 2012. As a result of her project management skills to clearly outline each task in a timeline to progressively manage the coordination of all the program events, the conference ran very smoothly at a record low cost. Collectively, the staff skills and efforts led to a budget surplus,

with the critical and excellent financial planning of our accountant, Nithya Ramachandran. National members and attendees noted that this conference was the best organized PEC conference they had attended in the past six years.

Additional administrative staff includes Suzanne Potts, an Administrative Assistant.

Suzanne Potts exclusively handles the administrative needs for the FUSION (Future Semiconductor Commercialization) and SiWEDS (Silicon Wafer Engineering and Defect Science) programs under the supervision of Jiyoung Kim and Moon Kim. This includes procurement, travel, reimbursements, event planning and account reconciliation for program transactions. She utilizes the same forms and tracking tools to effectively manage these functions. Suzanne works closely with the core staff to address all other human resource and academic affairs for these research groups.

The technical staff, funded by the Dean's office, is composed of Billy Raulston, Tommy Bennett (50%) and Richard Mills. In addition, there are several technical staffs funded by shared facilities revenues or soft money from individual groups, such as Dr. Jinguo Wang (associate director for the advanced characterization lab), James Burris (electrical characterization lab), and Dr. J-F. Veyan (XPS). Individual groups often have lab managers, such as Yun-Ju Lee (Hsu), Jean-François Veyan (Chabal), Stephen McDonnell (Wallace), Ka Xiong (Cho), Xiao-Mei Zhao (M. Kim), Jesus Mejia Silva (Gnade), and Jang-Sik Lee (J. Kim).

5.2 Departmental Administration

The Department Head position, currently held by Yves Chabal, is responsible for departmental growth (e.g. faculty recruitment) and operation (staff recruitment and development), communication between the MSE faculty and Mark Spong, the Dean of the Erik Jonsson School of Engineering, and for ensuring that the University policies and budgetary issues are met. The Department Head is responsible for annual reviews of faculty and staff, with input from the Personnel Review Committee (PRC), and for making recommendation for merit increases to the Dean. He is also responsible for appointing an Associate Head who helps draft teaching and service duties, and prepare for Faculty Meetings. To accomplish various department functions, the Department Head is supported by departmental committees for i) curriculum development and teaching needs and assignments, ii) graduate student admission and recruiting, iii) administrating qualifying exam, iv) outreach activities, and v) the colloquium series. The Department Head also appoints ad Hoc committees for non-regular events, e.g. faculty searches. The PRC committee, in charge of all appointments, is composed of at least five tenured Core Faculty Members of the Department. The members are proposed by the Department Head, confirmed by the voting Members of the Faculty, and serve for three years. The committee chair is elected by the voting Members of the faculty. The graduate program and advising are overseen by the Graduate Director. Governance of the department has been democratic and important issues are generally decided by voting.

The advanced characterization facility is managed by Moon Kim, and operated by Dr. Jinguo Wang. The electrical characterization facility is managed by Chris Hinkle and operated by J. Burris. The XPS facility is managed by Dr. J-F. Veyan. These facilities are open to the whole University and are all self-sustainable with no expense to the school. In addition, there are two and a half staff positions funded by the Dean and managed by Robert Wallace, to support work with his cluster tool (B. Raulston and T. Bennett @50%) and to provide electrical support (R. Mills).

5.3 Budgets

The primary departmental budget is divided into i) state funds to support the 9-month faculty salaries (+ partial summer salary for Head and Associate Head) and the 12-month staff salaries; and ii) operating funds (M&O) allocated by the Dean, as summarized in Table 7:

Table 7: *Faculty and Staff Salary*

Faculty and Staff Salary Budget and Actuals				
	2009-2010	**2010-2011**	**2011-2012**	**2012 - Jan 31, 2013**
Faculty Salary Budget	$470,230	$790,083	$1,546,985	$1,658,464
Actual Salary	$470,230	$833,072	$1,537,201	$899,176
Staff Salary	$274,655	$376,347	$339,678	$307,961
Actual Salary	$273,279	$330,582	$334,356	$131,214
Departmental M&O	$45,610	$66,000	$60,000	$62,388
Actual Expenses	$37,060	$60,116	$57,825	$17,365

The operations budget (operations and infrastructure) covers administrative costs (phones, office machines, supplies, expenses for seminar speakers, etc.), and part of the costs for repair of departmental instrumentation. A summary of the M&O budgets for the past three years is presented in Table 4 and a typical pattern of expenditures (FY12) are shown in Table 8.

Table 8: *F12 M&O expenses*

Items	**Cost**	**Items**	**Cost**
Colloquia	$8,611	MSE Video	$23,900
Departmental Events	$5,041	Public Relations	$1,012
Faculty Meetings	$803	Recruitment	$ 330
Faculty Travel	$1,243	Staff Development	$556
Supplies	$14,682	Student Materials	$1,447
UMC membership	$200		
TOTAL COST $57,825			

6. BENCHMARKING WITH PEER INSTITUTIONS

Benchmarking is performed using three peer public universities of similar scope (e.g. without an undergraduate program): the **University of Delaware**, The **University of Texas at El Paso**, and the **University of Virginia**. Table 9 summarizes the key metrics based on the 2012 ASEE survey data.

The large enrollment at the University of Delaware is due to a relatively large and recent number of MS students (see the relatively low number of degrees awarded). Our enrollment is 54 MSE students and will increase since several of our recent faculty members are still populating their research group. An increase in graduations is also expected over the next 4-5 years when the groups are fully developed. Despite this factor, we show the highest number of degrees awarded, particularly impressive if we add degrees awarded to the non-MSE students (5 last year alone)

that were fully supported and advised by MSE faculty. Our research expenditures are also the highest, consistent with our research activity and focus. In fact, our department was ranked third in research expenditures among Materials Science departments at public universities in the 2011 ASEE survey (after Pennsylvania State University and University of Illinois at Urbana-Champaign, which have each 25 core faculty members).

Table 9: *Benchmarking with peer public institutions of similar size and programs based on 2012 ASEE survey data*

	University of Texas at Dallas	**University of Texas El Paso**	**University of Delaware**	**University of Virginia**
Enrollment	54	30	72	45
Degrees Awarded	19+5*	11	7	8
Faculty	15	9	13	18
Research Expenditures	$12.44M	$0.83M	$4.87M	$9.47M
Minimum Required School Credit Hours Courses/Research	30/45	35/39	36/18	38/25
Minimum SCH required for graduation	75	74		

***** 19 graduates from MSEN department and 5 graduates from other departments but supported by MSEN faculty

Appendix 1

Department Research Expenditures

Appendix 1

Breakdown in departmental research expenditures for FY 12

Material Science Engineering Research Expenditures					
	Total	Federal & National Government	State Government	Private & Non-Profit Organizations	Local Government
Department Allocation	$1,451,411	$82,326	$336,815	$31,884	$1,000,386
Chabal Yves J	$1,876,539	$713,170	$837,361	$133,063	$192,945
Cho Kyeongjae	$86,514	$26,740	$0	$36,657	$23,117
Duncan Walter M	$3,067	$0	$2,289	$0	$778
Fischetti Massimo	$507,751	$49,949	$0	$131,645	$326,157
Gelb Lev D	$349,407	$244,834	$0	$0	$104,573
Gnade Bruce E	$1,127,714	$776,399	$0	$264,060	$87,255
Hinkle Christopher L	$688,854	$0	$0	$246,625	$442,229
Hsu Julia W	$711,392	$70,574	$0	$58,541	$582,277
Kim Jiyoung	$1,013,562	$0	$0	$922,444	$91,118
Kim Moon J	$1,603,375	$132,523	$946,129	$305,274	$219,448
Quevedo Manuel	$265,782	$61,835	$0	$51,279	$152,668
Smith Jr Dennis W	$104,437	$104,437	$0	$0	$0
Vogel Eric M	$217,216	$0	$43,090	$54,403	$119,723
Voit Walter E	$276,909	$40,452	$23,416	$0	$213,040
Walker Amy V	$362,372	$305,889	$0	$275	$56,208
Wallace Robert M	$1,265,318	$877,703	$149,302	$116	$238,196
	$11,911,619	$3,486,832	$2,338,402	$2,236,266	$3,850,119

* From Chemistry Department, MSEN Cost Center

Appendix 2

Facilities and Equipment

Appendix 2

Facilities and equipment

The Erik Jonsson School of Engineering and Computer Science has extensive, excellent, modern facilities to fully support the students and faculty in Materials Science & Engineering. The Jonsson School has a dedicated Facilities Director, Mr. Tarun Basu, to oversee the Jonsson School Complex. The Jonsson School features state-of-the-art classrooms and labs located in the 330,000-square-foot Engineering and Computer Science Complex and the 192,000-square-foot Natural Science and Engineering Research Laboratory building (NSERL shown below) completed in 2006, where the MSE department is housed.

Throughout the Engineering complex and University there is signage and directions so that everyone is aware of his/her location in the buildings. This ensures that the occupants can safely vacate the complex in case of fire emergency or assemble in a safe location within the building in case of a tornado or extreme weather. The Engineering complex is monitored by a number of cameras to ensure safety of the occupants 24/7, and wall-mounted red emergency phones are located throughout ECSN that provide direct lines to the university police department. University police check the complex regularly and are available 24/7 in case of emergency.

There are a number of plasma displays throughout the complex that show what is happening at the School (that includes course requirements, seminars by guest lecturers, student society activities, etc.) to keep students informed. Cleaning is done on a regular basis, and maintenance processes are followed for routine and non-routine procedures. There are chairs and tables throughout the ECS complex that support student study and rest. In addition, there is a reading room on the ground floor of ECS North that provides high-quality space for quiet study, as well as a small reference collection.

Natural Science and Engineering Research Laboratory building (NSERL)

Equipment available to the MSE faculty in NSERL

RL 4.502	Young Lab: Advanced Electrical Characterization Laboratory (AECL)
Item No.	**Equipment name**
1	Cascade Summit 11000B-AP Probe station on vibration isolation table
2	Keithley 4200-SCS with 4 SMU
	Windows XP,with Kiethley software (KCON, KITE, KULT, KXCI, Kpulse)
	Hard drive size:
	Located in Rack on casters
3	Agilent 4284A Precision LCR Meter
	Located in Rack on casters
4	AH 2760A Ultra-precision capacitance bridge (50Hz - 20 kHz)
	Located in Rack on casters
5	Keithley 707 A Switching Matrix
	Located in Rack on casters
6	IPE Set up on vibration isolation table
	Alessi 5000 Probestation with 2 manipulators and enclosure box
	SRS SR770 FFT Network Analyzer
	SRS SR 570 low noise current preamplifier
	SRS SR530 Lock-in Amplifier
	Newark UV lamp, power supply, monochrometer, optics, fiber optics
7	Wenworth Labs probe station and enclosure box
8	Fluke 114 Digital Volt Meter
9	Misellaneous items
	Assorted cables (BNC, GPIB, etc.)
	2 work benches, 8 roller cabinets
	Tools, assorted connectors, etc.
	LN2 Dewar (160L)

RL 4.504	AECL Lab - Shared Electrical Characterization lab
Item No.	Description
1	Desert Cryogenics probe station with turbo pump station
	Lakeshore 332 Temperature controller
2	Cascade summit 11861B with 4 manipulators
	Attoguard chamber
3	Keithley 4200 with 2 SMU
	Located in Rack on casters
4	Keithley 590 CV Analyzer
	Located in Rack on casters
5	Agilent 4284A Precision LCR Meeting
	Located in Rack on casters
6	Agilent 81110A Pulse/Pattern Generator (165/330 MHz)
7	Agilent 33120 A 15MHz Waveform Generator
8	HP 4155A Semiconductor Paramater Analyzer
9	Tetronix DPO Digital Phosphor Oscilloscope
10	SRS DS345 Synthesized Function Generator
11	HP 6181B DC Current Source (0-100V; 0-250 mA)
12	MC Systems MC8806 probe station with enclosure box and 3 manipulators
	Has Model 3100 xy motorized stage

RL 3.718	Chabal Lab
Item No.	Equipment name
1	Eleven Thermo Nicolet 6700 Infrared spectrometers
2	Two Thermo Fisher Scientific Nexus 670 Infrared spectrometers
3	One Thermo Fisher iS50 Infrared spectrometer equipped with ATR capabilities
4	One Thermo Nicolet micro and macro Almega XR Raman spectrometer,
5	One Woolam spectroscopic ellipsometer (193-1000 nm),
6	One Horiba Jobin Yvon UVISEL spectroscopic ellipsometer (190-2000 nm),
7	One Veeco Dimension 3100 atomic force microscope,
8	One Physical Electronic 5600 X-Ray photoelectron spectrometer equipped with standard and monochromated sources,
9	One Low Energy Ion Scattering (Q-Tac LEIS from IonTOF),
10	Three Specac high pressure- high temperature (HP-HT) IR cell
11	One Janis PTSHI series cold refrigerator (CCR) system (liquid He)
12	Seven Ultra High Vacuum chambers equipped with surface science experiment (RGA, LEED, TPD, Sputtering, Physical deposition, CVD)
13	Five High Vacuum ALD reactors, two of them equipped with Residual Gas Analyser MKS Vision 1000-CTM.
14	One SPECS PCF-RF remote plasma source,
15	One M-Braun Dual glove box
16	One IKA RV10 Digital Rotovap with motorized lift, digital RPM display and heating bath with digital temperature control.
17	One SDT Q600 TA Instrument for simultaneous TGA/DSC measurements
18	One Rame-Hart Contact Angle Goniometer
19	One BASi Controlled Growth Mercury Electrode
20	One Thermo Legend-Mach 1.6 centrifuge
21	One UVOCS Inc. UV-Ozone cleaning system
22	One Tube furnace Carbolite 1000^{o}C and one atmospheric furnace Thermolyne 1000^{o}C
23	Two 160^{o}C ovens for chemical glassware drying
24	One fully automated Tousimis (Autosamdri-825, series A) critical point dryer One Carver
25	One 12 tons press with 13mm dies
26	One atmospheric furnace Lindberg Blu M 1200^{o}C
27	One Sonicator
28	One Miyachi 300 ADP dual Pulse spot welder
29	One Pfeiffer vacuum Helium Leak Checker
30	Two DI water polishers (one per chemical prep room)
31	One Carver 12 Tons press with 13 mm die for pellet compression
32	One Branson SSE-1 sonifier sound enclosure
33	Two Pfeiffer 300 ls^{-1} pumping stations
34	One Princeton Applied Research 273A Potentiostat/Galvanostat
35	One UV Rayonet RPR 200 equipped with sources for 253, 300, 350 and 575 nm
36	One micro balance

RL	Cho
Item No.	**Equipment name**
1	PC cluster with 368 Intel CPUs

RL	Fischetti
Item No.	**Equipment name**
1	One IBM P755 cluster system: 128 nodes
2	6 IBM AIX Workstations

ECSS 4.613	Gelb Lab - ECSS 4.613, 4.614
Item No.	**Equipment name**
1	File -servers with 10 TB of available RAID disk space
2	Six desktop workstations
3	Cluster system: 20 nodes, each with a single quad-core Intel Q9400 and 4 GB RAM, connected via gigabit Ethernet
4	Cluster system: 16 nodes, each with foujr quad-core AMD 2.9 GHz "Barcelona" processors and 32 GB RAM, connected via ConnectX Infiniband networking. This system provides 2.2 million core-hours/year
5	Cluster system: 96 nodes, each with a single Xeon E3-1240v2 quad-core 3.4 GHz processor, 8 GB RAM, and 60 GB SSD. These are based on SuperMicro "MicroCloud" chassis, and are connected using two independent gigabit Ethernet networks of stacked 48-port switches

RL 1.422	Gnade (Cleanroom) - RL 1.422, 1.430, 1.432, 1.436, 1.440
Item No.	**Equipment name**
1	TYSTAR LPCVD - Silicon Nitride Dep
2	TYSTAR LPCVD - Poly-Silicon Dep
3	TYSTAR LPCVD - Doped Poly-Silicon Dep
4	TYSTAR LPCVD - Low Temp Oxide (LTO)
5	THERMCO Minibrute - N-Type Diffusion
6	THERMCO Minibrute - General use (metal annealing)
7	THERMCO Minibrute - Si Only - forming gas metal annealing
8	THERMCO Minibrute - Si Only - Oxidation
9	Cambridge Atomic Layer Deposition
10	JETFIRST 200 jipelec RTA
11	TYSTAR Atmospheric Furnace - Oxidation
12	TYSTAR Atmospheric Furnace - Oxidation
13	TYSTAR Atmospheric Furnace - solid source doping P Type
14	TYSTAR Atmospheric Furnace - solid source doping N Type
15	CDO Burn Box for Thermal Bay
16	Modular Process Technology RTP-600S
17	Modular Process Technology RTP-600S
18	Special Coating Systems Parylene Labcoter
19	Heidelberg DWL66 Laser Witer
20	ULTRATECH Mask Cleaner
21	Leica INM 200 Optical Microscope
22	CPK Chrome **E**tch & Base **D**evelop
23	CPK **S**olvent & Base **D**evelop
24	Leatherwood Solvent Hood
25	Q-4000 Series Quintel Contact Printer
26	CEE Coat Spinner
27	Cole Parmer Tabletop Hotplate
28	Cole Parmer Tabletop Hotplate
29	TPS Digital Hotplate [exhausted enclosure]
30	TPS Digital Hotplate [exhausted enclosure]
31	TPS Digital Hotplate [exhausted enclosure]
32	TPS Digital Hotplate [exhausted enclosure]
33	HMDS Oven
34	Blue M Oven
35	Blue M Oven
36	Blue M Oven
37	Blue M Oven

38	Cole Parmer Oven
39	Vacuum Oven
40	Karl Suss Contact Printer
41	Headway Resist Spinner
42	CHA 50 E-Gun Vac Evap
43	K&S Ball Wire Bonder
44	K&S Chisel Wire Bonder
45	Micro Tech Dual-stack Spin Rinse Dryer
46	Tousimis Supercritical Dryer (MEM structure release)
47	Samco UV-Ozone Stripper/Cleaner model UV-1
48	Leatherwood General Solvent Hood
49	Leatherwood Manual Acid Hood
50	Leatherwood Manual Base Hood
51	Leatherwood RCA Acid Hood
52	Thermal Oven
53	Reichert-Jung Optical Microscope
54	Leica INM 100 Optical Microscope
55	LEO Supra40 FESEM w/ NPGS, EDAX & Nanomanipulator
56	Raith 150-TWO E-Beam Litho
57	SENTECH SE800 Ellipsometer
58	Alessi 4-Point Probe
59	Prometrix Auto 4-Point Probe
60	Toho FLX-2320-S Wavelength Stress Measurement
61	Veeco Dektak VIII Profilometer
62	Nanometrics Nanospec Film Thickness
63	Thermo Electron FTIR Spectrometer
64	Hummer - SEM Sample Coater
65	Obducat Nano-Imprinter NIL-2.5" Imprint Tool
66	Digital Instruments (Veeco) Dimension 5000 series SPM
67	Rame'-Hart Goniometer
68	Integrated Ozone Delivery System (ALD capability)
69	Residual Gas Analyzer (RGA)
70	Ge ATR Crystal (FTIR accessory)
71	Keithly 4200 Semiconductor Characterization System

RL 4.422	Hinkle Lab
1	MBE Molecular Beam Epitaxy for Growth of:
	Group IV:
	Growth Chamber
	Ion Pump
	Ion pump controller
	Cryo Pump
	Compressor for Cryo pump
	Cryo Shroud
	Chilled water supply for heaters and e-beam
	Ion Gauge x 2
	Monitoring Ion Gauge
	Deposition Controller
	Thickness Monitor
	Linear Motion Shutter x4
	Shutter Controller
	Germanium e-beam source
	Silicon e-beam source
	High Voltage Power Supply for e-beam
	Boron Effusion Cell
	Antimony effusion Cell
	Power Supplies for effusion cells
	PID Temperature Controller
	Residual Gas Analyzer
	RHEED camera
	RHEED gun and screen
	Substrate Heater
	Power supply for Heater
	Wobble Stick
	Preparation Chamber
	Ion Pump
	Ion pump controller
	Titanium Sublimation Pump
	Ion gauge
	High Temperature Heating Station
	Wobble stick x 2
	Other
	Roughing Pump
	Sorption Pump x 2
	Turbo Molecular Pump
	Ion Gauge for Turbo

	Backing pump for Turbo
	Cold trap
	Heating elements for baking
	Bake control
	Baking panels
	Group III-V:
	Growth Chamber
	Ion pump
	Ion pump controller
	Cryo pump
	Compressor for cryo pump
	Control Panel for cryo pump
	Cryo shroud for chamber
	Cryo shroud for effusion cells
	Liner Motion Shutter x6
	Shutter control
	Ion Gauge
	Monitoring ion Gauge
	Effusion Cells x 6
	PID Temperature Controller
	Plasma Nitrogen Source
	Atomic Hydrogen Source
	Arsenic Cracker Source
	Phosphorus Cracker Source
	Phosphorus Recovery System
	Power supplies for effusion cells and sources
	Chilled water supply for heaters and effusion cells
	RHEED Gun and screen
	Wobble stick
	Substrate manipulator
	Substrate heater
	Preparation Chamber
	Ion pump
	Ion pump controller
	Ion gauge
	Wobble stick
	Other
	Roughing Pump
	Sorption Pump x 2
	Heating elements for bake
	Bake control

	Baking panels
	Group II-VI:
	Growth Chamber
	Ion pump
	Ion pump controller
	Cryo pump
	Compressor for cryo pump
	Cryo shroud for chamber
	Linear Motion Shutter
	Shutter control
	Ion Gauge
	Monitoring ion Gauge
	Effusion Cells x 6
	PID Temperature Controller
	Plasma Nitrogen Source
	Power supplies for effusion cells and sources
	Chilled water supply for heaters and effusion cells
	RHEED Gun and screen
	Residual Gas Analyzer
	Wobble stick
	Substrate manipulator
	Substrate heater
	Preparation Chamber
	Ion pump
	Ion pump controller
	Ion gauge for prep chamber
	Ion gauge for Load lock
	Wobble stick
	Other
	Turbo molecular pump
	Backing pump for turbo
	Control panel for turbo
	Heating elements for bake
	Bake control
	Baking panels
	Transfer Chamber:
	Wobble stick x 2
	Ion Pump
	Ion Pump Controller
	Ion gauge
	Substrate Rail

	Bake control
	Baking panels
2	Other:
	Acid hood
	Solvent Hood
	MilliQ Millipore DIW supply system
	MBraun Glove box
	Rotary vacuum pump
	Nitrogen dry box
	Liquid Nitrogen Filling station
	Liquid nitrogen phase separator
	Liquid nitrogen storage tank
	Perkin Elmer MBE chamber
	Riber III-V MBE chamber

RL 4.718	**Hsu Lab**
1	Glovebox with integrated thermal evaporator
2	Solar Simulator (class AAA)
3	External quantum efficiency apparatus
4	Atomic force microscope
5	Electrochemical impedance spectroscopy
6	Light modulated photocurrent/photovoltage spectroscopy
7	Scanning Kelvin probe and surface photovoltage spectroscopy
8	Kelvin probe apparatus
9	Photoelectron spectroscopy in air
10	Dynamic light scattering apparatus
11	Fourier transform infrared spectroscopy
12	Thermogravimetric analysis
13	UV-vis spectrometer
14	Optical/Fluorescence microscope
15	Digital electronic balance
16	Microwave reactor
17	Spin coater

RL 4.436	Kim, Jiyoung Lab
Item No.	**Equipment name**
1	Portable Cleanroom
2	Chemical hood
3	Cambridge Nanotech Savannah 200 ALD
4	Picosun ALD
5	NCD D100
6	NCD G100
7	TIMEC ozone generator
8	Nitridation system
9	Renishaw Raman
10	NTMDT Atomic Force Microscope (AFM)
11	Plasma Enhanced ALD (PEALD)

RL B.804	Kim, Moon Lab
Item No.	**Equipment name**
1	UHV wafer bonding instrument
2	EVG wafer bonder
3	Modular cleanroom

RL B.510	Kim, Moon - Nano-Characterization Facility
Item No.	**Equipment name**
1	FIB (Focused Ion Beam) System: FEI Nova 200 NanoLab FIB
2	3D Nano Structures
3	NanoStudio3D™
4	Lift-Out Sample Preparation
5	SEM (Scanning Electron Microscope): Zeiss Supra 40 SEM
6	SEM (Scanning Electron Microscope): JEOL NeoScope JCM-5000 Benchtop SEM
7	TEM (Transmission Electron Microscope): JEOL JEM-2100F Analytical TEM
8	TEM (Transmission Electron Microscope): JEOL JEM-ARM200F Atomic Resolution Analytical TEM
9	Picometer imaging by HAADF-STEM and Atomic Resolution 2D Elemental Analysis
10	INSITU I-V Measurement by STM-TEM Nanofactory
11	Probing P-N Junction in a Single Transitor Device
12	Gatan 655 Turbo Pumping Station
13	South Bay Technology PC2000 Plasma Cleaner
14	XRD (X-Ray Diffraction) System: Rigaku Ultima-III Thin Film System
15	XRD (X-Ray Diffraction) System: Rigaku Rapid/Spider System
16	AFM (Atomic Force Microscopy): Veeco MultiMode V SPM (Scanning Probe Microscope)
17	Allied Techcut Diamond Saw Cutting Tool
18	Gata TPC (Tuned Piezo Cutting) Tool
19	Allied Techprep Polishing Machine
20	Ultra Tec 4" Wafer Polishing Machine
21	Gatan 656 Dimple Grinder
22	Branson 2510-DTH Ultrasonic Cleaner
23	Olympus BX51 Optical Microscope
24	Fischione Instruments 1010 Ion Mill
25	Gatan 691 Precision Ion Polishing System
26	Denton Vacuum Desk III TSC
27	Specimen Holders:
	JEOL Holders
	Gatan Liquid Nitrogen Cooling Holder
	Nano-Factory Holders
	Fischione Tomagraphy Holder
	Protochips Holders

RL 3.740	Quevedo Lab
Item No.	**Equipment name**
1	PLD1
2	PLD2/PED1
3	KrF Laser
4	Glove box
5	Hood1
6	Hodd2
7	pH meter
8	Electronic balance
9	Dry oven
10	Viscometer
11	Omini Jet Printer
12	Probe station
13	Solar simulator
14	AC/DC HMS
15	UV-Vis spectrophotometer
16	FTIR

RL 3.740	Walker Lab
Item No.	**Equipment name**
1	ION TOF IV (ION TOF, Inc.), time-of-flight secondary ion mass spectrometer
2	Chamber for Photo-assisted Chemical Vapor Deposition
3	Infrared Spectrometry System
4	UHV Chamber for Catalysis and Photocatalysis Experiments
5	Thermionics Dual Source Thermal Evaporator
6	Gaertner Scientific Single Angle Stokes Ellipsometer
7	Q-Sense Quartz Crystal Microbalance with Dissipation (QCM-D)
8	KSV Langmuir-Blodgett Films
9	Keyence VHX200 Digital Microscope

RL 4.436	Wallace Lab
Item No.	**Equipment name**
1	100mm Wafer-Capatible UHV deposition and characterization tool
	Anaytical Module:
	Low energy electron diffraction (LEED)
	X-ray and ultra-violet photoelectron spectroscopy (XPS/UPS)
	Ion scattering spectroscopy (ISS)
	Sphera 7-channeltron detector for XPS/UPS/ISS
	Monochromated Al-Kalpha source for XPS
	Molecular beam epitaxy (MBE):
	100cc Si-shielded e-beam hearth for silicon thin film deposition. Cross beam quadupole mass spectrometer for flux monitoring
	100cc Ge-shielded e-beam hearth for silicon thin film deposition. Cross beam quadupole mass spectrometer for flux monitoring
	Staib RHEED system with k-space imaging digitization/analysis module
	Heating to 1200 °C with sample rotation
	Effusion cells for p-type and n-type dopants
	Sample temperature monitoring with optical pyrometer and thermocouple
	Chamber LN_2 cooling shroud to reduce H_2O partial pressures
	Sputter Module:
	Four 600 W confocal RF sputter magnetron sources. Co-sputtering and 2% thickness uniformity possible
	Heating to 1000 °C with sample rotation in reactive O2 ambient
	4-channel mass flow controller manifold for controlling gas injection
	Automated throttle valve to control pumping
	Molecular beam deposition (MBD):
	Exact copy of MBE module chamber
	2 x 4-pocket 8cc e-beam evaporator hearths for various metal and metal oxide depositions
	2 effusion cells for high-k oxide growth (e.g. Ga and Gd growth)
	Heating to 1000 °C with sample rotation
	Sample temperature monitoring with optical pyrometer and thermocouple
	Staib RHEED system with k-space imaging digitization/analysis module
	Hydrogen cracker source
	Oxygen and nitrogen plasma source
	Chamber LN_2 cooling shroud to reduce H_2O partial pressures
	Anneal module:
	Allows anneal to 700 °C in under various ambients (Such as UV/O_3, as well as O_2, N_2, Ar, etc.)
	Atomic Layer deposition (ALD) Module:

	Commercial Picosun ALD reactor
	2 loading option
2	Small sample UHV surface science deposition and characterization tool
	Analytical Module:
	X-ray and ultra-violet photoelectron spectroscopy (XPS/UPS)
	Argus 128-channeltron detector for XPS/UPS
	Capable of dynamic XPS (quasi-real time XPS)
	Monochromated Al-Kalpha source for XPS
	Dual Al/Mg x-ray source for imaging-XPS
	Manipulator with 77K – 1500 K sample dependant heating and cooling capabilities
	Cooling through a gold LN_2 reserve in direct contact with sample plate
	Heating via, direct current, e-beam or radiative
	Variable Temperature SPM
	< 40 K – 700 K
	Atomic force microscopy
	Scanning tunneling microscopy
	Q-plus AFM/STM
	In-situ gas dosing
	Preparation/Deposition Module:
	Low energy electron diffraction (LEED)
	Quadrople Mass spectrometer
	4-pocket EGC04 oxford applied research mini e-beam evaporator
	TC-50 Oxford applied research thermal gas (H and O) cracker
	Optical pyrometer
	Manipulator with 160 K – 1500 K sample dependant heating and cooling capabilities
	Cooling through a copper LN_2 reserve
	Heating via, direct current, e-beam or radiative

Appendix 3

Admission and Curriculum Requirements

Appendix 3

Admission and Curriculum Requirements – from Graduate Catalog

Department of Materials Science and Engineering
http://www.mse.utdallas.edu/

Faculty

Professors: Yves J. Chabal (Head), Massimo V. Fischetti, Bruce E. Gnade, Julia W. Hsu (Associate Head), Moon J. Kim, Robert M. Wallace.
Associate Professors: Kyeongjae (KJ) Cho, Lev D. Gelb, Jiyoung Kim, Manuel Quevedo, Amy V. Walker.
Assistant Professors: Christopher L. Hinkle, Walter E. Voit.
Professor Emeritus: Don W. Shaw.
UTD Affiliated Faculty: Ray H. Baughman (Chemistry), Wonjae Choi (Mechanical Engineering), Xin-Lin Gao (Mechanical Engineering), Matthew J. Goeckner (Electrical Engineering), Fatemeh Hassanipour (Mechanical Engineering), Gil S. Lee (Electrical Engineering), J.B. Lee (Electrical Engineering), Mark Lee (Physics), Hongbing Lu (Mechanical Engineering), Anton Malko (Physics), Padmakumar Nair (School of Management), Larry J. Overzet (Electrical Engineering), Dennis Smith (Chemistry), Mihaela Stefan (Iovu) (Chemistry), Anvar Zakhidov (Physics).
Adjunct Faculty: Shela Aboud (Stanford University), Husam Alshareef (KAUST, Saudia Arabia), Glen Birdwell (Army Research Laboratories), Luigi Colombo (Texas Instruments), Mathew David Halls (Materials Design), Richard Irwin (Texas Instruments), Oleg Lourie (Nanofactory Instruments Inc.), Prashant Majhi (SEMATECH, Austin, Texas), Steven Mick (Protochips, Inc.), Bhabendra Pradahn (NanoHoldings LLC), Bin Shan (Huazhong University of Science and Technology), Purushothaman Srinivasan (Texas Instruments), Scott Summerfelt (Texas Instruments), Eric M. Vogel (Georgia Tech).

Objectives

The objective of the Master of Science (M.S.) degree in materials science and engineering is to provide intensive preparation for the professional practice in modern materials science by those engineers and scientists who wish to continue their education. Courses are offered at times and locations convenient for the student who is employed on a full-time basis.

The objective of the Doctor of Philosophy (Ph.D.) program in materials science and engineering is to prepare individuals to perform original, cutting-edge research in materials science, particularly in the areas of nano-structured materials, electronics, optical and magnetic materials, bio-mimetic materials, polymeric materials, MEMS materials and systems, organic electronics, and advanced processing of modern materials.

Scholarship Opportunities

The Erik Jonsson School of Engineering and Computer Science offers competitive scholarship awards for very well qualified students. Interested students should request application materials by contacting the Department of Materials Science and Engineering.

Master of Science in Materials Science and Engineering

Admission Requirements

The University's general admission requirements are discussed here.

A student lacking undergraduate prerequisites for graduate courses in Materials Science and Engineering must complete these prerequisites or receive approval from the graduate adviser and the course instructor. A diagnostic exam may be required. Specific admission requirements are as follows:

- Student has met standards equivalent to those currently required for admission to the Ph.D. or Master's degree programs in Materials Science, Electrical Engineering, Chemistry, Physics, or Biology.
- A grade-point average in undergraduate-level course work of 3.5 or better on a 4-point scale.
- GRE scores of 500, 700 and 4 for the verbal, quantitative and analytical writing components, respectively, are advisable based on our experience with student success in the program.

Students, who fulfill only some of the above requirements, if admitted conditionally, will be required to take graduate level courses as needed to make up any deficiencies.

Degree Requirements – MS degree

The University's general degree requirements are discussed here.

The MSEN M.S. degree requires a minimum of 33 semester credit hours.

All students must have an academic advisor and an approved degree plan. These are based upon the student's choice of concentration. Courses taken without advisor approval will not count toward the 33 semester-hour requirement. Successful completion of the approved course of studies leads to the M.S. degree.

M.S. students undertaking the non-thesis option must complete at least 33 semester credit hours of coursework with a grade of B or better.

M.S. students undertaking the thesis option must carry out a research project under the direction of a faculty or affiliated faculty in Materials Science and Engineering, and complete and defend a thesis on the research project, but they need only complete the four core courses and 9 semester credit hours of advanced course work. A Supervisory Committee will be appointed once the faculty member accepts the student for a research project. The rules for the thesis defense are specified by the Office of the Dean of Graduate Studies.

For each of the proposed degree programs, students must obtain a grade of B- or better in each class and maintain an average core class GPA of at least 3.0 to remain in good standing and satisfy their degree requirements:

- MSEN 5310 Thermodynamics of Materials
- MSEN 5360 Materials Characterization

- MSEN 6324 (EEMF 6324) Electronic, Optical and Magnetic Materials
- MSEN 6319 Quantum Mechanics for Materials Scientists

Note: the presence of a course number in parentheses indicates that this course is cross-listed in another department.

A minimum of 9 semester credit hours of advanced coursework is required, from the following list:

- MSEN 5320 Materials Science for Sustainable Energy
- MSEN 5340 (CHEM 5340) Advanced Polymer Science and Engineering
- MSEN 5361 Fundamentals of Surface and Thin Film Analysis
- MSEN 5370 Ceramics and Metals
- MSEN 5375 (PHYS 5375) Electronic Devices Based On Organic Solids
- MSEN 5377 (PHYS 5377) Computational Physics of Nanomaterials
- MSEN 6310 (MECH 6301) Mechanical Properties of Materials
- MSEN 6320 (EEMF 6320) Fundamentals of Semiconductor Devices
- MSEN 6330 Phase Transformations
- MSEN 6340 Advanced Electron Microscopy
- MSEN 6350 Imperfections in Solids
- MSEN 6362 Diffraction Science

These courses are intended to provide greater depth and advanced training in areas broadly relevant to Materials Science and Engineering research.

The remaining credit hours are to be taken from the following list of Specialized Courses (or approved electives from Physics, Chemistry, Biology, Electrical Engineering, Mechanical Engineering or other departments):

- MSEN 5300 (PHYS 5376) Introduction to Materials Science
- MSEN 5331 (CHEM 5331) Advanced Organic Chemistry I
- MSEN 5333 (CHEM 5333) Advanced Organic Chemistry II
- MSEN 5341 (CHEM 5341) Advanced Inorganic Chemistry
- MSEN 5344 Thermal Analysis
- MSEN 5353 Integrated Circuit Packaging
- MSEN 5355 (CHEM 5355) Analytical Techniques I
- MSEN 5356 (CHEM 5356) Analytical Techniques II
- MSEN 5371 (PHYS 5371) Solid State Physics
- MSEN 5383 (PHYS 5383 and EEMF 5383) Plasma Technology
- MSEN 5410 (BIOL 5410) Biochemistry of Proteins and Nucleic Acids
- MSEN 5440 (BIOL 5440) Cell Biology
- MSEN 6313 (EEOP 6313) Semiconductor Opto-Electronic Devices
- MSEN 6321 (EEMF 6321) Active Semiconductor Devices
- MSEN 6322 (EEMF 6322, MECH 6322) Semiconductor Processing Technology
- MSEN 6341 Advanced Electron Microscopy Laboratory
- MSEN 6348 (EEMF 6348) Lithography and Nanofabrication

- BMEN 6355 (MSEN 6355) Nanotechnology and Sensors
- MSEN 6358 (BIOL 6358) Bionanotechnology
- MSEN 6361 (MECH 6361) Deformation Mechanisms in Solid Materials
- MSEN 6371 (PHYS 6371) Advanced Solid State Physics
- MSEN 6374 (PHYS 6374) Optical Properties Of Solids
- MSEN 6377 (PHYS 6377) Physics of Nanostructures: Carbon Nanotubes, Fullerenes, Quantum Wells, Dots and Wires
- MSEN 6382 (EEMF 6382) Introduction to MEMS
- MSEN 7320 (EEMF 7320) Advanced Semiconductor Device Theory
- MSEN 7V80 Special Topics in Materials Science and Engineering
- MSEN 8V40 Individual Instruction in Materials Science and Engineering
- MSEN 8V70 Research In Materials Science and Engineering
- MSEN 8V98 Thesis

The specialized courses are intended to provide Materials Science and Engineering graduate students with expertise in a specific field of endeavor.

Doctor of Philosophy in Materials Science and Engineering

Admission Requirements

The University's general admission requirements are discussed here.

A student lacking undergraduate prerequisites for graduate courses in Materials Science and Engineering must complete these prerequisites or receive approval from the graduate adviser and the course instructor.

A diagnostic exam may be required. Specific admission requirements follow.

The student entering the MSEN program should meet the following guidelines:

- Student has met standards equivalent to those currently required for admission to the Ph.D. or Master's degree programs in Materials Science, Electrical Engineering, Chemistry, Physics, or Biology.

- A grade-point average in undergraduate-level course work of 3.5 or better on a 4-point scale.

- GRE scores of 500, 700 and 4 for the verbal, quantitative and analytical writing components, respectively, are advisable based on our experience with student success in the program.

Students who fulfill some of the above requirements, if admitted conditionally, will be required to take graduate level courses as needed to make up any deficiencies.

Degree Requirements

The University's general degree requirements are discussed here.

The MSEN Ph.D. requires a minimum of 75 semester hours beyond the baccalaureate degree. These credits must include at least 30 semester hours of graduate-level courses in MSEN.

All students must have an academic advisor and an approved degree plan. Courses taken without advisor approval will not count toward the 75 semester-hour requirement.

Each doctoral student must carry out original research in the area of Materials Science and Engineering, under the direction of a faculty or affiliated faculty of Materials Science and Engineering, and complete and defend a dissertation on the research project. A Supervisory Committee will be appointed once the faculty member accepts the student for a research project. Students must be admitted to doctoral candidacy by passing a Qualifying Exam, which will be administered near the time that the students have completed their course work. Upon passing the Qualifying Exam, students must present and defend a Research Proposal with their Supervisory Committee within approximately nine months or sooner after passing the Qualifying Exam. The rules for the dissertation research and defense are specified by the Office of the Dean of Graduate Studies.

For the proposed degree program, students must obtain a grade of B- or better in each class and maintain an average core class GPA of at least 3.0 to remain in good standing and satisfy their degree requirements:

- MSEN 5310 Thermodynamics of Materials
- MSEN 5360 Materials Characterization
- MSEN 6319 Quantum Mechanics for Materials Scientists
- MSEN 6324 (EEMF 6324) Electronic, Optical and Magnetic Materials

Note: the presence of a course number in parentheses indicates that this course is cross-listed in another department.

A student may petition for waiver of core courses based on prior coursework of equivalent scope and level, and if the Department finds that the student has already mastered the course material, the student may replace that core course with elective courses for up to a total of twelve semester credit hours.

A minimum of 9 semester credit hours of advanced coursework is required, from the following list:

- MSEN 5320 Materials Science for Sustainable Energy
- MSEN 5340 (CHEM 5340) Advanced Polymer Science and Engineering
- MSEN 5361 Fundamentals of Surface and Thin Film Analysis
- MSEN 5370 Ceramics and Metals
- MSEN 5375 (PHYS 5375) Electronic Devices Based On Organic Solids
- MSEN 5377 (PHYS 5377) Computational Physics of Nanomaterials
- MSEN 6310 (MECH 6301) Mechanical Properties of Materials
- MSEN 6320 (EEMF 6320) Fundamentals of Semiconductor Devices

- MSEN 6330 Phase Transformations
- MSEN 6340 Advanced Electron Microscopy
- MSEN 6350 Imperfections in Solids
- MSEN 6362 Diffraction Science

These courses are intended to provide greater depth and advanced training in areas broadly relevant to Materials Science and Engineering research.
The remaining credit hours are to be taken from the following list of Specialized Courses (or approved electives from Physics, Chemistry, Biology, or Electrical Engineering, Mechanical Engineering, or other departments):

- MSEN 5300 (PHYS 5376) Introduction to Materials Science
- MSEN 5331 (CHEM 5331) Advanced Organic Chemistry I
- MSEN 5333 (CHEM 5333) Advanced Organic Chemistry II
- MSEN 5341 (CHEM 5341) Advanced Inorganic Chemistry
- MSEN 5344 Thermal Analysis
- MSEN 5353 Integrated Circuit Packaging
- MSEN 5355 (CHEM 5355) Analytical Techniques I
- MSEN 5356 (CHEM 5356) Analytical Techniques II
- MSEN 5371 (PHYS 5371) Solid State Physics
- MSEN 5383 (PHYS 5383 and EEMF 5383) Plasma Technology
- MSEN 5410 (BIOL 5410) Biochemistry of Proteins and Nucleic Acids
- MSEN 5440 (BIOL 5440) Cell Biology
- MSEN 6313 (EEOP 6313) Semiconductor Opto-Electronic Devices
- MSEN 6321 (EEMF 6321) Active Semiconductor Devices
- MSEN 6322 (EEMF 6322, MECH 6322) Semiconductor Processing Technology
- MSEN 6341 Advanced Electron Microscopy Laboratory
- MSEN 6348 (EEMF 6348) Lithography and Nanofabrication
- BMEN 6355 (MSEN 6355) Nanotechnology and Sensors
- MSEN 6358 (BIOL 6358) Bionanotechnology
- MSEN 6361 (MECH 6361) Deformation Mechanisms in Solid Materials
- MSEN 6371 (PHYS 6371) Advanced Solid State Physics
- MSEN 6374 (PHYS 6374) Optical Properties Of Solids
- MSEN 6377 (PHYS 6377) Physics of Nanostructures: Carbon Nanotubes, Fullerenes, Quantum Wells, Dots and Wires
- MSEN 6382 (EEMF 6382) Introduction to MEMS
- MSEN 7320 (EEMF 7320) Advanced Semiconductor Device Theory
- MSEN 7V80 Special Topics in Materials Science and Engineering
- MSEN 8V40 Individual Instruction in Materials Science and Engineering
- MSEN 8V70 Research In Materials Science and Engineering
- MSEN 8V98 Thesis
- MSEN 8V99 Dissertation

The specialized courses are intended to provide Materials Science and Engineering graduate students with expertise in a specific field of endeavor.

Description of Facilities Available for Conducting Research

An extensive array of the materials characterization, synthesis, and processing tools exist in the Department for student use in research Characterization capabilities include advanced high-resolution electron microscopy, x-ray diffraction, a large variety of surface analysis methods, and electrical characterization. Thin film deposition methods include atomic layer deposition, sputter deposition, thermal deposition, molecular beam epitaxy, chemical vapor deposition, pulksed laser deposition, and gas phase adsorption. Fabrication methods can be accomplished the Cleanroom Research Laboratory as well (http://www.utdallas.edu/research/cleanroom/). Computational modeling activities include studies from the atomistic to the macroscopic level. Details of the capabilities and faculty research can be obtained at: http://mse.utdallas.edu/.

Materials Science and Engineering Course Descriptions

CORE COURSES

MSEN 5310 Thermodynamics of Materials (3 semester hours)Work, energy and the first law of thermodynamics; the second law of thermodynamics, thermodynamic potentials, the third law of thermodynamics, thermodynamic identities and their uses, phase equilibria in one-component systems, behavior and reactions of gases. Solutions, binary and multicomponent systems: phase equilibria, materials separation and purification. Electrochemistry. Thermodynamics of modern materials. (3-0) S

MSEN 5360 Materials Characterization (3 semester hours) Survey of atomic and structural analysis techniques as applied to surface and bulk materials. Physical processes involved in the interaction of ions, electrons and photons with solids; characteristics of the emergent radiation in relation to the structure and composition. (3-0) S

MSEN 6319 Quantum Mechanics for Materials Scientists (3 semester hours) Quantum-mechanical foundation for study of nanometer-scale materials. Principles of quantum physics, stationary-states for one-dimensional potentials, symmetry considerations, interaction with the electromagnetic radiation, scattering, reaction rate theory, spectroscopy, chemical bonding and molecular orbital theory, solids, perturbation theory, nuclear magnetic resonance. (3-0) S

MSEN 6324 (EEMF 6324) Electronic, Optical and Magnetic Materials (3 semester hours) Foundations of materials properties for electronic, optical and magnetic applications. Electrical and Thermal conduction, elementary quantum physics, modern theory of solids, semiconductors and devices, dielectrics, properties of magnetic and optical materials. Prerequisite: MSEN 5300 or PHYS 5376 or equivalent. (3-0) S

ADVANCED COURSE LIST

MSEN 5320 Materials Science for Sustainable Energy (3 semester hours) Sustainable energy solutions require examining current fossil fuel supply, climate change, and renewable energy source development. Fossil fuel supply and climate change are intimately related, and the global community is actively developing renewable energy source to replace the fossil fuel and minimize its impact on the climate change. Materials science will enable diverse renewable

energy technologies (solar cell, biofuel, wind, geothermal etc.) and their practical utilization (energy storage, fuel cell, electrical vehicles, etc.). This course will examine energy and climate issues and sustainable energy solutions with emphasis on the role of materials science. (3-0) T

MSEN 5340 (CHEM 5340) Advanced Polymer Science and Engineering (3 semester hours) Polymer structure-property relations, Linear and nonlinear viscoelasticity. Dynamic mechanical analysis, time-temperature superposition, creep and stress relaxation. Mechanical models for prediction of polymer deformation, rubber elasticity, environmental effects on polymer deformation, instrumentation for prediction of long term properties. (3-0) R

MSEN 5361 Fundamentals of Surface and Thin Film Analysis (3 semester hours) Survey of materials characterization techniques; Rutherford backscattering; secondary ion mass spectroscopy; ion channeling; scanning tunneling and transmission microscopy; x-ray photoelectron and Auger electron spectroscopy; x-ray and electron diffraction. Prerequisite: MSEN 5360 or equivalent.(3-0) R

MSEN 5370 Ceramics and Metals (3 semester hours) Emphasis on structure-property relationships: chemical bonding, crystal structures, crystal chemistry, electrical properties, thermal behavior, defect chemistry. Chemical and physical properties of metals and alloys. Topics include: powder preparation, sol-gel synthesis, densification, toughening mechanisms, crystal structure, thermodynamics, phase diagrams, phase transformations, oxidation, mechanical, electrical and magnetic properties. Prerequisite: MSEN 5300 and 5310 or equivalents. (3-0) R

MSEN 5375 Electronic Devices Based On Organic Solids (3 semester hours) Solid state device physics based on organic condensed matter structures, including: OLEDs (organic light emitting diodes), organic FETs, organic lasers, plastic photocells, molecular electronic chips. (3-0) R

MSEN 5377 (PHYS 5377) Computational Physics of Nanomaterials (3 semester hours) This course introduces atomistic and quantum simulation methods and their applications to modeling study nanomaterials (nanoparticles, nanowires, and thin films). The course has three main parts: basic theory of materials (thermodynamics, statistical mechanics, and solid state physics), computational methods to model materials systems, and applications to practical problems. There are three main themes of the course: structure-property relationship of nanomaterials; atomistic modeling for atomic structure optimization; and quantum simulations for electronic structure study and functional property analysis. Prerequisite: MSEN 6319 or equivalent.(3-0) R

MSEN 6310 Mechanical Properties of Materials (3 semester hours) Phenomenology of mechanical behavior of materials at the macroscopic level and the relationship of mechanical behavior to material structure and mechanisms of deformation and failure. Topics covered include elasticity, viscoelasticity, plasticity, creep, fracture, and fatigue. Prerequisite: MECH 3301 or MSEN 5300 or equivalent. (3-0) R

MSEN 6320 (EEMF 6320) Fundamentals of Semiconductor Devices (3 semester hours) semiconductor material properties, band structure, equilibrium carrier distribution, non-

equilibrium carrier distribution, non-equilibrium current-transport processes, and recombination-generation processes. Prerequisite: EEMF 6319 or equivalent. (3-0) R

MSEN 6330 Phase Transformations (3 semester hours) Thermodynamic, kinetic, and structural aspects of metallic and ceramic phase transformations: mechanisms and rate-determining factors in solid-phase reactions; diffusion processes, nucleation theory, precipitations from solid solution, order-disorder phenomena, and applications of binary and ternary phase diagrams. Prerequisite: MSEN 5310 or equivalent. (3-0) R

MSEN 6340 Advanced Electron Microscopy (3 semester hours) Theory and applications of scanning and transmission electron microscopy; sample preparation, ion beam and analytical techniques. Prerequisite: MSEN 5360 or equivalent.(3-0) Y

MSEN 6350 Imperfections in Solids (3 semester hours) Point defects in semiconductors, metals, ceramics, and nonideal defect structures; nonequilibrium conditions produced by irradiation or quenching; effects of defects on electrical and physical properties, effects of defects at interfaces between differing materials. Prerequisite: MSEN 5310 and 6324 or equivalents.(3-0) R

SPECIALIZED COURSE LIST

MSEN 5300 (PHYS 5376) Introduction to Materials Science (3 semester hours) This course provides an intensive overview of materials science and engineering and includes the foundations required for further graduate study in the field. Topics include atomic structure, crystalline solids, defects, failure mechanisms, phase diagrams and transformations, metal alloys, ceramics, polymers as well as their thermal, electrical, magnetic and optical properties. (3-0) R

MSEN 5331 (CHEM 5331) Advanced Organic Chemistry I (3 semester hours) Modern concepts of bonding and structure in covalent compounds. Static and dynamic stereochemistry and methods for study.Relationships between structure and reactivity. Prerequisite: CHEM 2325 or equivalent. (3-0) Y

MSEN 5333 (CHEM 5333) Advanced Organic Chemistry II (3 semester hours) Application of the principles introduced in CHEM 5331, emphasizing their use in correlating the large body of synthetic/preparative organic chemistry. Prerequisite: MSEN 5331/CHEM 5331. (3-0) R

MSEN 5341 (CHEM 5341) Advanced Inorganic Chemistry (3 semester hours) Physical inorganic chemistry addressing topics in structure and bonding, symmetry, acids and bases, coordination chemistry and spectroscopy. Prerequisite: CHEM 3341, or consent of instructor. (3-0) Y

MSEN 5344 Thermal Analysis (3 semester hours) Differential scanning calorimetry; thermogravimetric analysis; dynamic mechanical and thermomechanical analysis; glass transition; melting transitions, relaxations in the glassy state, liquid crystalline phase changes. Prerequisite: MSEN 5360 or equivalent. (3-0) R

MSEN 5353 Integrated Circuit Packaging (3 semester hours) Basic packaging concepts,

materials, fabrication, testing, and reliability, as well as the basics of electrical, thermal, and mechanical considerations as required for the design and manufacturing of microelectronics packaging. Current requirements and future trends will be presented. General review of analytical techniques used in the evaluation and failure analysis of microelectronic packages. Prerequisite: MSEN 6324. (3-0) R

MSEN 5355 (CHEM 5355) Analytical Techniques I (3 semester hours) Study of fundamental analytical techniques, including optical spectroscopic techniques and energetic particle and x-ray methods including SEM, EDS, STM, AFM, AES, XPS, XRF, and SIMS. (3-0) Y

MSEN 5356 (CHEM 5356) Analytical Techniques II (3 semester hours) Study of chromatography (GC, LC, CZE), statistical methods (standard tests and ANOVA), chemical problem solving, and modern bio/analytical techniques such as biochips, microfluidics, and MALDI-MS. Prerequisite: CHEM 5355 or consent or instructor. (3-0) R

MSEN 5371 (PHYS 5371) Solid State Physics (3 semester hours) Symmetry description of crystals, bonding, properties of metals, electronic band theory, thermal properties, lattice vibration, elementary properties of semiconductors. Prerequisites: PHYS 5301 and 5320 or equivalent. (3-0) Y

MSEN 5383 (EEMF 5383, MECH 5383, PHYS 5383) Plasma Processing (3 semester hours) Hardware oriented study of useful laboratory plasmas. Topics will include vacuum technology, gas kinetic theory, basic plasma theory and an introduction to the uses of plasmas in various industries. (3-0) T

MSEN 5410 (BIOL 5410) Biochemistry of Proteins and Nucleic Acids (4 semester hours) Chemistry and metabolism of amino acids and nucleotides; biosynthesis of nucleic acids; analysis of the structure and function of proteins and nucleic acids and of their interactions including chromatin structure. Prerequisite: BIOL 3361 (biochemistry) or equivalent. (4-0) Y

MSEN 5440 (BIOL 5440) Cell Biology (4 semester hours) Molecular architecture and function of cells and subcellular organelles; structure and function of membranes; hormone and neurotransmitter action; growth regulation and oncogenes; immune response; eukaryotic gene expression. Prerequisites: BIOL 5410 and BIOL 5420, or the equivalent, or permission of the instructor. (4-0) Y

MSEN 6313 (EEOP 6313) Semiconductor Opto-Electronic Devices (3 semester hours) Physical principles of semiconductor optoelectronic devices: optical properties of semiconductors, optical gain and absorption, wave guiding, laser oscillation in semiconductors; LEDs, physics of detectors, applications. Prerequisite: EE 3310 or equivalent. (3-0) R

MSEN 6321 (EEMF 6321) Active Semiconductor Devices (3 semester hours) The physics of operation of active devices will be examined, including p-n junctions, bipolar junction transistors and field-effect transistors: MOSFETs, JFETs, and MESFETs. Special-purpose MOS devices including memories and imagers will be presented. Recommended co-requisite: EEMF 6320. (3-0) R

MSEN 6322 (EEMF 6322 and MECH 6348) Semiconductor Processing Technology (3 semester hours) Modern techniques for the manufacture of semiconductor devices and circuits. Techniques for both silicon and compound semiconductor processing are studied as well as an introduction to the design of experiments. Topics include: wafer growth, oxidation, diffusion, ion implantation, lithography, etch and deposition. (3-0) R

MSEN 6341 Advanced Electron Microscopy Laboratory (3 semester hours) Lab support for MSEN 6340. MSEN 6340 must be taken with or before MSEN 6341. (0-3) Y

MSEN 6348 (EEMF 6348, MECH 6341) Lithography and Nanofabrication (3 semester hours) Study of the principles, practical considerations, and instrumentation of major lithography technologies for nanofabrication of devices and materials. Advanced photolithography, electron beam lithography, nanoimprint lithography, x-ray lithography, ion beam lithography, soft lithography, and scanning probe lithography, basic resist and polymer science, applications in nanoelectronic and biomaterials. (3-0) Y

MSEN 6355 (BMEN 6355) Nanotechnology and Sensors (3 semester hours) Introduction to the concept of nanotechnology, in context toward designing sensors/diagnostic devices. Identifying the impact of nanotechnology in designing "state-of-the art" sensors for healthcare applications. Topics include: nanotechnology and nanomaterials, principles of sensing and transduction and heterogeneous integration toward sensor design. (3-0) Y

MSEN 6358 (BIOL 6358) Bionanotechnology (3 semester hours) Protein, nucleic acid and lipid structures. Macromolecules as structural and functional units of the intact cell. Parallels between biology and nanotechnology. Applications of nanotechnology to biological systems. (3-0) T

MSEN 6361 Deformation Mechanisms in Solid Materials (3 semester hours) Linear elastic fracture mechanics, elastic-plastic fracture mechanics, time dependent failure, creep and fatigue, experimental analysis of fracture, fracture and failure of metals, ceramics, polymers and composites Failure analysis related to material, product design, manufacturing and product application. Prerequisite: MSEN 5300 or MECH 6301/MSEN 6310 or equivalent. (3-0) R

MSEN 6362 Diffraction Science (3 semester hours) Diffraction theory; scattering and diffraction experiments; kinematic theory; dynamical theory; x-ray topography; crystal structure analysis; disordered crystals; quasi-crystals. (3-0) R

MSEN 6371 (PHYS 6371) Advanced Solid State Physics (3 semester hours) Continuation of MSEN 5371/PHYS 5371, transport properties of semiconductors, ferroelectricity and structural phase transitions, magnetism, superconductivity, quantum devices, surfaces. Prerequisite: MSEN 5371/PHYS 5371 or equivalent. (3-0) R

MSEN 6374 (PHYS 6374) Optical Properties of Solids (3 semester hours) Optical response in solids and its applications. Lorentz, Drude and quantum mechanical models for dielectric response function. Kramers-Kronig transformation and sum rules considered. Basic properties related to band structure effects, excitons and other excitations. Experimental techniques

including reflectance, absorption, modulated reflectance's Raman scattering. Prerequisite: MSEN 5371/PHYS 5371 or equivalent. (3-0) R

MSEN 6377 (PHYS 6377) Physics of Nanostructures: Carbon Nanotubes, Fullerenes, Quantum Wells, Dots and Wires (3 semester hours) Electronic bands in low dimensions. 0-D systems: fullerenes and quantum dots. Optical properties, superconductivity and ferromagnetism of fullerides. 1-D systems: nano-wires and carbon nanotubes (CNTs). Energy bands of CNTs: chirality and electronic spectrum. Metallic versus semiconducting CNTs: arm-chair, zigzag and chiral tubes. Electrical conductivity and superconductivity of CNTs, thermopower. Electromechanics of SWCNT: artificial muscles. Quantum wells, FETs and organic superlattices: confinement of electrons and excitons. Integer and fractional quantum Hall effect (QHE). (3-0) R

MSEN 6382 (EEMF 6382, MECH 6347) Introduction to MEMS (3 semester hours) Study of micro-electro-mechanical devices and systems and their applications. Microfabrication techniques and other emerging fabrication processes for MEMS are studied along with their process physics. Principles of operations of various MEMS devices such as mechanical, optical, thermal, magnetic, chemical/biological sensors/actuators are studied. Topics include: bulk/surface micromachining, LIGA, microsensors and microactuators in multiphysics domain. (3-0) R

MSEN 7320 (EEMF 7320) Advanced Semiconductor Device Theory (3 semester hours) Quantum mechanical description of fundamental semiconductor devices; carrier transport on the submicron scale; heterostructure devices; quantum-effect devices. Prerequisite: EEMF 6320 and EEMF 6321. (3-0) R

MSEN 7V80 Special Topics in Materials Science and Engineering (1-6 semester hours) For letter grade credit only. (May be repeated for a maximum of 9 hours.) ([1-6]-0) S

MSEN 8V40 Individual Instruction in Materials Science and Engineering (1-6 semester hours) (May be repeated for credit.) For pass/fail credit only. ([1-6]-0) S

MSEN 8V70 Research In Materials Science and Engineering (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S

MSEN 8V98 Thesis (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S

MSEN 8V99 Dissertation (1-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([1-9]-0) S

Appendix 4

New Student Orientation Presentation

Welcome to Materials Science and Engineering

The University of Texas at Dallas

Coursework and Qualifying Exams

Dr. Lev Gelb

Curriculum Review

Degree requirements are of two types:

Academics
- course requirements
- qualifying exams (only for Ph.D. students)

Research
- proposal
- dissertation / thesis

All students must have an academic advisor and an approved degree plan. Courses taken without advisor approval will not count towards your degree!

Course requirements (1)

The Department divides courses into three categories:

Core	foundational material
Advanced	of greater depth, building on the Core
Specialized	narrower, on very specific topics

Course requirements for both M.S. and Ph.D. students include:

MSEN 5300 Introduction to Materials Science

MSEN 5310 Thermodynamics of Materials
MSEN 6324 Electronic, Optical and Magnetic Materials
MSEN 6319 Quantum Mechanics for Materials Scientists
MSEN 5360 Materials Characterization

Course requirements (2)

Requirements vary by degree:

M.S. degree (non-thesis option)
- 33 total credit hours, including Core courses, with at least 9 credits of Advanced courses

M.S. degree (thesis option)
- 33 total credit hours, including Core courses
  - at least 9 credits Advanced course work
    - "Research" can be taken for remaining credit

Ph.D. degree:
- 75 total credit hours, including Research;
  - 30 credit hours of coursework, including Core and at least 9 credits of Advanced courses

Advanced Courses

- MSEN 5320 Materials Science for Sustainable Energy
- MSEN 5340 (CHEM 5340) Advanced Polymer Science and Engineering
- MSEN 5361 Fundamentals of Surface and Thin Film Analysis
- MSEN 5370 Ceramics and Metals
- MSEN 5375 (PHYS 5375) Electronic Devices Based On Organic Solids
- MSEN 7V80 Nanostructured Materials: Synthesis, Properties and Applications
- MSEN 5377 (PHYS 5377) Computational Physics of Nanomaterials
- MSEN 6310 (MECH 6301) Mechanical Properties of Materials
- MSEN 6320 (EEMF 6320) Fundamentals of Semiconductor Devices
- MSEN 6330 Phase Transformations
- MSEN 6340 Advanced Electron Microscopy
- MSEN 6350 Imperfections in Solids
- MSEN 6362 Diffraction Science
- MSEN 7V80 Semiconductor Device Characterization

Most advanced courses are offered every other year.

Actual offerings are on *CourseBook:*
http://provost.utdallas.edu/coursebook

Course Descriptions are in the *Graduate Catalog:*
www.utdallas.edu/student/catalog/gradcurrent/

Specialized Courses

- MSEN 5300 (PHYS 5376) Introduction to Materials Science
- MSEN 5331 (CHEM 5331) Advanced Organic Chemistry I
- MSEN 5333 (CHEM 5333) Advanced Organic Chemistry II
- MSEN 5341 (CHEM 5341) Advanced Inorganic Chemistry
- MSEN 5344 Thermal Analysis
- MSEN 5353 Integrated Circuit Packaging
- MSEN 5355 (CHEM 5355) Analytical Techniques I
- MSEN 5356 (CHEM 5356) Analytical Techniques II
- MSEN 5371 (PHYS 5371) Solid State Physics
- MSEN 5383 (PHYS 5383 and EEMF 5383) Plasma Technology
- MSEN 5410 (BIOL 5410) Biochemistry of Proteins and Nucleic Acids
- MSEN 5440 (BIOL 5440) Cell Biology
- MSEN 6313 (EEOP 6313) Semiconductor Opto-Electronic Devices
- MSEN 6321 (EEMF 6321) Active Semiconductor Devices
- MSEN 6322 (EEMF 6322, MECH 6322) Semiconductor Processing Technology
- MSEN 6341 Advanced Electron Microscopy Laboratory
- MSEN 6348 (EEMF 6348) Lithography and Nanofabrication
- BMEN 6355 (MSEN 6355) Nanotechnology and Sensors
- MSEN 6358 (BIOL 6358) Bionanotechnology
- MSEN 6361 (MECH 6361) Deformation Mechanisms in Solid Materials
- MSEN 6371 (PHYS 6371) Advanced Solid State Physics
- MSEN 6374 (PHYS 6374) Optical Properties Of Solids
- MSEN 6377 (PHYS 6377) Physics of Nanostructures: Carbon Nanotubes, Fullerenes, Quantum Wells, Dots and Wires
- MSEN 6382 (EEMF 6382) Introduction to MEMS
- MSEN 7320 (EEMF 7320) Advanced Semiconductor Device Theory

MSEN 5300

Fall semester:

MSEN 5300 Introduction to Materials Science
This course provides an intensive overview of materials science and engineering and includes the foundations required for further graduate study in the field. Topics include atomic structure, crystalline solids, defects, failure mechanisms, phase diagrams and transformations, metal alloys, ceramics, polymers as well as their thermal, electrical, magnetic and optical properties.

MSEN 5300 is considered a Specialized course for the purposes of credit-hour allocation; nonetheless, it is required for incoming students without equivalent prior coursework.

Core Courses

Fall semester:

MSEN 5310 Thermodynamics of Materials
Work, energy and the first law of thermodynamics; the second law of thermodynamics, thermodynamic potentials, the third law of thermodynamics, thermodynamic identities and their uses, phase equilibrium in one-component systems, behavior and reactions of gases. Solutions, binary and multicomponent systems: phase equilibrium, materials separation and purification. Electrochemistry. Thermodynamics of modern materials.

MSEN 6324 Electronic, Optical and Magnetic Materials
Foundations of materials properties for electronic, optical and magnetic applications. Electrical and thermal conduction, elementary quantum physics, modern theory of solids, semiconductors and devices, dielectrics, properties of magnetic and optical materials.

Core Courses

Spring semester:

MSEN 5360 Materials Characterization
Survey of atomic and structural analysis techniques as applied to surface and bulk materials. Physical processes involved in the interaction of ions, electrons and photons with solids; characteristics of the emergent radiation in relation to the structure and composition.

MSEN 6319 Quantum Mechanics for Materials Scientists
Quantum-mechanical foundation for study of nanometer-scale materials. Principles of quantum physics, stationary-states for one-dimensional potentials, symmetry considerations, interaction with the electromagnetic radiation, scattering, reaction rate theory, spectroscopy, chemical bonding and molecular orbital theory, solids, perturbation theory, nuclear magnetic resonance.

Grading

You are required to maintain a 3.0 (B) average, in both your CORE classes and OVERALL.

You must receive a B- (2.7) or better in each class taken towards your degree.

What does this mean?

A is an ACCEPTABLE grade
B is a BARELY PASSING grade
C+ or below is a FAILING grade

You will have to retake any course with a C+ or lower grade.

You will have to 'balance' any B- grades with higher ones.

Qualifying Exams (1)

Qualifying exams are given at the end of the Spring semester, in May or June. There are four parts, all taken on one day, that confirm your mastery and integration of Core material.

Ph.D. students must take the qualifying exam offered immediately after their completion of the four core courses.

M.S. students who wish to apply for re-admission as Ph.D. students must also take the qualifying exam offered immediately after their completion of the four core courses. Otherwise they will not be considered eligible for the Ph.D. program.

Qualifying Exams (2)

You must pass all four components of the exam in order to proceed to the proposal and Ph.D. candidacy.

You have only two chances to pass.

- If you fail only one of the sections, you will be required to retake only that section the following year.
- If you fail more than one, you will have to retake the entire exam.

If you need to retake all or part of the qualifying exam, you will be told to audit the core courses relevant to the parts you will be retaking.

If you have all "A" grades in the Core Courses, you may apply for a waiver from the qualifying exam; we encourage you to do this!

If you have passed comparable qualifying exams at a different institution, you may also apply for a waiver.

Qualifying Exams (3)

General comments

The qualifying exams are **hard**.

It is **important** to pass the first time.

It is important to start studying **before** the end of the Spring semester.

It is important to do well in your Core courses, so that you will have an easier time with the qualifiers.

On to Research?

Within **six months** of passing the qualifying exam, you must assemble your **Ph.D. Dissertation Committee.**

Within **nine months** of passing the qualifying exam, you must present your **research proposal**.

The research proposal describes your results to date and your plan for the major part of research to be conducted for your Dissertation. The proposal consists of a written document, in proper publication format, and a presentation made to the Committee.

Upon passing the proposal, you will be admitted to Candidacy for the Ph.D.

Colloquia

Department-wide colloquia (seminars) are held approximately every other week during the semester, and occasionally in the summer.

These are usually (but not always) on Thursdays, 10:45 AM – 12:00 PM. Coffee and cookies are provided.

These will expose you to current research - not just in your own narrow area of focus!

They are also a networking opportunity

You are expected to attend!

15-Minute Break

Research

Dr. Yves Chabal

Research

- Research vs. courses - becoming a professional scientist/engineer
- Work methods and ethics
  The research process
- Forming a committee and proposal defense
  - what it is and documentation
- Publishing, etc.
- Thesis

Research vs. courses

Research is primary goal of PhD program
Start immediately
Sustained effort during semester

Research is not measured by presence (time in the lab or on the computer)
Research is goal oriented: think of tasks and milestones, not time. Time is never wasted when active research is pursued. Most is learned from failures.

Apparently "mundane" (or technician-like) work is the foundation of successful research (hands on learning is the only way to progress) → Volunteer for "chores"

Productive research is interactive, not done in isolation

An important component of research work is effective communication of results (written and oral), requiring background knowledge, understanding, logic and organization. Good research papers cannot be written without a detailed outline with logical development.

Research vs. courses (cont'd)

Develop independence in research: do not expect your advisor to give you your program every day. Think independently. Come up with ideas that you then can bounce off your advisor. Take risks and learn from outcome.

Establish collaboration with other groups and students to learn things that are outside the scope of your group.

Own your work for which you are 100% responsible. Establish your deliverables and milestones, to be vetted by your advisor. Research requires independent thinking that is best developed by guided trial and errors.

Research methods and ethics

Learn: by formal and informal training, by volunteering, and by taking on more than your project, i.e. by constantly challenging yourself to do new things (most general learning during the first year)

Practice on your own: by performing experiments or measurements that you have learned

Focus: when in the lab, your mind must be 100% on the work → critical for SAFETY

Safety: learn and be aware of all safety issues and procedures in the lab

Be rigorous with attention to details. Discoveries are always based on "noticing" something unexpected which can only be done with attention to details.
→ Maintain a detailed lab book, particularly when "the experiment is not working"
→ Learn and use error analysis (all data have error bars; conclusions are only valid outside error bars)

Develop research integrity:
Data are sacred and cannot be modified or manipulated, only analyzed
Experimental results should be reproduced by anyone with similar equipment
Results are never wrong when care is taken to remove artifacts, only interpretations can vary
→ Make sure you present the results quantitatively (error bars, etc)

Research process

1. Identify problem and issue that can be studied (lit. search + knowledge of lab)
2. Design experiments and build necessary instrumentation/test structure/hardware
3. Focus first on targeted preliminary data to help refine experimental plans
4. Start study in earnest, but keep examining data at each step
5. Derive information from each experimental run, even when problem arise; Search for and welcome unexpected findings (no result is worthless unless an artifact)
6. Determine/reproduce experimental results with error bars under convinced that all results are fully reliable. Ensure that all parameters are controlled (reproducibility)
7. With firm results, creatively think of interpretation. Be bold and creative. Seek potential breakthroughs, then
8. Meticulously check every hypothesis with new experiments based on the predictions derived from the hypothesis. Checks should be comprehensive and analysis conservative at this stage. No data should be thrown out if they do not support the hypothesis. Rule out the hypothesis if a subset of data conflict with it.
9. Re-examine the data with a different hypothesis and repeat step 8.
10. Put together the whole story when data fully explained, focusing on clarity and logic, in a draft. Make an outline (discussed later).
11. Make figures (time consuming for good figures) and start writing paper.

Forming a committee + Proposal defense

Need to form a committee after passing the qualifier composed of:
Research advisor, two other MSE faculty member, one external member (outside department or external to university)

Schedule Proposal defense within one year of successful qualifier
Proposal defense includes:
1) written document circulated to committee at least two weeks before defense including motivation, preliminary data and proposed research with specific time line and milestones.
2) Power point presentation sent to committee the day before the presentation including similar information. Aim to present for 35-45 min and be ready for extensive questioning.

FORMING THE COMMITTEE AND SCHEDULING THE PROPOSAL DEFENSE IS THE SOLE RESPONSIBILITY OF THE STUDENT

Research communication: publications

When research complete enough and with approval of advisor, plan to write papers:

1) Make an outline: that logically organizes the paper with

- **Introduction:** background/motivation and main thrust of the paper
- Methods: experimental and theoretical approach (sample prep, measurements)
- **Results:** Data in a well-organized fashion (most plots are in this section) with clear description of results. This section should be reproducible by anyone with similar capabilities. The main concern for this section is to be sure there are no artifacts in the data or errors in calculations. Otherwise, data should be presented as fact and well organized. No interpretation here, just basic assignments (for spectra or other data).
- **Discussion:** This section is the most important because it brings the full impact of the results. It is based on specific assumptions or methods of analysis that need to be clearly described. The resulting conclusions or interpretations are always subject to revision if other assumptions are made or other information is available. This is why they are to be clearly described.
- **Conclusion and outlook:** This section summarizes the main conclusions/ interpretations and give an idea of the impact of the work.

Paper (cont'd)

2) Finalize figures for the result section: The effort here is the organization and the finalization of figures; figures with caption need to be self sufficient and organized in a way that the knowledgeable reader can figure out the paper just with the figures. This takes time!!

3) Write the methods and results sections: It is good to start with those sections that completely stand on their own. They are factual and precise. The effort is on making them clear to a reader who is not expert and to make them complete so that any other group can reproduce the data.

4) Write the introduction and discussion sections: Now that the facts have been established and you know what you observed, the effort is in motivating the work and understanding the data, and of course in presenting the interpretation clearly. That must include stating the assumptions or methods used to arrive at the conclusions and to discuss the impact of error bars on the conclusions.

5) Summarize

Thesis

The thesis is your legacy to the university and your foundation for your career.
Needs to be done thoroughly and with care

The thesis should be complete enough for another student to pick up the project where you left it and to continue →
Methods section should be much more detailed than in a paper

Formatting is important for the university. Do not underestimate the time it will take to get the final copy right!!

Can include the content of your papers verbatim, but usually not the method section that should be a separate chapter for reasons given above.

Research Etiquette

Dr. Julia Hsu

Research Etiquette

Etiquette is a code of behavior that delineates expectations for social behavior according to contemporary conventional norms within a society, social class, or group.

Materials Science and Engineering Student Orientation: Spring 2013

Some thoughts……

- At its most general, laboratory etiquette is the preferred (if not required) conduct in the lab.
- Lab skills are important, but etiquette and manners are too!
- You're going to be working with people from all over the world and different scientific/engineering backgrounds – not everyone is the same as you!

Some thoughts……and possible "rules"

1. Listen to others – nobody gets anything done if you're arguing all the time!
2. Respect other people's space – not everyone is into your music, etc.
3. Take responsibility – if you use up the last of something, order some more; admit if you broke something – it can get fixed!
4. Say "Thank you"
5. Clean up after yourself!
6. Don't be greedy!

Keep Good Records

What were you doing on January 8th 2008?

In ~5 years you will be writing your thesis.

You'll need to know what you did on January 8th 2013!

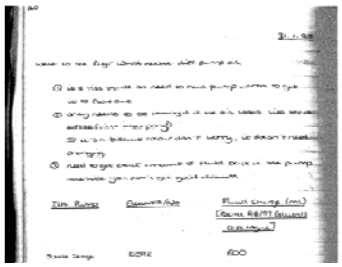
Your lab notebook is this record!

Keep it like a diary!

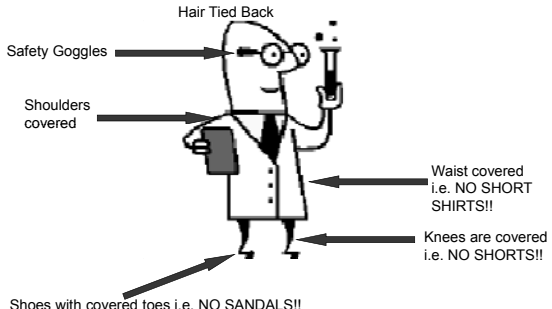
Every detail! Observations! Numbers!

Lab Notebooks

What was Prof. Walker doing on Jan 31st 1997?



Basic Lab Safety



Basic Lab Safety

- Use appropriate safety equipment – gloves, safety glasses, lab coats, etc.
- NEVER throw chemicals down the sink. They need to properly disposed.
- Do not work in a lab on your own.
- Make sure you have the appropriate training for any equipment that you use.

FIND OUT WHAT YOUR SPECIFIC LAB SAFETY RULES ARE!

Shared Equipment

The MSE department has a lot of shared equipment including SEMs, XPS, AFM, probe stations……

- Consult your advisor which equipment you will need.
- It is your responsibility to get trained on the equipment.
- Plan the appropriate amount of time for your experiments!
- If you break something, then you must let the person in charge of the equipment know. DO NOT LEAVE IT!

Materials Science and Engineering Student Orientation: Spring 2013

Deadlines and Your PhD/MS

You are responsible for completing the requirements of your degree:

- Classes
- Qualifying Exam
- Proposal
- MS/PhD Thesis

Not your advisor!

Additional Training

Attendance is required for the following training session:

New Student Orientation – Part 2

Friday, January 11, 2013

Location: NSERL Seminar Room 3.204

Training for Purchasing, Travel, & Reimbursements (with MSE Staff)
9:00 am – 10:00 am

Environmental Health and Safety (EH&S) Training (with Kathy White)
10:30 am – 11:30 am

Administrative Paperwork

Tonya Griffin, Administrative Services Officer

MS&E Administrative Procedures

Administrative Staff

- Tonya Griffin
  - Human Resources/Payroll
  - Scholarships
  - Shipping
- Diane Griffith
  - Graduate Admissions
  - Purchasing
- Julieta Terry
  - Travel
  - Special Events
- Ashley Willess
  - Graduate Advising
  - Curriculum
- Nithya Ramachandran
  - Accounting
- Suzanne Potts
  - FUSION

Department Organizational Chart

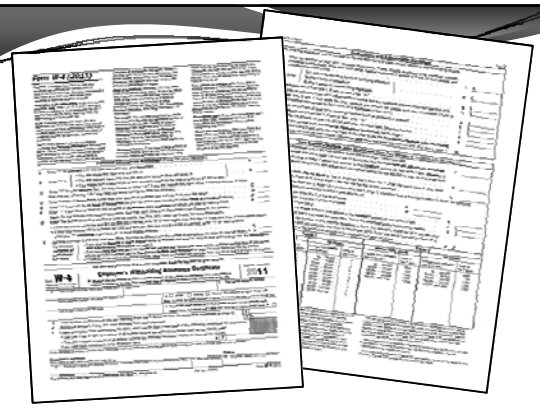
Mark Spong
School of Engineering and Computer Science
Dean

Yves Chabal
Materials Science and Engineering
Department Head

Julia Hsu
Materials Science and Engineering
Associate Department Head

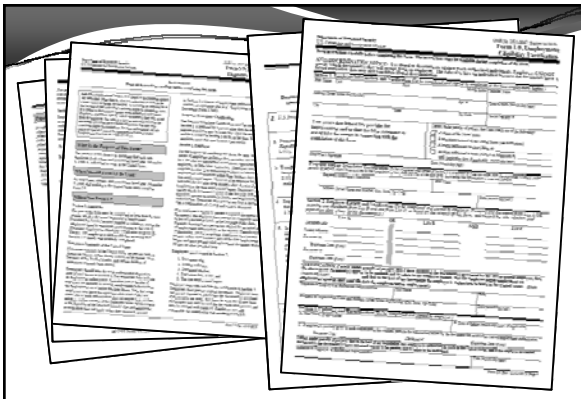
MSE Faculty

Personal Data Form



Form W-4

Direct Deposit or Check Distribution



Employment Eligibility Verification (I-9)

Additional Requirements

- Copies of I-9 Documentation
- Copy of Social Security Card (required for payroll)
- Driver's License
- Passport
- I-94

APPOINTMENT WITH WANDA BEVERLY

Wanda Beverly
Student Services Building:
Room SSB 2.313A
Phone Number:
972-883-4268
Email:
wjb110030@utdallas.edu

Date: _____
Mon. Tue. Wed. Thu. Fri.

Time: _____

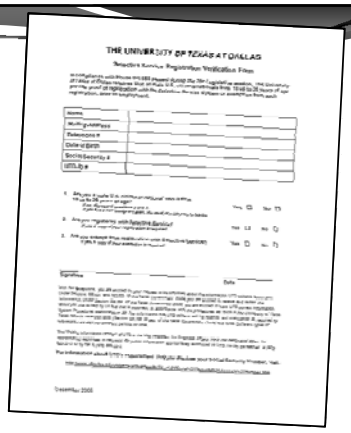
Bring to appointment:

- Passport
- All Visas
- I-94
- All I-20s (from any Trade School, College, or University)
- Social Security Card

NOTE: All international employees must meet with Wanda Beverly

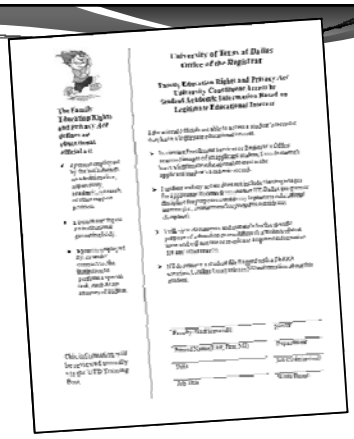
Selective Service Form

Males 18-26 only

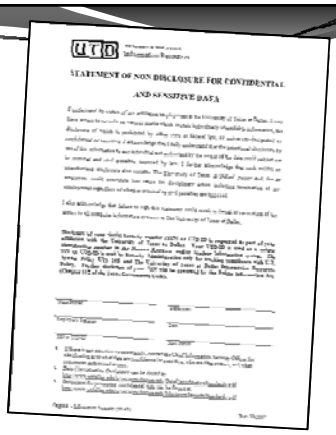


Criminal Background Check

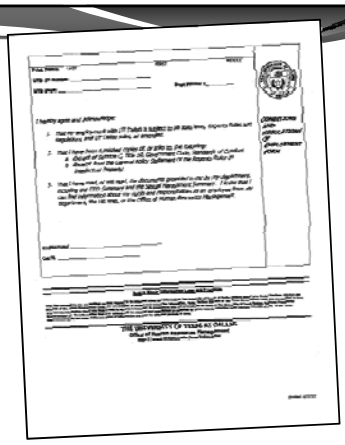
FERPA



Non-Disclosure Agreement



Conditions and Regulations of Employment Form



University Account Authorization (UAAF) Form

Computer Access Request (CAR) Form

What's Next For Payroll…

- Turn in Payroll Verification form monthly

Building Access and Facilities

Building Access

- Comet Card
- NSERL Badges
- Security

Laboratories

- Access granted by owner after qualified training

Questions and Answers

Session 2:
MSE New Student Orientation

Purchasing Procedures
Travel Procedures
Shipping and Receiving Procedures

Shipping and Receiving

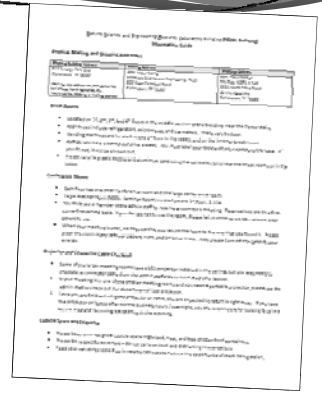
Tonya Griffin

Shipping & Receiving

- Shipping And Receiving
  - Shipping Form
  - Package Must Be Ready To Ship
  - Deadline to drop off packages for shipping is 2:00PM
  - Shipping address:
    800 W. Campbell Rd. RL10
    Richardson, TX 75080-3021
- Mail
  - Personal mail is not allowed at our mail room.
  - The nearest USPS mail drop box is in front of the Activity Center building
  - The FedEx and UPS shipping drop boxes are between parking lot A & B.

NSERL Building Information

- Shipping, Mailing, & Delivery Address
- Conference Room Reservation
- Projector Reservation



Additional Training Session

Environmental Health and Safety (EH&S) Training with Kathy White

Attendance is MANDATORY!

Purchasing Procedures

Diane Griffith

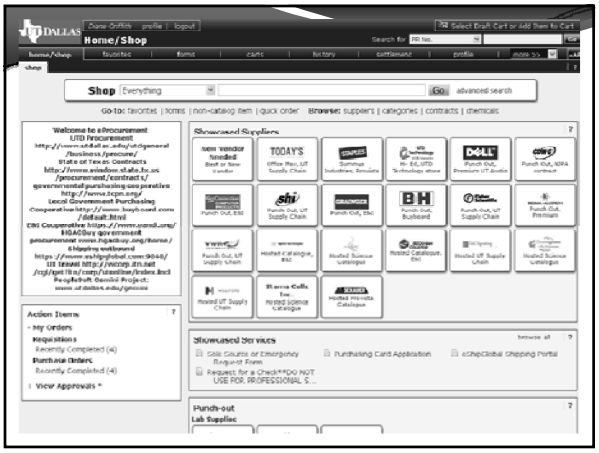
Purchasing

- There are two ways to purchase supplies at the University.

1. Use the electronic ordering system: E-Procurement
2. Use the departmental credit card

E-Procurement

- The University adopted the e-procurement system in the spring of 2011 and it is the preferred method for ordering supplies.
- Once you are given access to the online University systems you will be able to use the e-procurement system.
- E-Procurement is accessed by signing on to Galaxy and choosing the e-procurement link. The following slides give you an idea of what the screens will look like.



Departmental Credit Card

- Orders should be placed using the E-procurement system if possible.
- If an order cannot be placed using E-procurement the departmental credit card may be used.
- To place an order on the credit card you must take your order to Julieta or Diane, who will place the order for you.
- In both instances, you must have a Cost Center (which is an account number) where your purchase will be charged. Please ask your PI for the cost center he/she would like to use.

Travel Procedures

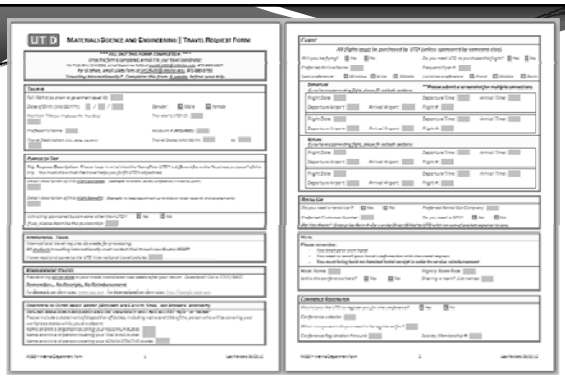
Julieta Terry

Julieta Terry – Duties

- Assist with travel arrangements
- Process travel reimbursements
- Process business reimbursements
- Process P-Card requests
- Colloquium

You are going to travel, what next:

- Go to the Materials Science Website (mse.utdallas.edu)
- Click on the "Faculty & Staff" tab, click on "Staff"
- On the left side, click on
  "Travel Request Form: Faculty/Students/Staff"



- Complete the Travel Request Form
- Email it to Julieta Terry

Paperwork for UTD

- Email to your travel coordinator:
  - Completed *Travel Request Form*
    - Select your preferred flight, don't just put the cities
  - Hotel confirmation information
    - Room rate per night (within per diem)
- Forms your travel coordinator will have:
  - Indemnification Form
  - Medical Form
  - Travel Authorization
  - Travel Voucher

What can I be reimbursed for?

- **Expenses WITH a receipt**:
  - Hotel room and tax
  - Taxi/shuttle to and from the airport and destination
  - Parking
  - Toll and train fees
  - Meals
  - Internet at hotel
  - Conference registration
  - Personal car mileage from UTD to the airport
  - Rental Car
  - Gas for Rental Car
  - Poster at conference
  - Airport checked bag fee

What will I NOT get reimbursed for?

- Flights you booked personally
- Parking violations
- Toothbrushes/toiletries/gum
- Hotel movies
- Meals over the daily per diem amount
- Hotel charges over the approved per diem
- Expenses **WITHOUT** a receipt
- *Remember **Receipt = Reimbursement**
  - (ex: train entrance took my ticket receipt)
  - (no exceptions: Professor, PostDoc, RA, Staff)

Traveling internationally?

- Contact your travel coordinator **SIX WEEKS** before the trip
  - Completed Travel Request Form
  - Copy of Passport, VISA, I-20
  - Proof of International health insurance
  - Foreign location and hotel information
  - Acceptance letter
  - Office of International Education (OIE) training
- Remember at least **SIX WEEKS** before trip

What is per diem?

- Per diem:
  - Latin meaning "per day"
  - Amount the state allows you to spend per day while traveling
  - The maximum is determined by month and location and will be listed on your travel envelope
    - Ex: San Francisco per diem is $150/$71/$53.25 (hotel/day/travel day)
    - Website to check per diem: www.gsa.gov → Click on "Per Diem Rates" on left side
  - You will **not** get reimbursed over the max amount, only what **you spent, WITHIN per diem,** and **have a receipt for.**

I've returned…what next?

- 1) Complete the Travel Expense Report
- 2) Bring your **Receipts** and **Report** to Julieta
- 3) Sign your Travel Voucher

Your reimbursement check should be deposited 2-4 weeks after you sign your voucher.

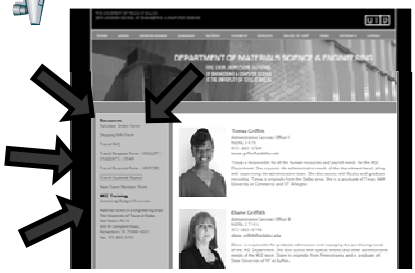
Good things to know:

- Alcohol while traveling is **not** reimbursed
- Remember, UTD **will not reimburse Texas state tax**. If you need a Poster printed, please stop by and get a "State Tax Exempt" form before paying.
- Sharing a hotel room can cut down on expenses (which makes your sponsor happy ☺), however, if both travelers paid a part of the hotel bill, both names need to be listed on the hotel receipt.
  - Ex: Bill and Joe shared a hotel room. Both Mr. Bill and Mr. Joe need to be listed on the hotel receipt.

Good things to know:

- When staying overnight in Texas, please see Julieta for a "Texas Hotel Tax Exemption" form
- Julieta can pay for your conference registration with a UTD credit card… so you won't have to pay out-of-pocket ☺. When requesting a conference registration, please have a cost center to charge the fee for registration.
- On our Staff website, there is a "**Travel FAQ**" webpage for further information

Questions?



Registration Deadlines

Ashley Willess

Late Registration & Transfer Credits

- Late Registration - Last Day to Add/Swap Classes
  - **Friday, January 11 through Tuesday, January 22 (last day)**
  - If you register or add during late registration, payment is due the same day you register. You will be assessed a minimum $100 late payment fee.
- Transfer Credit Request
  - Please email Ashley if you want to transfer a course
  - Requirements detailed on website: mse.utdallas.edu/about/degrees.html Click on "Course Transfer Policy" on left-hand side

How To Check for Policy Updates

Go to the Materials Science website:

mse.utdallas.edu
Graduate > Degrees

Most recent revisions to:

MS and PhD requirement policies

Course Transfer policy

Qualifying Exam policy

Additional Links:

Graduate Catalog

UT Dallas Policy for Completing a Graduate Degree

Use UT Dallas Email Accounts

- All official student email correspondence will be sent only to your UT Dallas email account.
- Only send requests using your UT Dallas email address, not your personal email address
- **This is required for security and privacy purposes**

Orientation Survey

Appendix 5

Faculty Qualifications & Department Personnel

Appendix 5: Faculty Qualifications & Department Personnel

Faculty Qualifications (MSEN appointment)

MSEN FACULTY								
Faculty Name	**Highest Degree, Field, Year**	**Rank**	**Academic Appointment**	**FT or PT**	**FTE**	**Years of Experience**		
						Industry	**Academia**	**UTD**
Auciello, Orlando	PhD, Physics, 1976	P	Tenured	FT	100%	29	27	1
Chabal, Yves	PhD, Physics, 1980	P	Tenured	FT	100%	21	10	5
Cho, KJ	PhD, Physics, 1994	P	Tenured	FT	100%	ns	18	6
Fischetti, Massimo	PhD, Physics, 1978	P	Tenured	FT	100%	26	7	2
Gelb, Lev	PhD, Chemistry, 1995	ASC	Tenured	FT	100%	ns	17	3
Gnade, Bruce	PhD, Nuclear Chemistry, 1982	P	Tenured	FT	100%	20	17	10
Hinkle , Chris	PhD, Physics, 2005	AST	Tenure Track	FT	100%	ns	5	5
Hsu, Julia	PhD, Physics, 1991	P	Tenured	FT	100%	13	12	3
Kim, Jiyoung	PhD, Mat Science & Eng, 1994	ASC	Tenured	FT	100%	5	17	5
Kim, Moon	PhD, Material Science, 1988	P	Tenured	FT	100%	ns	23	8
Quevedo, Manuel	PhD, Mat Science & Eng, 2002	ASC	Tenured	FT	100%	7	14	5
Voit, Walter	PhD, Mat Science & Eng, 2009	AST	Tenure Track	FT	100%	8	2	2
Walker, Amy	PhD, Chemistry, 1998	ASC	Tenured	FT	100%	ns	14	3
Wallace, Robert	PhD, Physics, 1988	P	Tenured	FT	100%	10	13	9
Young, Chadwin	PhD, Electrical Eng, 2004	AST	Tenure Track	FT	100%	10	1	1

P-Professor; ASC-Associate Professor; AST-Assistant Professor

Faculty Qualifications (Affiliated faculty)

AFFILIATED FACULTY							
Faculty Name	**Highest Degree, Field, Year**	**Rank**	**Academic Appointment**	**UTD Department**	**Years of Experience**		
					Industry	**Academia**	**UTD**
Balkus, Ken	Phd, Chemistry, 1986	P	Tenured	Chemistry	0	25	17
Baughman, Ray	PhD, Materials Science, 1971	P	Tenured	Chemistry	31	12	12
Choi, Wonjae	PhD, Mech Eng, 2009	AST	Tenure Track	Mech Eng	0	2	2
Ferraris, John	Phd, Chemistry, 1973	P	Tenured	Chemistry	0	38	38
Gao, Xin-Lin	PhD, Mech Eng, 1998	P	Tenured	Mech Eng	2	12	2
Goeckner, Matthew	PhD, Physics, 1990	P	Tenured	Math	11	22	5
Hassanipour, Fatemeh	PhD, Mech Eng, 2009	AST	Tenure Track	Mech Eng	10	4	4
Hu, Walter	PhD, Elec Eng, 2004	ASC	Tenured	Elec Eng	0	7	7
Lee, Gil	PhD, Elec Eng, 1987	P	Tenured	Elec Eng	0.5	29	11
Lee, J.B.	PhD, Elec Eng, 1997	P	Tenured	Elec Eng	5	13	11
Lee, Mark	PhD, Applied Physics, 1991	P	Tenured	Physics	13	9	2
Lu, Hongbing	PhD, Aeronautics, 1997	P	Tenured	Mech Eng	0	17	3
Malko, Anton	PhD, Physics, 2002	AST	Tenure Track	Physics	5	5	5
O, Ken	PhD, Elec Eng, 1989	P	Tenured	Elec Eng	8	11	4
Overzet, Larry	PhD, Elec Eng, 1988	P	Tenured	Elec Eng	0	24	24
Prasad, Shalini	PhD, Elec Eng, 2004	ASC	Tenured	BioEng	0	8	1
Qian, Dong	PhD, Mech Eng, 2002	ASC	Tenured	Mech Eng	0	12	1
Rotea, Mario	PhD, Control Sci, 1990	P	Tenured	Mech Eng	7	23	4
Smith, Dennis	PhD, Chemistry, 1992	P	Tenured	Chemistry	5	15	3
Stefan, Mihaela (Iovu)	PhD, Polymer Science, 1998	AST	Tenure Track	Chemistry	0	10	8
Zakhidov, Anvar	PhD, Physics, 1981	P	Tenured	Physics	5	27	12

P-Professor; ASC-Associate Professor; AST-Assistant Professor

Faculty Qualifications (Adjunct faculty)

ADJUNCT FACULTY			
Faculty Name	**Highest Degree, Field, Year**	**Rank**	**Institution/Company**
Aboud, Shela	PhD, Electrical Eng, 2002	ASC	Stanford University
Alshareef, Husam	PhD, Materials Sci & Eng, 1995	P	KAUST, Saudia Arabia
Birdwell, Glen	PhD, Experimental Physics, 2001	AST	U.S. Army Research Laboratory
Colombo, Luigi	PhD, Materials Sci, 1980	P	Texas Instruments
Halls, Mathew	PhD, Chemistry (Quantum), 2001	ASC	Schrödinger Inc.
Huber, Dale L.	PhD, Polymer Science, 2000	ASC	Sandia National Laboratories
Irwin, Richard B.	PhD, Physics, 1984	P	Texas Instruments
Mahji, Prashant	PhD, Materials Sci & Eng, 2000	P	SEMATECH-Austin/Intel
Mick, Stephen	PhD, Electrical Eng, 2004	ASC	Protochips
Muthukumar, Sriram	PhD, Ceramics & Mat Eng, 2003	ASC	Maxim Integrated
Pradhan, Bhabendra	PhD, Chemistry, 1998	P	NanoHoldings
Shan, Bin	PhD, Applied Physics, 2006	ASC	Hua-Zhong University
Srinivasan, Purushothaman	PhD, minor Electrical Eng, 2006	AST	Texas Instruments
Summerfelt, Scott	PhD, Electrical Eng, 2007	ASC	Texas Instruments
Vogel, Eric	PhD, Electrical Eng, 1998	P	Georgia Institute of Technology
Wang, Weichao	PhD, Materials Sci & Eng, 2011	AST	Nanostellar Inc.

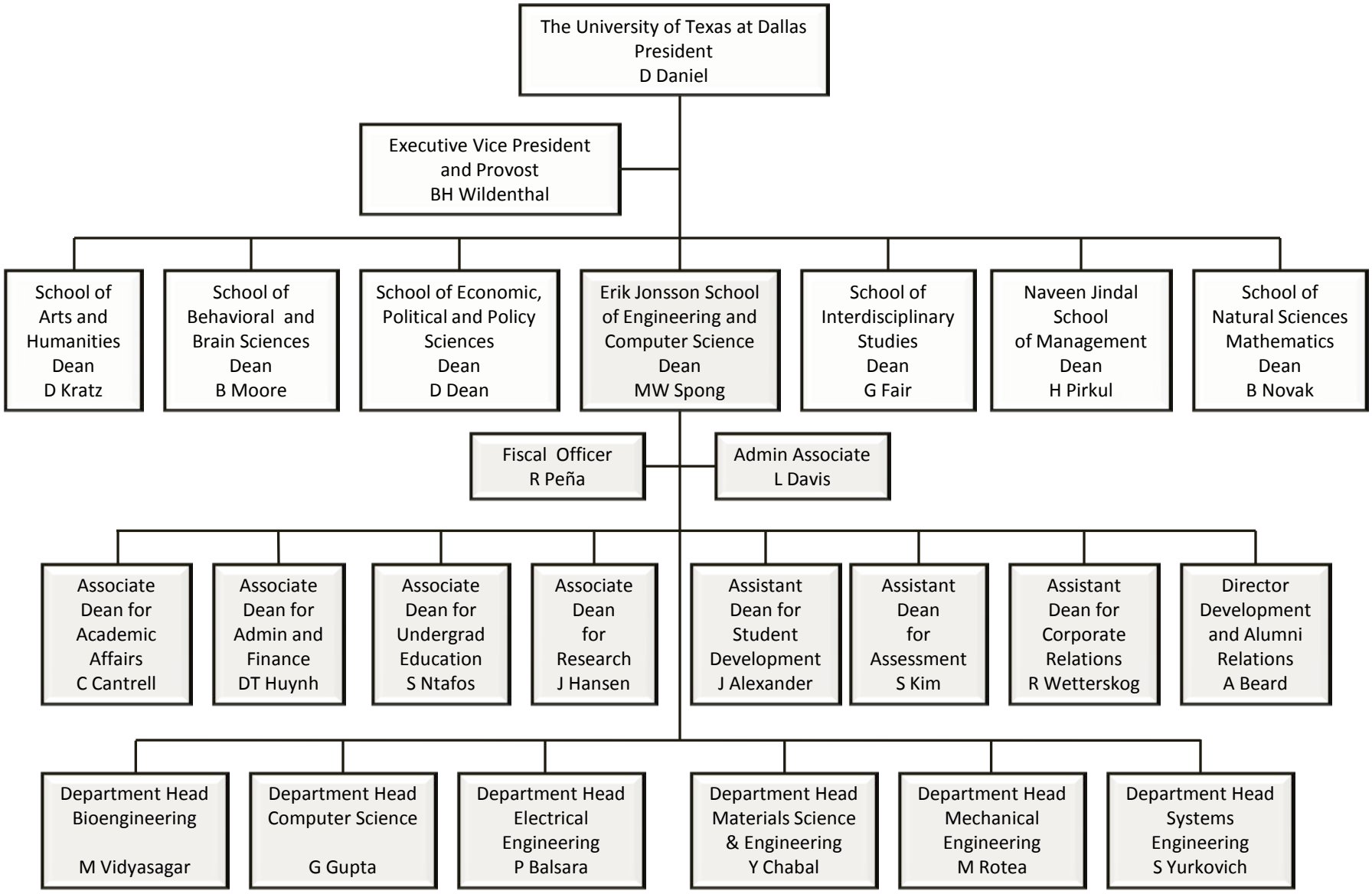
P-Professor; ASC-Associate Professor; AST-Assistant Professor

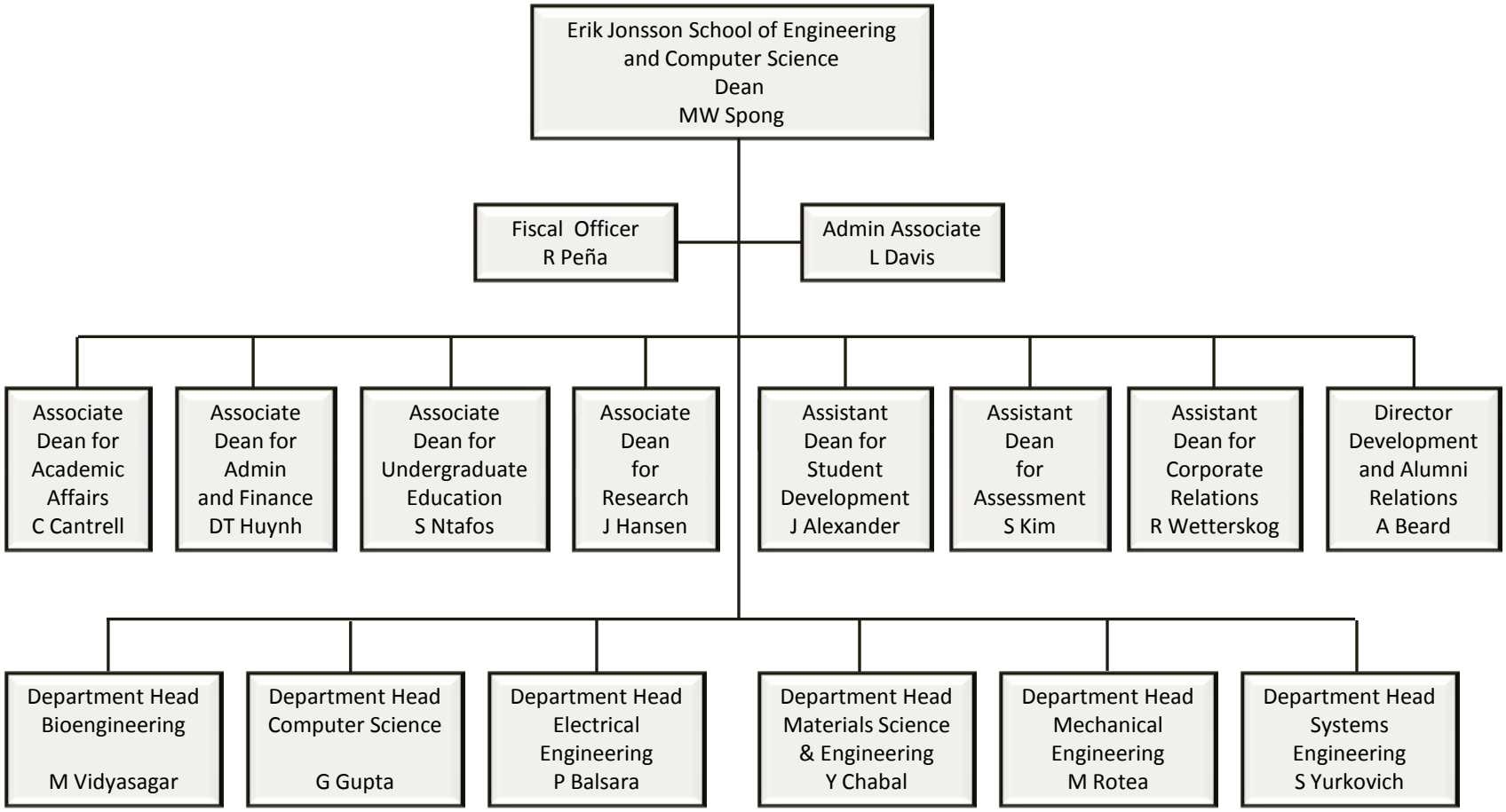
Faculty Demographics:

MSEN Faculty							
Ethnicity	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**
African American							1
Asian			3	3	4	4	4
Hispanic					1	1	2
International							
Two or more							
Unknown							
White			4	6	9	8	8
Total			7	9	14	13	15
Male %			100.00%	88.89%	85.71%	84.62%	86.67%
Female %			0.00%	11.11%	14.29%	15.38%	13.33%

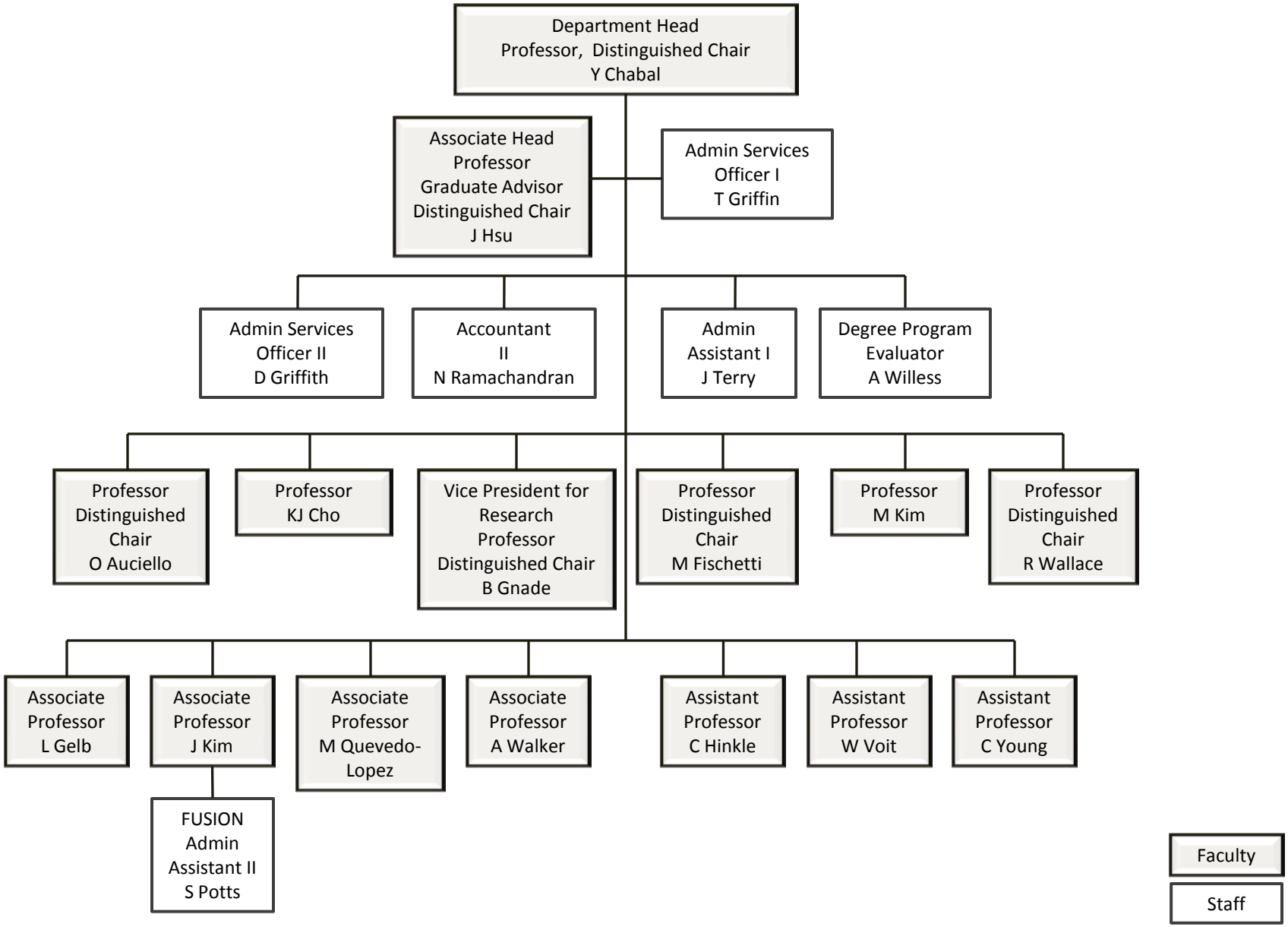
Department Personnel Count

Materials Science and Engineering - Personnel Count						
		2012-13	**2011-12**	**2010-11**	**2009-10**	**2008-09**
Administrative (faculty)	**Total**	**0**	**0**	**0**	**0**	**0**
Faculty (tenure track)	**Total**	**15**	**13**	**14**	**12**	**8**
Other faculty	**Total**	**0**	**0**	**2**	**2**	**4**
Student Teaching Assistants	**Total**	**0**	**0**	**0**	**0**	**0**
Student Research Assistants	**Total**	**66**	**75**	**76**	**64**	**45**
Administrative & Professional	Associate Center Director	1	1	1	1	1
	J-1 Visiting Lab Assistants (salaried)	4	1	2	4	5
	Research Associates (Post Docs)	20	23	19	16	12
	Research Scholar	0	0	0	0	1
	Research Scientists	8	12	17	13	14
	Visiting Scientists	0	1	2	3	4
	Total	**33**	**38**	**41**	**37**	**37**
Classified	Administrative Staff	6	6	6	4	4
	Process Tech	0	0	1	0	0
	Research Engineer Associate	0	0	1	1	0
	System Specialist	0	1	1	0	0
	Technical Staff	7	6	5	5	6
	Total	**13**	**13**	**14**	**10**	**10**
Hourly	A&P Temporary	4	13	3	2	0
	Casual Labor	0	4	14	12	12
	Classified Temporary	4	5	0	0	0
	Federal Work Study	2	1	2	1	0
	J-1 Visiting Lab Assistants (hourly)	4	9	7	0	0
	Student Workers	16	35	21	11	8
	Total	**30**	**67**	**47**	**26**	**20**


The University of Texas at Dallas
President
D Daniel
Executive Vice President
and Provost
BH Wildenthal
School of
Arts and
Humanities
Dean
D Kratz
School of
Behavioral and
Brain Sciences
Dean
B Moore
School of Economic,
Political and Policy
Sciences
Dean
D Dean
Erik Jonsson School
of Engineering and
Computer Science
Dean
MW Spong
School of
Interdisciplinary
Studies
Dean
G Fair
Naveen Jindal
School
of Management
Dean
H Pirkul
School of
Natural Sciences
Mathematics
Dean
B Novak
Fiscal Officer
R Peña
Admin Associate
L Davis
Associate
Dean for
Academic
Affairs
C Cantrell
Associate
Dean for
Admin and
Finance
DT Huynh
Associate
Dean for
Undergrad
Education
S Ntafos
Associate
Dean
for
Research
J Hansen
Assistant
Dean for
Student
Development
J Alexander
Assistant
Dean
for
Assessment
S Kim
Assistant
Dean for
Corporate
Relations
R Wetterskog
Director
Development
and Alumni
Relations
A Beard
Department Head
Bioengineering
M Vidyasagar
Department Head
Computer Science
G Gupta
Department Head
Electrical
Engineering
P Balsara
Department Head
Materials Science
& Engineering
Y Chabal
Department Head
Mechanical
Engineering
M Rotea
Department Head
Systems
Engineering
S Yurkovich


Erik Jonsson School of Engineering and Computer Science
Dean
MW Spong
Fiscal Officer
R Peña
Admin Associate
L Davis
Associate Dean for Academic Affairs
C Cantrell
Associate Dean for Admin and Finance
DT Huynh
Associate Dean for Undergraduate Education
S Ntafos
Associate Dean for Research
J Hansen
Assistant Dean for Student Development
J Alexander
Assistant Dean for Assessment
S Kim
Assistant Dean for Corporate Relations
R Wetterskog
Director Development and Alumni Relations
A Beard
Department Head Bioengineering
M Vidyasagar
Department Head Computer Science
G Gupta
Department Head Electrical Engineering
P Balsara
Department Head Materials Science & Engineering
Y Chabal
Department Head Mechanical Engineering
M Rotea
Department Head Systems Engineering
S Yurkovich

Materials Science & Engineering Department



MATERIALS SCIENCE & ENGINEERING

ORGANIZATIONAL CHART ▪ FACULTY & STAFF

FACULTY

Yves Chabal
Department Head, Professor

Julia Hsu
Associate Head, Professor, Graduate Advisor

Orlando Auciello
Professor

Kyeongjae Cho
Professor

Massimo Fischetti
Professor

Lev Gelb
Associate Professor

Bruce Gnade
Professor

Christopher Hinkle
Assistant Professor

Jiyoung Kim
Associate Professor

RESEARCH / TECHNICAL STAFF

Research Scientist
Jean Francois (Jeff) Veyan

Technical Staff Assistant I
William DeBenedetti

Post Doc
Weina Peng
Oliver Seitz*

J1 Visiting Lab Assistant
Peter Thissen*

Federal Work Study
Neilsen Truong
Ironesha Williams*

Research Scientist
Yun-Ju (Alex) Lee

Post Doc
Geunhee Lee
Jung H. (Josh) Park

J1 Visiting Lab Assistant
Pablo Gurman

Research Scientist
Ka Xiong

Post Doc
Roberto Longo

J1 Visiting Lab Assistant
Yoon Young Kim*

Post Doc
Jiseok Kim
Zhun-Yong Ong
William Vandenberge

Post Doc
Carlos Ferreiro Rangel
Dongsheng Zhang

Student Worker
Roger Larson

Research Scientist
Huiping (Max) Jia
Jesus Mejia Silva

Post Doc
Ravi Arvapally*
Tao Zheng

A&P Temporary
Isaac Trachtenberg

Classified Temp.
Alexander Eddy*

Student Worker
Saud Ahmed
Eric Greene
Ryan Hayes
Krystal Haynes*
Hyo Lee*
Gregory Phipps*
Luke Skinner*
Paul Winkler*

Technical Staff Associate
James (Jim) Burris

Student Worker
Joseph Rossi

Research Scientist
Min Woo Ha
Jang-Sik Lee*

Post Doc
Lanxia Cheng

Student Worker
Saungeun Park

GRADUATE RESEARCH ASSISTANTS

Materials Science & Engineering
Karla Bernal Ramos
Wilfredo Cabrera
Louis Caillard
Yingzhen (Catherine) Lu
Tatiana Peixoto
Natis Shafiq
Kui Tan
Abraham Vega

Physics
Irinder Chopra†
Don Dick

Materials Science & Engineering
Diego Barrera Mendez
Kaiyuan Luo
Jian Wang
Liang Xu

Materials Science & Engineering
(None)

Materials Science & Engineering
Cheng Gong
Santosh KC
Fantai Kong

Physics
Hengji Zhang

Materials Science & Engineering
Jingtian Fang
Bo Fu
Sudarshan Narayanan†
Saeedeh Hosseini Ravandi
Catherine Sachs

Physics
Gautam Hemani

Materials Science & Engineering
Yue Wang*

Materials Science & Engineering
Erika Fuentes Fernandez
Omokhodion David Iyore†
Maribel Maldonado*
Stacey McLeroy
John Murphy
Christian Stone

Chemistry
Michael Perez†

Materials Science & Engineering
Creighton Buie
Shakil Mohammed
Ruoyu Yue

Electrical Engineering
Sarkar Anwar

Materials Science & Engineering
Jie Huang
Srikar Jandhyala
Mingun Lee
Antonio Lucero

Electrical Engineering
Gregory Mordi

† = Graduated
* = Assignment Ended

FACULTY

Moon Kim
Professor

Manuel Quevedo
Associate Professor

Walter Voit
Assistant Professor

Amy Walker
Associate Professor

Robert Wallace
Professor

Chadwin Young
Assistant Professor

RESEARCH / TECHNICAL STAFF

Assoc. Ctr. Director
Jinguo Wang

Research Scientist
Ning Lu
Xiao-Mei Zhao

Technical Staff Assistant V
Joel Gray*

Post Doc
Carlo Floresca*
Ce Sun

Classified Temp.
Aaron Klick
Zakiya Bryant

J1 Visiting Lab Assistant
Xin Peng

Student Worker
Angie Luu*

Post Doc
Kurtis Cantley
Norberto Hernandez

A&P Temporary
Richard Chapman

J1 Visiting Lab Assistant
Miguel Dominguez Jimenez*
Gerardo Gutierrez-Heredia
Victor Martinez-Landeros
Juan Carlos Ramos

Post Doc
Wenzhe Cao*
Yuvaraj Haldorai*

A&P Temporary
Tong Kang

J1 Visiting Lab Assistant
Aldo Garcia Sandoval

Student Worker
Katherine Borner
Kristen Genter

Research Scientist
Stephen McDonnell

Technical Staff Associate
Tommy Bennett
Billy Raulston

Technical Staff Assistant V
Richard Mills Jr.

Technical Staff Assistant I
David Hinojos*

Post Doc
Barry Brennan

(None)

GRADUATE RESEARCH ASSISTANTS

Materials Science & Engineering
Ji Hyung Lee
Juan Pablo Oviedo Robles

Electrical Engineering
Jin Seock Ma

Materials Science & Engineering
Jesus Avila Avendano
Dewan Kabir
Marcela Mireles Ramirez
Martha Rivas
Ana Salas-Villasenor

Electrical Engineering
Kevin La Rosa

Materials Science & Engineering
David Arreaga-Salas
Adrian Avendano
Connie Manz
Jonathan Reeder
Dustin Simon
Taylor Ware

Materials Science & Engineering
Paul Arevalo Rodriguez
Zhiwei Shi
Jing Yang
Bo Zhang

Materials Science & Engineering
Angelica Azcatl Zacatzi
Hong Dong
Xiaoye Qin

Physics
Dmitry Zhernokletov

Materials Science & Engineering
(None)

† = Graduated
* = Assignment Ended

ADJUNCT FACULTY

Shela Aboud
(Stanford)
Husam Alshareef
(KAUST, Saudi Arabia)
Glen Birdwell
(U.S. Army Research Laboratory)
Luigi Colombo
(Texas Instruments)
Mathew Halls
(Schrödinger Inc.)
Dale Huber
(Sandia National Laboratories)
Richard Irwin
(Texas Instruments)
Prashant Mahji
(SEMATECH-Austin / Intel)
Stephen Mick
(Protochips)
Sriram Muthukumar
(Maxim Integrated)
Bhabendra Pradhan
(NanoHoldings)
Bin Shan
(Hua-Zhong University)
Purushothaman Srinivasan
(Texas Instruments)
Scott Summerfelt
(Texas Instruments)
Eric Vogel
(Georgia Tech)
Weichao Wang
(Nanostellar, Inc.)

AFFILIATED FACULTY

Bioengineering
Shalini Prasad

Chemistry
Kenneth Balkus
Ray Baughman
John Ferraris
Dennis Smith
Mihaela Stefan (Iovu)

Electrical Engineering
Wenchuang (Walter) Hu
Gil Lee
Jeong-Bong (JB) Lee
Ken O
Lawrence Overzet

Mathematics
Matthew Goeckner

Mechanical Engineering
Wonjae Choi
Xin-Lin Gao
Fatemeh Hassanipour
Hongbing Lu
Dong Qian
Mario Rotea

Physics
Mark Lee
Anton Malko
Anvar Zakhidov

AFFILIATED STUDENTS

GRADUATE RESEARCH ASSISTANTS SUPPORTED BY AFFILIATED FACULTY

Materials Science & Engineering
Bhaswar Chakrabarti
Gitogo Churu
Carter Haines
Patricia Martinez

Electrical Engineering
Rohit Galatage
Anand Subramaniam†

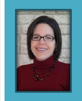
MATERIALS SCIENCE & ENGINEERING GRADUATE STUDENTS

Luke Ackerman
Nouf Aldegaither
Philip Campbell
Kang-Hsien (Gary) Chiang
Jung-Yang Chung
Yingjie Du
Stephen Fasolino
Gautam Gaddemane
Roberta Hawkins
Shawn Junker
Yun Li
Alvin Darnell Lindsay
Sampreetha Thampy
Yang Xi
Shuai Zhang

ADMINISTRATIVE STAFF

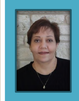
Tonya Griffin
Administrative Services Officer I,
Staff Supervisor,
Human Resources Coordinator

Diane Griffith
Administrative Services Officer II,
Purchasing,
Admissions Coordinator



Suzanne Potts
Administrative Assistant II,
FUSION Coordinator

Nithya Ramachandran
Accountant II,
Budget / Grant Accountant



Julieta Terry
Administrative Assistant I,
Travel Coordinator

Ashley Willess
Degree Plan Evaluator I,
Advising Coordinator

ACADEMIC YEAR 2012 – 2013

Appendix 6

Short format Resumes for MSEN Core Faculty

NAME:
Orlando Auciello

EDUCATION:
Electronic Engineering, National University of Cordoba, Argentina, 1964-70.
MS, Physics, Physics Institute, "Dr. Balseiro", National University of Cuyo, Argentina,1 973.
PhD, Physics, Physics Institute, "Dr. Balseiro", National University of Cuyo, Argentina, 1976.

ACADEMIC EXPERIENCE:
Endowed Chair Professor, Materials Science & Engineering, Bioengineering, Nov. 2012-present.
Adjunct Professor, Michigan State Univ. and Univ. Colorado-Colorado Springs, 2010-present.
Adjunct Professor, North Carolina State University, University of Illinois-Chicago and University of Colorado-Colorado Springs, 1996-2010.
Adjunct Professor, Materials Science and Eng., North Carolina State University, 1988-1996.
Associate Professor, Nuclear Engineering, North Carolina State University, 1985-1988.

NON-ACADEMIC EXPERIENCE:
Co-founder, equity holder and consultant for Advanced Diamond Technology, 2003-present.
Co-founder, equity holder, and consultant for Original Biomedical Implants**,** 2011-present**.**
Argonne Distinguished Fellow, Argonne National Laboratory, 2010-2012.
Senior Scientist, Argonne National Laboratory, 1996-2010.

CERTIFICATIONS / PROFESSIONAL REGISTRATION: N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Association for the Advancement of Science, American Vacuum Society, Material Research Society, Institute for Electronic and Electrical Engineers, The Planetary Society

HONORS AND AWARDS:
President of the Materials Research Society, 2013. Vice President of the MRS, 2012.
R&D 100 Award for RF MEMS Switch, 2011.
Named Argonne Distinguished Fellow of Argonne National Laboratory, 2010.
Elected Fellow of the Materials Research Society and AAAS, 2009.
R&D Editors' Choice Top R&D 100 Award selected from 100 Awards given in 2009, for development of artificial retina to restore sight to people blinded by retina degeneration, 2009
University of Chicago Distinguished Performance Award, 2008.
R&D 100 Award, for ultrananocrystalline diamond-coated mechanical pump seals, 2008
Prof. "Honoris Causa" of National University of Cordoba-Argentina, 2007.
Federal Laboratory Consortium Award, for ultrananocrystalline diamond film technology commercialization via ADT, co-founded by Auciello and colleague, 2006.
Hispanic Engineering National Achievement Award, 2006.
R&D 100 Award**,** for development of large area ultrananocrystalline diamond technology, 2003.

SERVICE ACTIVITIES IN THE LAST FIVE YEARS:
2013 Co-Chair, International Symposium Integrated Functionalities, Dallas, USA,
2012 Co-Chair, International Materials Research Congress, Cancun-Mexico,
. Co-Chair, International Symposium on Integrated Functionalities, Hong Kong.
Co-Chair, 21th New Diamond and Nanocarbon Conference, San Juan-Puerto Rico.
2011 Co-Chair, MRS Spring 2011 Symposium "Functional Materials for Memories, San Francisco.
2010 Co-Chair, 1st International Symposium on Integrated Functionalities", San Juan, Puerto Rico,

2009 Program Chair, 21th International Symposium on Integrated Ferroelectrics", Colorado Springs, Member Advisory Committee, 3th New Diamond Nanocarbon Conference, Michigan.
2008 Co-Organizer, 20th International Symposium on Integrated Ferroelectrics", Singapore. International Advisory Committee, 2th New Diamond Nanocarbon Conference, Taiwan.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Journals Refereed: Appl. Phys. Lett., Appl. Surf. Sci., J. of Appl. Phys., J. Appl. Phys., J. of Phys. D, J. Materials Res., J. Vac. Sci. Technol., Nature Materials, Phys. Rev., Phys. Rev. Lett.,

Proposal Reviews: NSF, DOE, ARO,

Consulting
Advanced Diamond Technologies, Inc: (Founder and consultant, **2004- present).**

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:
Patents (of a total of 14)
"Piezo-actuated Ultrananocrystalline Diamond Tip Array Integrated With Ferroelectric or Phase Change Media For High-Density Memory", O. Auciello, US Patent # 7,602, 2009.

Books (18 as of 2012)
Materials Science and Technology for Nonvolatile Memories, edited by D. Wouters**, S. Hong,** S. Soss, O. Auciello, Mater. Res. Soc. Symp. Proc. 1071, Warrendale, PA, (2008).

Book Chapters (27 as of 2012)
"Science and Technology of Ultrananocrystalline Diamond (UNCD^{TM}) Film-Based MEMS and NEMS Devices and Systems", O. Auciello, in Springer (in press, 2013).

"Microchip Embedded Capacitors for Implantable Neural Stimulators", O. Auciello, in "Implantable Neural Prostheses: Techniques and Engineering Approaches, Eds. David D. Zhou and Elias Greenbaum. Springer p. 331 ((2010).

Special Journal Publications (21 as of 2012)

MRS Bulletin "Ultrananocrystalline and Nanocrystalline Diamond Thin Films for MEMS/NEMS Applications", A. V. Sumant, O. Auciello, R. W. Carpick, S. Srinivasan, and J. E. Butler, **vol. 35,** pp. 1-8 **(2010**).

Invited Review Articles in Journals and Conference Proceedings (45 as of 2011)
"Status Review of the Science and Technology of Ultrananocrystalline Diamond (UNCD^{TM}) Films and Application to Multifunctional Devices", O. Auciello and A. V. Sumant, Diamond and Related Materials, **19** (2010) 699–718.

Publications in Journals and Conference Proceedings (309 as of 2012)
"Cell Growth on Different Types of Ultrananocrystalline Diamond Thin Films", B. Shi, Q. Jin, L. Chen, A. S. Woods, A. J. Schultz, and O. Auciello, in Coating Deposition and Surface Functionalization of Implants for Biomedical Applications, *J. Funct. Biomater.3*(3), 588 (2012).

"Controllable Giant Dielectric Constant in Al_2O_3/TiO_2 Nanolaminates", W. Li, Z. Chen, R. N. Premnath, B. Kabius, and O. Auciello, J. Appl. Phys. **110** (2011) 024106-1-8

PRESENTATIONS
Keynote Talk, "S&T of Ultrananocrystalline Diamond Thin Films for Biomedical Implants"**,** ECI Conference, Suzhou City, China, October 17-21 (2011).

Plenary Talk, "Science and Technology of Multifunctional Thin Films for Devices for Sustainable Energy"**,** Workshop on New Materials for Sustainable Energy, Stephenson Institute for Renewable Energy, Liverpool, UK, February 25-26 (2011).

NAME:
Yves J. Chabal

EDUCATION:
BA, Physics, Princeton University, 1974.
MS, Physics, Cornell University, 1977.
PhD, Physics, Cornell University, 1980.

ACADEMIC EXPERIENCE:
Professor and Head, Department of Materials Science and Engineering, UT Dallas, TX, Sept 2008 – present.
TI Distinguished Chair in Nanoelectronics, Materials Sci.&Eng, UT Dallas, TX, Jan 2008.
Director of the Laboratory for Surface Modification, Rutgers University, NJ, July 2004-Dec. 2007.
Professor, Chemistry & Chemical Biology, and Biomedical Engineering, Rutgers, Jan 2003-Dec 2007.

NON-ACADEMIC EXPERIENCE:
Materials Research Dept., Consulting Member of Technical Staff, 2001-2002.
Optical Physics Research, Distinguished Member of Technical Staff, 1997-2001.
Phys. Research, Bell Labs, Distinguished Member of Technical Staff 1995-1997.
CNRS, Thiais (France), Visiting Scientist (sabbatical) 1989-90.
Surface Physics Research, Bell Labs, Member of Technical Staff, 1981-1995.
Surface Physics Research, Bell Labs, Postdoc, 1980-81.

CERTIFICATIONS / PROFESSIONAL REGISTRATION:
N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Physical Society (APS), Materials Research Society (MRS), AVS, American Chemical Society (ACS), Electrochemical Society (ECS), Technology & Materials Society (TMS)

HONORS & AWARDS:
Elected on Board of Directors of the Materials Research Society, 2008-2011.
Fellow of APS (1996), AVS (1995) and MRS (2012).
Bell Laboratories Affirmative Action Award (1994)
IBM Faculty award, 2003.
Rutgers Board of Trustees Award for Excellence in Research, 2006.
Davisson-Germer Prize in Surface Physics (American Physical Society), 2009.
Tech Titan technology innovator Award, 2010.
ACS award for encouraging women into careers in the chemical sciences, 2012
Medard W. Welch Award (AVS), 2012

SERVICE ACTIVITIES:
Graduate Committee Activities: Ph.D. Committees: 20 as Chairman; 33 as Member
Master's Committees: 2 as Chairman; 2 as Member.

UTD administrative duties (department head, faculty and Head searches, school committees, university committees, mentor for Academic Bridge Program and McDermott Scholar Program; professional society officer, journal editor, conference organizer, etc.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Attended seminars, workshops, and conferences. Participated in MRS-sponsored board development.

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:[1-15]

1. S. Chaudhuri, S. Rangan, J. F. Veyan, J. T. Muckerman, and Y. J. Chabal, *Formation and bonding of alane clusters on Al(111) surfaces studied by infrared absorption spectroscopy and theoretical modeling*, Journal of the American Chemical Society **130** (32), 10576 (2008)
2. M. Dai, Y. Wang, J. Kwon, M. D. Halls, and Y. J. Chabal, *Nitrogen interaction with hydrogen-terminated silicon surfaces at the atomic scale*, Nature Materials **8** (10), 825 (2009)
3. O. Seitz, M. Dai, F. S. Aguirre-Tostado, R. M. Wallace, and Y. J. Chabal, *Copper-metal deposition on self assembled monolayer for making top contacts in molecular electronic devices*, Journal of the American Chemical Society **131** (50), 18159 (2009)
4. M. Acik, G. Lee, C. Mattevi, M. Chhowalla, K. Cho, and Y. J. Chabal, *Unusual infrared-absorption mechanism in thermally reduced graphene oxide*, Nature Materials **9** (10), 840 (2010)
5. A. Bagri, C. Mattevi, M. Acik, Y. J. Chabal, M. Chhowalla, and V. B. Shenoy, *Structural evolution during the reduction of chemically derived graphene oxide*, Nature Chemistry **2** (7), 581 (2010)
6. D. J. Michalak, S. R. Amy, D. Aureau, M. Dai, A. Esteve, and Y. J. Chabal, *Nanopatterning Si(111) surfaces as a selective surface-chemistry route*, Nature Materials **9** (3), 266 (2010)
7. I. S. Chopra, S. Chaudhuri, J. F. Veyan, and Y. J. Chabal, *Turning aluminium into a noble-metal-like catalystfor low-temperature activation of molecularhydrogen*, Nature Materials **10** (11), 884 (2011)
8. N. Nijem, L. Kong, Y. Zhao, H. Wu, J. Li, D. C. Langreth, and Y. J. Chabal, *Spectroscopic evidence for the influence of the benzene sites on tightly bound H2 in metal-organic frameworks with unsaturated metal centers: MOF-74-cobalt*, Journal of the American Chemical Society **133** (13), 4782 (2011)
9. N. Nijem, P. Thissen, Y. Yao, R. C. Longo, K. Roodenko, H. Wu, Y. Zhao, K. Cho, J. Li, D. C. Langreth, and Y. J. Chabal, *Understanding the preferential adsorption of CO 2 over N 2 in a flexible metal-organic framework*, Journal of the American Chemical Society **133** (32), 12849 (2011)
10. O. Seitz, P. G. Fernandes, R. Tian, N. Karnik, H. C. Wen, H. Stiegler, R. A. Chapman, E. M. Vogel, and Y. J. Chabal, *Control and stability of self-assembled monolayers under biosensing conditions*, Journal of Materials Chemistry **21** (12), 4384 (2011)
11. S. Kim, S. Zhou, Y. Hu, M. Acik, Y. J. Chabal, C. Berger, W. De Heer, A. Bongiorno, E. Riedo, *Room-temperature metastability of multilayer graphene oxide films*, Nature Materials **11**(6), 544 (2012)
12. J. Kwon, M. Saly, M. D. Halls, R. K. Kanjolia, and Y. J. Chabal, *Substrate selectivity of (tBu-Allyl)Co(CO)$_3$ during thermal atomic layer deposition of Co*, Chemistry of Materials **24**(6), 1025 (2012)
13. N. Nijem, H. Wu, P. Canepa, A. Marti, K. J. Balkus, T. Thonhauser, J. Li, and Y. J. Chabal, *Tuning the gate opening pressure of Metal-Organic Frameworks (MOFs) for the selective separation of hydrocarbons*, Journal of the American Chemical Society **134** (37), 15201 (2012)
14. C. Su, M. Acik, K. Takai, J. Lu, S. J. Hao, Y. Zheng, P. Wu, Q. Bao, T. Enoki, Y. J. Chabal, and K. P. Loh, *Probing the catalytic activity of porous graphene oxide and the origin of this behaviour*, Nature Communications **3** (2012)
15. P. Thissen, T. Peixoto, R. C. Longo, W. Peng, W. G. Schmidt, K. Cho, and Y. J. Chabal, *Activation of surface hydroxyl groups by modification of H-terminated Si(111) surfaces*, Journal of the American Chemical Society **134** (21), 8869 (2012)

NAME:
Cho, Kyeongjae (KJ)

EDUCATION:
BS, Physics, Seoul National University, 1986
MS, Physics, Seoul National University, 1988
PhD, Physics, M.I.T., 1994

ACADEMIC EXPERIENCE:
Professor, Department of Materials Science and Engineering, UT Dallas, TX, 2012 – present.
Associate Professor, Department of Materials Science and Engineering, UT Dallas, TX, 2006 – 2012.
Assistant Professor, Stanford University, 1997-2006
Research Fellow, Harvard University, 1995-1996
Research Scientist, M.I.T., 1995-1997
Postdoctoral Associate, M.I.T., 1994-1995

NON-ACADEMIC EXPERIENCE:
Co-founder and Scientific Advisor, Nanostellar Inc., CA, 2003 - 2012

CERTIFICATIONS / PROFESSIONAL REGISTRATION:
N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
Members of American Physical Society, Material Research Society, IEEE, ASME, Electrochemical Society, and Institute of Physics (Fellow)

HONORS & AWARDS:
Korean Government Overseas Study Fellowship (1988-1990)
MIT Industry Liaison Fellowship (1988)
Packard Foundation Frederich E. Terman Junior Faculty Fellowship (1997-2000)
Fellow of the Institute of Physics (Elected in 2002)
WCU visiting professor at Seoul National University (2009 – present).

SERVICE ACTIVITIES IN THE LAST FIVE YEARS:
The 3rd, 4th, 5th, 6th and 7th KIAS Electronic Structure Calculation Workshop (2007, 2008, 2009, 2010, 2011); KIAS Graphene Research Seminar (2007-2009).
The first and second Graphene Research Workshop (2009 in Korea, 2010 in Singapore)
Member of faculty search committees
Chair of Curriculum Committee at Materials Science and Engineering Department
Member of Academic Affairs Council of Erik Jonsson School Engineering and Computer Science

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Referees for Physical Review Letters, Physical Review A, B and E, Material Science and Engineering, International Journal of Solids and Structures, Journal of Biochemistry, and Computational Materials Science, Nano Letter.

Members of Editorial Boards of Modeling and Simulation in Materials Science and Engineering (2001-2005), Computer Modeling in Engineering & Science (2002-2006), and Journal of Computational and Theoretical Nanoscience (2003-2006).

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

(Career total: 161 Journal Papers; 37 Conference Proceeding Papers; Jan. 20, 2013 Citation Numbers: SCI = 7,587, SCOPUS = 8,235; SCI h-index = 37, SCOPUS h-index = 37)

1. P. Leu, A. Svizhenko, and K. Cho, "Ab initio calculations of the mechanical and electronic properties of strained Si nanowires," Phys. Rev. B 77, 235305 (2008).
2. H. Gong and K. Cho, "Electronic structure and related properties of Mo-W: a density functional study," J. Phys. – Con. Matt. 20 (25), 255208 (2008).
3. B. Magyari-Kope, S. Park, L. Colombo, Y, Nishi, and K. Cho, "Ab initio study of Al–Ni bilayers on SiO2: Implications to effective work function modulation in gate stacks," J. Appl. Phys. 105, 013771 (2009).
4. W. Xiao, M.I. Baskes, and K. Cho, "MEAM study of carbon atom interaction with Ni nanoparticle," Surf. Sci. 603, 1985 (2009).
5. M. Huang and K. Cho, "Density Functional Theory Study of CO Hydrogenation on a MoS2 Surface," J. Phys. Chem. C 113, 5238 (2009).
6. B. Shan, L. Wang, S. Yang, J. Hyun, N. Kapur, Y. Zhao, J. Nicholas, and K. Cho, "First-principles-based embedded atom method for PdAu nanoparticles," Phys. Rev. B 80, 035404 (2009).
7. K. Xiong, W. Wang, H. N. Alshareef, R. P. Gupta, J. B. White, B. E. Gnade and K. Cho, "Electronic structures and stability of Ni/Bi2Te3 and Co/Bi2Te3 interfaces" Journal of Physics D: Applied Physics 43, 115303 (2010).
8. H. Zhang, G. Lee, A. Fonseca, T. Borders and K. Cho, "Isotope Effect on the Thermal Conductivity of Graphene," J. Nanomat. 537657 (2010).
9. M. Acik, G. Lee, C. Mattevi, M. Chhowalla, K. Cho and Y. J. Chabal "Unusual infrared-absorption mechanism in thermally reduced graphene oxide," Nature Mat. 9, 840-845 (2010).
10. C. Gong, G. Lee, B. Shan, E.M. Vogel, R.M. Wallace, and K. Cho, "First-principles study of metal-graphene interfaces," J. Appl. Phys. 108, 123711 (2010).
11. W. Wang, K. Xiong, R.M. Wallace, and K. Cho, "Impact of Interfacial Oxygen Content on Bonding, Stability, Band Offsets and Interface States of GaAs:HfO_2 Interfaces," J. Phys. Chem. C 114, 22610-22618 (2010).
12. W. Wang, K. Xiong, C. Gong, R.M. Wallace, and K. Cho, "Si Passivation Effects on Atomic Bonding and Electronic Properties at HfO_2/GaAs interface: A first-principles study," J. Appl. Phys. 109, 063704 (2011).
13. W. Wang, C. Gong, B. Shan, R.M. Wallace, and K. Cho, "Sulfur Passivation Effect on HfO_2/GaAs Interface: A First-Principles Study," Appl. Phys. Lett. 98, 232113 (2011).
14. H. Zhang, G. Lee and K. Cho, "Thermal Transport in Graphene and Effects of Vacancy Defects" Phys. Rev. B 84, 115460 (2011).
15. S. Chen, Q. Wu, C. Mishra, J. Kang, H. Zhang, K. Cho, W. Cai, A.A. Balandin, and R.S. Ruoff, "Thermal conductivity of isotopically modified graphene," Nature Mat. 11, 203-207 (2012).
16. W. Wang, G. McCool, N. Kapur, G. Yuan, B. Shan, M. Nguyen, U. M. Graham, B. H. Davis, G. Jacobs, K. Cho, X. Hao, "Mixed-Phase Oxide Catalyst Based on Mn-Mullite (Sm, Gd)Mn_2O_5 for NO Oxidation in Diesel Exhaust," Science 337, 832-835 (2012).
17. R. C. Longo, K. Xiong, W. Wang and K. Cho, "Influence of the exchange-correlation potential on the electrochemical properties of multicomponent silicate cathode materials," Electrochimica Acta 80, 84 (2012).
18. C. Gong, L. Colombo, and K. Cho, "Photon-Assisted CVD Growth of Graphene Using Metal Adatoms as Catalysts", J. Phys. Chem. C 116, 18263-18269 (2012).

NAME:
Massimo V. Fischetti

EDUCATION:
"Laurea" magna cum laude, Physics, University of Milan, Italy, 1974,
Doctor of Philosophy, Physics, University of California, Santa Barbara, 1978

ACADEMIC EXPERIENCE:

UT-Dallas, Full Professor with tenure	2010–present
University of Massachusetts-Amherst, Full Professor with tenure	2005–2010

NON-ACADEMIC EXPERIENCE:

IBM T.J. Watson Research Center	Research Staff Member	1983–2005
3M-Italia Research Center	Research Staff Member	1982–1983
ST-Micro Research	Research Staff Member	1979-1982

CONSULTING, PATENTS, ETC.:
US Patent Application:

20080217691	Higher performance CMOS on (110) wafers	2008
20080206958	Enhancement of electron and hole mobility in <110> Si under biaxial compressive strain	2008

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Physical Society

HONORS & AWARDS:
Institute of Electrical and Electronics Engineers Cledo Brunetti Award, 2011
Senior Faculty Award, University of Massachusetts, 2009
Fellow, American Physical Society, 1996
IBM Research Division Award, 1993
IBM Technical Innovation Awards, 1989
IBM Technical Innovation Awards, 1987

SERVICE ACTIVITIES IN THE LAST 5 YEARS:
Technical Program Committee Member, International Workshop on Computational Electronics (IWCE), 1997-2012
Technical Program Committee Member, European Solid State Devices Research Conference (ESSDERC), 2010-2012
Technical Program Committee Member, Simulation of Semiconductor Processes and Devices (SISPAD), 2010
Technical Program Committee Member, IEEE Semiconductor Interface Specialist Conference (SISC), 2008-2009.
Chair, IEEE International Workshop on Computational Electronics, Amherst, Massachusetts, 2007
Technical Program Committee Member, Modeling and Simulation subcommittee, IEEE International Electron Device Meeting (IEDM), 2007-2009

Member of the Editorial Board, Journal of Applied Physics and Applied Physics Letters, 2006-2008
Member of the Editorial Board and Associate Editor, Journal of Computational Electronics, 2007-present

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:
Attended several conferences (American Physical Society, ElectroChemical Society, Material Research Society, Semiconductor Interface Specialist Conference, EUROSOI, International Workshop on Computational Electronics, International Symposium on Advanced Nanoelectronics, Electron Dynamic in Semiconductor, Optoelectronics and Nanodevices, etc.)

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:
Scaling to 10 nm: Coulomb Effects, Source Starvation, and Virtual Source Model, *Journal of Computational Electronics* **8**, 60-77 (2009) [with S. Jin, T.-w. Tang, P. Asbeck, Y. Taur, S. Laux, M. Rodwell, and N. Sano].
An empirical pseudopotential approach to surface and line-edge roughness scattering in nanostructures: Application to Si thin films and nanowires and to graphene nanoribbons, *J. Appl. Phys.* **110**, 083713 (2011) [with S. Narayanan].
Semiclassical and Quantum Electronic Transport in Nanometer-Scale Structures: Empirical Pseudopotential Band Structure, Monte Carlo Simulations and Pauli Master Equation, in "*Nano-Electronic Devices: Semiclassical and Quantum Transport Modeling*", D. Vasileska and Stephen M. Goodnick Eds. (Springer, New York, 2011), pp. 183-247 [with Bo Fu, S. Narayanan, and J. Kim].
Impact of field-induced quantum confinement in tunneling field-effect devices, *Appl. Phys. Lett.* **98**, 143503 (2011) [with W. Vandenberghe, B. Sorée, W. Magnus, and G. Groesenken].
Generalized phonon-assisted Zener tunneling in indirect semiconductors with non-uniform electric fields: A rigorous approach, *J. Appl. Phys.* **109**, 124503 (2011) [with W. Vandenberghe, B. Sorée, W. Magnus, and G. Groesenken].
Empirical Pseudopotential Calculation of the Band Structure and Ballistic Conductance of Strained [001], [110], and [111] Si Nanowires, *J. Appl. Phys.* **110**, 033716 (2011) [with J. Kim].
Theory of interfacial plasmon-phonon scattering in supported graphene, *Phys. Rev. B* **86**, 165422 (2012) [with Z.-Y. Ong].
Fundamental limitations of hot carrier solar cells, *Phys. Rev. B* **86**, 165302 (2012) [with A. P. Kirk].
Structural, electronic, and transport properties of silicane nanoribbons, *Phys. Rev. B* **86**, 205323 (2012) [with J. Kim].

NAME:
Lev D. Gelb

EDUCATION:
B.A., Columbia University 1992
Ph.D., Theoretical Chemistry, Cambridge University 1995

ACADEMIC EXPERIENCE:
Associate Professor with Tenure, full time, University of Texas at Dallas, 2010-present
Associate Professor with Tenure, full time Washington University in St. Louis, 2006-2010
Assistant Professor, full time, Washington University in St. Louis, 2002-2006The Florida
Assistant Professor, full time, State University, 1999-2002
Postdoctoral associate, full time, University of Pittsburgh, 1999
Postdoctoral associate, full time, NCSU, 1998
Postdoctoral associate, full time, Cornell University, 1996-1998

NON-ACADEMIC EXPERIENCE:
None significant.

PROFESSIONAL REGISTRATION:
None.

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Institute of Chemical Engineers
American Chemical Society

HONORS & AWARDS:
NSF CAREER Award, 2002-2006
NSF Graduate Fellowship, 1994-1995
British Marshall Scholarship, 1992-1994

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:
More than 20 departmental and university-level committee appointments (UT- Dallas and Washington University); ACS national award committee member; proposal reviews for NSF, DOE, CRDF, ACS, NSERC, NASA; frequent session chair at AIChE annual meetings.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:
Conferences attended: >15; Workshops: 3; Departmental seminar visits: 6.

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:
1. "Monte Carlo strategies for first-principles simulations of elemental systems,", L. D. Gelb, XSEDE `12 Proceedings (ACM), (2012) art. no. 25.
2. 2. “A Monte Carlo Simulation Study of Methane Clathrate Hydrates Confined in Slit Pores,” S. N. Chakraborty and L. D. Gelb, J. Phys. Chem. B 11, (2012) 2183-2197.

3. “Boiling point determination using adiabatic Gibbs ensemble Monte Carlo simulations: Application to metals described by embedded-atom potentials,” L. D. Gelb and S. N. Chakraborty, J. Chem. Phys. 135 (2011) 224113.
4. “Extension of the Steele 10-4-3 potential for adsorption calculations in cylindrical, spherical, and other pore geometries,” D. W. Siderius and L. D. Gelb, J. Chem. Phys. 135 (2011) 084703.
5. “Simulation and Modeling of Aerogels Using Atomistic and Mesoscale Methods,” L. D. Gelb, in Aerogels Handbook , M. A. Aegerter et al. (eds.), (2011) 565-581.
6. “Thermodynamic and structural properties of finely-discretized on-lattice hard-sphere fluids: virial coefficients, free energies and direct correlation functions,” D. W. Siderius and L. D. Gelb, J. Chem. Phys. 131 (2009)084503.
7. “Modeling amorphous porous materials and confined fluids,” L. D. Gelb, *MRS Bulletin* **34** No. 8 (August 2009) pp. 553-624. (invited article.)
8. “Structure, Thermodynamics and Solubility in Tetromino Fluids,” B. C. Barnes, D. W. Siderius and L. D. Gelb, *Langmuir* **25** (2009) pp. 6702- 6716.
9. “Predicting Gas Adsorption in Complex Microporous and Mesoporous Materials Using a New Density Functional Theory of Finely Discretized Lattice Fluids,” D. W. Siderius and L. D. Gelb, *Langmuir* **25** (2009) pp. 1296-1299.
10. “Impact of Diffusion on Concentration Profiles Around Near-Critical Nuclei and Implications For Theories of Nucleation and Growth,” J. Diao, R. Salazar, K. F. Kelton and L. D. Gelb, *Acta Materialia* **56** (2008) pp. 2585- 2591.
11. “Simulating Silica Aerogels with a Coarse-Grained Flexible Model and Langevin Dynamics,” L. D. Gelb, *J. Phys. Chem. C* **111** (2007) pp. 15792- 15802.
12. “Meta-Optimization of Evolutionary Strategies for Empirical Potential Development: Application to Aqueous Silicate Systems,” B. C. Barnes and L. D. Gelb, *J. Chem. Theor. Comput.* **3** (2007) pp. 1749-1764.
13. “A computational study of the reconstruction of amorphous mesoporous materials from gas adsorption isotherms and structure factors via evolutionary optimization,” R. Salazar and L. D. Gelb, *Langmuir* **23** (2007) pp. 530-541.
14. “Isothermal-isobaric Monte Carlo Simulations of Liquid Lithium using Density Functional Theory,” L. D. Gelb and T. Carnahan, *Chem. Phys. Letts.* **417** (2006) pp. 283-287.

NAME:
Bruce Gnade

EDUCATION:
BA, Chemistry, St. Louis University, 1976
PhD, Nuclear Chemistry, Georgia Institute of Technology, 1982

ACADEMIC EXPERIENCE:
VP of Research, University of Texas at Dallas, Richardson, TX, 2006-present
Dis. Professor, University of Texas at Dallas, Richardson, TX, 2005-present
Professor, University of Texas at Dallas, Richardson, TX, 2003-present
Chairman, Materials Science Dept, Univ. of North Texas, Denton TX, 1998-2003
Visiting Scientist, Dept. of Materials and Nuclear Eng. Univ. of MD, College Park MD, 1996-1998

NON-ACADEMIC EXPERIENCE:
Board of Directors, PixTech, Inc, Santa Clara CA, 2001-2002
Guest Researcher, NIST, Gaithersburg MD, 2001-2003
Program Manager, DARPA, Arlington VA, 1996-1999
Manager, 1 Gbit Process Integration, Texas Inst., Dallas TX, 1996
Manager, FED Technology Dev., Texas Inst., Dallas TX, 1994-1996
Manager, Advanced Silicon Materials, Texas Inst., Dallas TX, 1989-1994
Technical Staff, Central Research Laboratories, Texas Inst., Dallas TX, 1982-1989

CERTIFICATIONS / PROFESSIONAL REGISTRATION:
N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Physical Society, Material Research Society, Society for Information Displays, IEEE (Sr. Member)

HONORS & AWARDS:
Sigma Xi award for outstanding doctoral thesis, Ga. Tech

SERVICE ACTIVITIES IN THE LAST FIVE YEARS:
United States Civilian Research and Development Foundation, Proposal review panel, 2000-present
National Academies Board of Assessment of NIST Programs – EEEL (2004-2010) Associate Editor, IEEE/OSA Journal of Display Technology (2004-2008)
Chair of Publications Committee, Society of Information Display (2009-2010)

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Attended several scientific conferences.

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:
1)D. Mao, I. Mejia, A.L. Salas-Villasenor, M. Singh, H. Stiegler, B.E. Gnade and M.A. Quevedo-Lopez, “Ferroelectric Random Access memory Based on One-Transistor-One-Capacitor Structure for Flexible Electronics”, Organic Electronics 14, 505 (2013).

2) A.L. Salas-Villasenor, I. Mejia, M. Sotelo-Lerma, B.E. Gnade and M.A. Quevedo-Lopez, "Performance and Stability of solution-based cadmium sulfide thin film transistors: Role of CdS cluster size and film composition", Appl. Phys. Lett. 101, 262103 (2012).
3) J.W. Murphy, G.R. Kunnen, I. Mejia, M.A. Quevedo-Lopez, D. Allee, B. Gnade, "Optimizing diode thickness for thin-film solid state thermal neutron detectors", *Appl. Phys. Lett.* **101**, 143506 (2012).
4) M.R. Perez, I. Mejia, A. L Salas-Villasenor, H. Stiegler, I. Trachtenberg, B.E. Gnade, and M.A. Quevedo-Lopez, "Hybrid CMOS Thin-Film Devices Based on Solution-Processed CdS n-TFTs and TIPS-Pentacene p-TFTs", Organic Electronics 13, 3045 (2012).
5) U.S. Bhansali, H. Jia. I.W.H. Oswald, M.A. Omary, B.E. Gnade, "High efficiency warm-white organic light emitting diodes from a single emitter in graded-doping device architecture", Appl. Phys. Lett. 100, 183305 (2012).
6) D. Mao, I. Mejia, H. Stiegler, B.E. Gnade and M.A. Quevedo-Lopez, "Fatigue Characteristics of Poly(vinylidene fluoride-trifluorothylene) copolymer Ferroelectric Thin Film Capacitors for Flexible Electronics Memory Applications", Organic Electronics 12, 1298 (2011).
7) Israel Mejia, Ana L. Salas-Villasenor, Adrian Avendano-Bolivar, Julius Horvath, Harvey Stiegler, Bruce E. Gnade and Manuel A. Quevedo-Lopez, "Low-Temperature Hybrid CMOS Circuits Based on Chalcogenides and Organic TFTs", Electron Dev. Letts. 32, 1086 (2011).
8) E. Fuentes-Fernandez, W. Debray-Mechtaly, M.A. Quevedo-Lopez, B. Gnade, A. Rajasekaran, A. Hande, P. Shah and H.N. Alshareef, "Fabrication and Characterization of Pb(Zr0.53,Ti0.47)O3-Pb(Nb1/3Zn2/3)O3 Thin Films on Cantilever Stacks", J. Electron. Mat. 40, 85 (2011).
9) A. Dey, A.E. Avendano, S.M. Venugopal, D.R. Allee, M. Quevedo and B.E. Gnade, "CMOS TFT Op- Amps: Performance and Limitations", Elec. Dev. Letts. 32, 650 (2011).
10) P. Sista, H. Nguyen, J. W. Murphy, J. Hao, D.K. Dei, K. Palaniappan, J. Servello, R. Kularatne, B.E. Gnade, B. Xue, P.C. Dastoor, M. C. Biewer, M.C. Stefan, "Synthesis and Electronic Properties of Semiconducting Polymers Containing Benzodithiophene with Alkyl Phenylethynyl Substituents", Macromolecules 43, 8063 (2010).
11) A.L. Salas-Vallasenor, I. Mejia, J. Horvath, H.N. Alshareef, D.K. Cha, R. Ramierz-Bon, H. Stiegler, B.E. Gnade, and M.A. Quevedo-Lopez, "Impact of Gate Dielectric in Carrier Mobility in Low Temperature Chalcogenide Thin Film Transistors for Flexible Electronics", Electrochemical and Solid-State Letters 13, H313 (2010).
12) D. Mao, I. Mejia, H. Stiegler, B.E. Gnade and M.A. Quevedo-Lopez, "Polarization Behavior of Poly(vinylidene fluoride-trifluoroethylene) copolymer ferroelectric thin film capacitors for non-volatile memory application in flexible electronics", J. Appl. Phys. 108, 094102 (2010).
13) D. Mao, M.A. Quevedo-Lopez, H.N. Alshareef, H. Stiegler and B.E. Gnade, "Optimization of Poly (vinylidene fluoride-trifluoroethylene) Films as Non-volatile Memory for Flexible Electronics", Organic Electronics 11, 925 (2010).
14) R.P. Gupta, K. Xiong, J.B. White, K. Cho, H.N. Alshareef, B.E. Gnade, "Low Resistance Ohmic Contacts to Bi2Te3 Using Ni and Co Metallization", J. Electrochem.. Soc. 157, H666 (2010).
15) C.R. Tracy, S.L. McLeroy, S.L. Best, B.E. Gnade, M.S. Pearle and J.A. Cadeddu, "Rendering Stone Fragments Paramagnetic with Iron-Oxide Microparticles Improves the Efficiency and Effectiveness of Endoscopic Stone Fragment Removal", Urology 76, 1266 (2010).
16) K. Trivedi, U.S. Bhansali, B. Gnade, W. Hu, "The Fabrication of High Density Nanochannel Organic Light Emitting Diodes with reduced charge spreading", Nanotechnology 20, 405204 (2009).
17) Unnat S. Bhansali, Evgueni Polikarpov, James S. Swensen, Wei-Hsuan Chen, Huiping Jia, Daniel J Gaspar, Bruce E. Gnade, Asanga B. Padmaperuma, and Mohammad A. Omary, "High-efficiency turquoise-blue electrophosphorescence from a Pt(II)-pyridyltriazolate complex in a phosphine oxide host", Appl. Phys. Lett. 95, 233304 (2009).
18) S. Gowrisankker, M.A. Quevedo-Lopez, H.N Alshareef, B.E. Gnade, S. Venugopal, R. Krishna, K. Kaftanoglu, D. Allee, "A Novel Low Temperature Integration of Hybrid CMOS Devices on Flexible Substrates", Organic Electronics 10, 1217 (2009).

NAME:
Christopher Hinkle

EDUCATION:
BS, Physics, North Carolina State University, Raleigh, 1999
PhD, Physics, North Carolina State University, Raleigh, 2005

ACADEMIC EXPERIENCE:
Assistant Professor, The University of Texas at Dallas, Richardson, TX, 2009-2012
Research Scientist, The University of Texas at Dallas, Richardson, TX, 2008-2009

NON-ACADEMIC EXPERIENCE:
None significant

PROFESSIONAL REGISTRATION:
None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
Materials Research Society
American Physical Society
Institute of Electrical and Electronics Engineers
American Vacuum Society
Electrochemical Society

HONORS & AWARDS:
NA

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST FIVE YEARS:
Elected to the Executive Committee of the Electronic Materials and Processing Division of the American Vacuum Society

Director of the UTD Advanced Electrical Characterization Laboratory

2009-2010 MSEN – Chair -- Colloquium Committee
2009-2010 MSEN – Member -- Graduate Admissions Committee
2009-2010 MSEN – Member -- Curriculum and Courses of Study Committee
2009-2013 MSEN – Member -- Departmental Committee
2010-2011 MSEN – Member -- Colloquium Committee
2010-2011 MSEN – Member -- Graduate Student Recruiting Committee
2010-2011 MSEN – Member -- Graduate Examination Committee
2010-2011 MSEN – Member -- Graduate Admissions Committee
2011-2012 MSEN – Chair – Graduate Examination Committee
2011-2012 MSEN – Member -- Colloquium Committee
2011-2012 MSEN – Member -- Graduate Student Recruiting Committee
2011-2012 MSEN – Member -- Graduate Admissions Committee
2011-2013 MSEN – Member -- Curriculum Committee

2012-2013 MSEN – Chair -- Graduate Ph.D. Qualifying Examination Committee
2012-2013 MSEN – Member -- Graduate Recruiting and Admissions Committee

Reviewer: Applied Physics Letters; Journal of the Electrochemical Society; Microelectronic Engineering; IEEE Transactions on Electron Devices; Journal of Applied Physics; Thin Solid Films; Journal of Applied Physics; Journal of Vacuum Science and Technology B

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Talks attended at conferences: >500
Seminars attended at UT-Dallas: >70
Established Molecular Beam Epitaxy (MBE) Laboratory at UT-Dallas

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:
C. L. Hinkle, R. V. Galatage, R. A. Chapman, E. M. Vogel, H. N. Alshareef, C. Freeman, M. Christensen, E. Wimmer, H. Niimi, A. Li-Fatou, J. B. Shaw, and J. J. Chambers, "Gate-Last TiN/HfO_2 Band Edge Effective Work Functions Using Low-Temperature Anneals and Selective Cladding to Control Interface Composition," Applied Physics Letters **100**, 153501 (2012).

D. E. Arreaga-Salas, A. K. Sra, E. Roodenko, Y. J. Chabal, and C. L. Hinkle, "Progression of Solid Electrolyte Interphase Formation on Hydrogenated Amorphous Silicon Anodes for Lithium-Ion Batteries," Journal of Physical Chemistry C **116**, 9072 (2012).

C. L. Hinkle, E. M. Vogel, P. D. Ye, and R. M. Wallace, "Interfacial Chemistry of Oxides on $In_xGa_{1-x}As$ and Implications for MOSFET Applications," Current Opinion in Solid State & Materials Science **15**, 188 (2011).

J. Chan, N. Y. Martinez, J. J. D. Fitzgerald, A. V. Walker, R. A. Chapman, D. Riley, A. Jain, C. L. Hinkle, and E. M. Vogel, "Extraction of Correct Schottky Barrier Height of Sulfur Implanted NiSi/n-Si Junctions: Junction Doping Rather than Barrier Height Lowering," Applied Physics Letters **99**, 012114 (2011).

C. L. Hinkle, M. Milojevic, B. Brennan, A. M. Sonnet, F. S. Aguirre-Tostado, G. J. Hughes, E. M. Vogel, and R. M. Wallace, “Detection of Ga suboxides and their impact on III-V passivation and Fermi-level pinning”, Applied Physics Letters **94**, 162101 (2009).

C. L. Hinkle, A. M. Sonnet, R. A. Chapman, and E. M. Vogel, “Extraction of the Effective Mobility of $In_{0.53}Ga_{0.47}As$ MOSFETs”, IEEE Electron Device Letters **30**, 316 (2009).

C. L. Hinkle, A. M. Sonnet, E. M. Vogel, S. McDonnell, G. J. Hughes, M. Milojevic, B. Lee, F. S. Aguirre-Tostado, K. J. Choi, H. C. Kim, J. Kim, and R. M. Wallace. “GaAs interfacial self-cleaning by atomic layer deposition,” Applied Physics Letters **92**, 071901 (2008).

NAME:
Julia W. P. Hsu

EDUCATION:
BS, Chemical Engineering, Princeton University, Princeton, NJ, 1985
Master of Science, Physics, Stanford University, 1987
PhD, Physics, Stanford University, Stanford, CA, 1990

ACADEMIC EXPERIENCE:
Professor in the Erik Jonsson School of Engineering and Computer Science, 2010 – present
Texas Instruments Distinguished Chair in Nanoelectronics, 2010 – present
Associate Professor of Physics (with tenure), University of Virginia, 1997 - 2001
Assistant Professor of Physics, University of Virginia, 1993 - 1997

NON-ACADEMIC EXPERIENCE:
Principal Member of Technical Staff, Sandia National Laboratories, 2003 - 2010
Scientist, Center for Integrated Nanotechnologies, Sandia National Laboratories, 2006 - 2010
Member of Technical Staff, Bell Laboratories, Lucent Technologies, 1999 – 2003
Postdoctoral Member of Technical Staff, AT&T Bell Labs, 1990-1992

CERTIFICATIONS / PROFESSIONAL REGISTRATION:
N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Physical Society, Materials Research Society

HONORS & AWARDS:
2011, Materials Research Society (MRS) Fellow.
2007, American Association for the Advancement of Science (AAAS) Fellow
2001, American Physical Society (APS) Fellow
1994, Alfred P. Sloan Foundation Research Fellowship
1993, National Science Foundation Young Investigator Award
1983, Society of Women Engineers Bechtel Corporation Scholarship

SERVICE ACTIVITIES IN THE LAST FIVE YEARS:
MSE Department: Associate Head (2011-present); Graduate Director (2011-present)
Meeting Quality Subcomittee, MRS (2011-present)
Nomination Committee, American Physical Society Division of Materials
Physics (2011-2013) and Division of Condensed Matter Physics (2010)
Panel review for NSF Solar Initiative (2010)
Chair, International Relations Committee, Materials Research Society (2010-2011)
External Advisory Committee, U. Massachusetts Energy Frontier Research Center (2009-2014)
Chair, Program Committee for American Physical Society Workshop on Energy Research for Young Physicists, American Physical Society Topic Group on Energy Research and Applications (2010)
Advisory panel, Princeton Center for Complex Materials (2009-2015)
Review panel, DOE EPSCoR program of Idaho State (2008, 2009)

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Attended scientific conferences, organizing workshops and programs

SELECTED PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

1. J. Wang, Y.-J. Lee, A. S. Chadha, J. Yi, M. L. Jespersen, J. J. Kelley, H. M. Hguyen, M. Nimmo, A. V. Malko, R. A. Vaia, W. Zhou, and **J. W. P. Hsu**, "Effect of Plasmonic Au Nanoparticles on Inverted Organic Solar Cell Performance," J. Phys. Chem. C, published on line (2012)
2. "QUANTIFYING BIMOLECULAR RECOMBINATION IN ORGANIC SOLAR CELLS USING WHITE LIGHT BIAS EXTERNAL QUANTUM EFFICIENCY MEASUREMENT," 2012 Fall MRS Meeting, Boston, MA
3. Y.-J. Lee, J. Yi, G. G. Gao, H. Koerner, K. Park, J. Wang, K. Luo, R. A. Vaia, and **J. W. P. Hsu**, "Low-temperature Solution Processed Molybdenum Oxide Nanoparticle Hole Transport Layers for Organic Photovoltaic Devices," Adv. Energy Mater. 2, 1193-1197 (2012)
4. S. R. Ferreira, P. Lu, Y.-J. Lee, R. J. Davis, and **J. W. P. Hsu**, "Zinc Oxide Electron Transport Layers Effect on Performance and Shelf Life of Organic Bulk Hererojunction Devices," J. Phys. Chem. C **115**, 13471-13475 (2011)
5. L. F. Drummy, R. J. Davis, D. L. Moore, M. Durstock, R. A. Vaia, and **J. W. P. Hsu**, "Molecular-scale and Nano-scale Morphology of P3HT:PCBM Bulk Heterojunctions: Energy Filtered TEM and Low Dose HREM," Chem. Matt. **23**, 907-912 (2011)
6. R. J. Davis, M. T. Lloyd, S. R. Ferreira, M. J. Bruzek, S. E. Watkins, L. Lindell, P. Sehati, M. Fahlman, J. E. Anthony, and **J. W. P. Hsu**, "Determination of Energy Level Alignment at Interfaces of Hybrid and Organic Solar Cells under Ambient Environment," J. Mater. Chem. **21**, 1721-1729 (2011)
7. J. A. Floro, J. Michael, L. N. Brewer, and **J. W. P. Hsu**, "Preferred Heteroepitaxial Orientations of ZnO Nanorods on Ag," J. Mater. Res. **25**, 1352 (2010)
8. M. T. Lloyd, Y.-J. Lee, R. J. Davis, E. Fang, R. M. Fleming, R. J. Kline, M. F. Toney, and **J. W. P. Hsu**, "Improved Efficiency in Poly(3-hexylthiophene)/Zinc Oxide Solar Cells via Lithium Incorporation," J. Phys. Chem. C **113**, 17608-17612 (2009)
9. E. D. Spoerke, M. T. Lloyd, E. S. Martin, D. C. Olson, Y.-J. Lee, J. A. Voigt, and **J. W. P. Hsu**, "Improved Performance of P3HT/ZnO Hybrid Photovoltaics Modified with Interfacial Nanocrystalline Cadmium Sulfide," Appl. Phys. Lett. **95**, 213506 (2009)
10. M. T. Lloyd, D. C. Olson, P. Lu, E. Fang, D. L. Moore, M. S. White, M. O. Reese, D. S. Ginley, and **J. W. P. Hsu**, "Impact of Contact Evolution on the Shelf Life of Organic Solar Cells," J. Mater. Chem. + Cover **19**, 7638-7642 (2009)
11. M. T. Lloyd, R. P. Prosankumar, M. B. Sinclair, A. C. Mayer, D. C. Olson, and **J. W. P. Hsu**, "Impact of Interfacial Polymer Morphology on Photoexcitation Dynamics and Device Performance in P3HT/ZnO Heterjunction," J. Mater. Chem. **19**, 4609-4614 (2009)
12. A. Trionfi, D. H. Wang, J. D. Jacobs, L.-S. Tan, R. A. Vaia, and **J. W. P. Hsu**, "Direct Measurement of the Percolation Probability in Carbon Nanofiber-Polyimide Nanocomposites," Phys. Rev. Lett. **102**, 116601 (2009)
13. A. Trionfi, D. A. Scrymgeour, **J. W. P. Hsu**, M. J. Arlen, D. Tomlin, J. D. Jacobs, D. H. Wang, L.-S. Tan, and R. A. Vaia, "Direct Imaging of Current Paths in Multi-walled Carbon Nanofiber Polymer Nanocomposites Using Conducting-Tip Atomic Force Microscopy," J. Appl. Phys. **104**, 083708 (2008)
14. T. C. Monson, M. T. Lloyd, D. C. Olson, and **J. W. P. Hsu**, "Photocurrent Enhancement in Polythiophene and Aklanethiol Modified ZnO Solar Cells," Adv. Mater. **20**, 4755-4759 (2008)
15. D. A. Scrymgeour and **J. W. P. Hsu**, "Correlated Piezoelectric and Electrical Properties in Individual ZnO Nanorods," Nano Lett **8**, 2204-2209 (2008)
16. Y.-J. Lee, D. S. Ruby, D. W. Peters, B. B. McKenzie, and **J. W. P. Hsu**, "ZnO Nanostructures as Efficient Antireflection Layers for Solar Cells," Nano Lett. **8**, 1501-1505 (2008)

NAME:
Jiyoung Kim

EDUCATION:
BS, Metallurgical Engineering, Seoul National University, 1986
MS, Metallurgical Engineering, Seoul National University, 1988
PhD, Materials Science and Engineering, University of Texas at Dallas, 1994

ACADEMIC EXPERIENCE:
Associate Professor, Dept of Materials Sci. Eng., Univ. of Texas, Richardson, TX, 2005-Present
Associate Professor, Sch. of Adv. Materials Eng., Kookmin U., Seoul, Korea, 2002-2005
Associate Professor, Prog. In Nano-Sci & Tech., Kookmin U., Seoul, Korea, 2003-2005
Visiting Researcher, Dept. of Electrical Eng. Univ. of Texas, Richardson, TX, Jan.-Aug. 2004
Visiting Researcher, Dept. of Materials Sci., U of North Texas, Denton, TX, Aug.–Dec. 2003
Assistant Professor, Sch. Materials Eng., Kookmin U., Seoul, Korea, 1998-2002
Fulltime Lecturer, Dept. of Materials Eng., Kookmin U., Seoul, Korea, 1996-1998

NON-ACADEMIC EXPERIENCE:
Director, Research Inst. of Nano Tech. & Sci., KMU, Seoul, Korea, 2004-2005
Process Integration Eng., World Wide Productization, Texas Inst.Dallas, TX, 1994-1996
Academic Contractor APRDL, Motorola, Austin, TX, 1993-1994
Second Lieutenant, Korean Army, Korea, 1988-1989

PROFESSIONAL REGISTRATION:
None.

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
Institute of Electrical and Electronics Engineer (Senior), TMS, American Vacuum Society, The Electrochemical Society, Materials Research Society, The Korean Institute of Metals and Materials, The Korean Ceramic Society, The Korean Materials Research Society

HONORS & AWARDS:
Best Paper Award from 2004 Korean Metals and Materials Society (2004) Korean Government Overseas Scholarship (1990 – 1993)

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:
Committee, EJS Nanoelectronics Initiative Distinguished Chair Search (2009)
Member, Faculty Search Committee, MSE (2011- Current)
Member of Graduate Recruiting and Admissions Committee, MSE (2009 – Current)
Member of External Relations, MSE (2010-Current)
Chair, Graduate faculty membership, MSE (2009-Current)
MSEN Colloquia Organizer (2008-2009)
TA Committee, Electrical Engineering (2006 – 2008)
Graduate Advisor for new coming graduate students in Materials Science & Engineering and Solid State Devices & Microsystems Fabrication (2007-2008)
Director, Advanced Electrical Characteristics Lab. (2011-Current)

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:

Vice Chair, Nanomaterials Committee, TMS (2011-2013)
Program Committee, 2011 IEEE Nanotechnology Materials and Device Conferences 2011 (Jeju, Korea) Lead Organizer, TMS, 2011-12 Functional and Structural Nanomaterials, (2010-12)
Co-Organizer and Session Chair, TMS, Functional and Structural Nanomaterials (2009-2010)
Executive Committee (2008-2010), EMPD, American Vacuum Society (2008-2010)
Technical Vice Chairman (2009), Executive Committee (2007-2009), IEEE International Symposium on Advanced Gate Stack Technology (ISAGST),
Technical Committee, IEEE Annual Non-volatile Memory Technology Symposium (NVMTS), (2007-2008)
Advisory Board Member of Electronic Materials Letters (2005 – present)
Guest Editor of Microelectronics Engineering (Elsevier) (2009-Present)

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

1. S. Jandhyala, G. Mordi, B. Lee, G. Lee, C. Floresca, P. R. Cha, J. Ahn, R. M. Wallace, Y. Chabal, M. Kim, L. Colombo, K. Cho, J. Kim, "Non-Destructive Ozone Functionalization Scheme for Scalable High-k Dielectrics on Graphene," ACS Nano 6(3), pp. 2711-2730 (2012)
2. G. Mordi, S. Janhyala, C. Floresca, S. McDonnel, M. Kim, R. Wallace, C. Luigi, J. Kim, "Low-k organic dielectric for dual-gate graphene field effect transistors," Appl. Phys. Lett. 100(19), 193117 (2012)
3. T. J. Park, P. Sivasubramani, B. E. Coss, H.-C. Kim, B. Lee, R. M. Wallace, J. Kim, "Effects of O3 and H2O oxidants on C and N-related impurities in atomic-layer-deposited La2O3 films observed by in-situ x-ray photoelectron spectroscopy," Appl. Phys. Lett., 97, 092904 (2010)
4. B. Lee, G. Mordi, M.J. Kim, Y. J. Chabal, E. M. Vogel, R. M. Wallace, KJ Cho, J. Kim, L. Colombo, "Charactreristics of high-k Al2O3 dielectric using ozone based atomic layer deposition," Appl. Phys. Lett., 97, 043107 (2010) This paper is also linked "Virtual Journal of Nanoscale Science and Technology" by American Institute of Physics
5. M. Lee, T. W. Kim, C. D. Bae, H. J. Shin, J. Kim, "Fabrications and Applications of Metal – Oxide Nanotubes," JOM, 62(4), pp.44-49 (2010) (Invited Review Article)
6. B. Lee, H. Kim, E. M. Vogel, R. M. Wallace, J. Kim, "Conformal Al2O3 dielectric layer deposited by atomic layer deposition for graphene-based nanoelectronics," Appl. Phys. Lett., 92, 203102 (2008) This paper is also linked "Virtual Journal of Nanoscale Science and Technology" by American Institute of Physics
7. B. Lee, K. Choi, A. Hande, R. Wallace, Y. Senzaki, M. Rousseau, J. Suydam, J. Kim, "Characteristics of the ALD ZrO2 gate capacitors," Microelectron Eng, 86(3)pp. 272 276 (2009)
8. D. Cha, S. J. Park, H. Horii, D. H. Kim, Y. K. Kim, S. O. Park, U. I. Jung, M. J. Kim, J. Kim, "A Direct observation on the structural evolution of memory-switching phenomena using in-situ TEM," Tech. Digest. 2009 Symp. VLSI Technology, pp.204-205 (2009)
9. M. Milojevic , F. Aguirre-Tostado , C. L. Hinkle, H. C. Kim , E. M. Vogel, J. Kim, and R. M. Wallace, "Half-cycle atomic layer deposition reaction studies of Al2O3 on In0.2Ga0.8As (100) surfaces," Appl. Phys. Lett., 93, 202902 (2008)
10. C. Bae, H. Yoo, S. Kim, K. Lee, J. Kim, M. Sung, H. Shin, "Template directed oxide nanotubes: Synthesis, characterization, and applications," (Review Article) Chem. Mater., 20, pp. 756-767 (2008)

NAME:

Moon J Kim

EDUCATION:

BS, Materials Science, Arizona State University, 1984
MS, Materials Science, Arizona State University, 1986
PhD, Materials Science, Arizona State University, 1988
PostDoc, Materials Science, Arizona State University, 1988-90

ACADEMIC EXPERIENCE:

Professor, University of Texas at Dallas, Richardson, TX, 2005-present
Adjunct Professor, Simmons Comprehensive Cancer Center, 2007-present
University of Texas Southwest Medical Center, Dallas, TX
Director, SiWEDS Industry University Cooperative Research Center (IU/CRC), 2009-present Director, Nano-characterization Facility, UTD, 2004-present
Associate Professor, University of Texas at Dallas, Richardson, TX, 2003-2005
Associate Professor, University of North Texas, Denton, TX, 2002-2003
Director, Facility for Electron Microscopy, University of North Texas, Denton, TX, 2002-2003
Assistant Professor, University of North Texas, Denton, TX, 2001-2002
Affiliated Faculty, Science and Engineering of Materials, ASU, Tempe, AZ, 1993-2001
HREM Laboratory & Workshop Instructor, User Program Committee Member,
Center for HREM, Arizona State University, Tempe, AZ 1988-2001
Visiting Scientist, German Aerospace Center (DLR), Cologne, Germany, 2000
Research Scientist, Center for Solid State Science, ASU, Tempe, AZ, 1990-2001

CERTIFICATIONS / PROFESSIONAL REGISTRATION:

N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Microscopy Society of America, Materials Research Society, Electrochemical Society

HONORS & AWARDS:

Fellow, Microscopy Society of America

SERVICE ACTIVITIES IN THE LAST FIVE YEARS:

Graduate Committee, Search Committee, ad-hoc committee
Student Chapter advisor, Electrochemical Society UT-Dallas chapter
Educational Committee, Microscopy Society of America
Proposal Review: National Science Foundation, North and Central Texas Clinical and Translational Science Initiative (NCTCTSI) Pilot Grant Program Review
Journal Review: ACS Nano, Acta Materialia, Applied Physics Letters, Composite Science and Engineering, Energy and Fuels, Environmental Science and Technology, IEEE Transactions on Electron Devices, IEEE Transactions on Nanotechnology, International Journal of Nanoscience, Journal of Applied Physics, Journal of Electrochemical Society, Journal of Electronic Materials, Journal of Materials Science, Journal of

Nanoengineering and Nanosystems, Metallurgical Transactions, Microelectronic Engineering, Microscopy and Microanalysis. Sensors and Actuators, Thin Solid Films, Ultramicroscopy
Annual Meeting symposium organizer, Microscopy Society of America (MSA)

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:

Attended several scientific conferences.

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

"Hello, Nano," M.J. Kim and S. Kim, *Apple iTunes iBookstore* (https://itunes.apple.com/us/book/hello-nano/id549327026?mt=11&ls=1), ISBN – 978-0-9856694-0-9.
"예술을 꿀꺽 삼킨 과학 (Arts and Science)," M.J. Kim and S. Song, *Sallim Books* (http://www.sallimbooks.com), ISBN 978-89-522-1902-2 (in Korean).
"In-situ studies on the shrinkage and expansion of graphene nanopores under electron beam irradiation at temperatures in the range of 400-1200°C," N. Lu, J. Wang, H.C. Floresca and M.J. Kim, *Carbon* **50**, 2961-2965 (2012). - Featured on the cover of journal CARBON
"Photoluminescent carbon nanoparticles produced by confined combustion of aromatic compounds," A. Rahy, C. Zhou, J. Zheng, S.Y. Park, M.J. Kim, I. Jang, S.J. Cho and D.J. Yang, *Carbon* **50**, 1298-1302 (2012).
"Copper can still be epitaxially deposited on palladium nanocrystals to generate core-shell nanocubes despite their large lattice mismatch," M. Jin, H. Zhang, J. Wang, X. Zhong, Z. Li, Z. Xie, M.J. Kim and Y. Xia, *ACS Nano* **6**, 2566-2573 (2012).
"Facile synthesis of polypyrrole coated copper nanowires: a new concept to engineered core-shell structures," Y. Liu, Z. Liu, Ning Lu, E. Preiss, S. Poyraz, M.J. Kim and X. Zhang, *Chem. Comm*. **48**, 2621-2623 (2012).
"Atomic layer deposition of dielectrics on graphene using reversibly physisorbed ozone," S. Jandhyala, G. Mordi, B. Lee, G. Lee, H.C. Floresca, P. Cha, J. Ahn, R.M. Wallace, Y. Chabal, M.J. Kim, L. Colombo, K.J. Cho and J. Kim, *ACS Nano* **6**, 2722-2730 (2012).
"Low-k organic layer as a top gate dielectric for graphene field effect transistors," G. Mordi, S. Jandhyala, H.C. Floresca, S. McDonnell, M.J. Kim R.M. Wallace, L. Colombo and J. Kim, *Appl. Phys. Lett*. **100**, 193117 (2012).
"Large area mapping of graphene grain structure and orientation," H.C. Floresca, D. Hinojos, N. Lu, J. Chan, L. Colombo, R.M. Wallace, J. Wang, J. Kim and M.J. Kim, *ECS Transactions* **45**, 79-82 (2012).
"Towards the controlled synthesis of hexagonal boron nitride films," A. Ismach, H. Chou, D.A. Ferrer, Y. Wu, S. McDonnell, H.C. Floresca, A. Covacevich, C. Pope, R. Pinder, M.J. Kim, R.M. Wallace, L. Colombo and R.S. Ruoff, *ACS Nano* **6**, 6378-6385 (2012).
"Controlled synthesis of transition metal/conducting polymer nanocomposites," Z. Liu, Y. Liu, L. Zhang, S. Poyraz, N. Lu, M.J. Kim, J. Smith, X. Wang, Y. Yu and X. Zhang, *Nanotech*. **23**, 335603 (2012).
"In-situ observations of nanopores and SiC nanoparticles on graphene using electron beam irradiation and heating," N. Lu, H.C. Floresca, J. Wang and M.J. Kim, *Microsc. Microanal*. **18** (suppl 2), 1498-1499 (2012).
"Synthesis of Pd-Rh Core-Frame Concave Nanocubes and Their Conversion to Rh Cubic Nanoframes by Selective Etching of the Pd Cores," S. Xie, N. Lu, Z. Xie, J. Wang, M.J. Kim and Y. Xia, *Angew. Chem. Int. Ed*. **51**, 10266-10270 (2012).
"A Mechanistic study on the nucleation and growth of Au on Pd seeds with a cubic or octahedral shape," G.N. He, J. Zeng, M.S. Jin, H. Zhang, N. Lu, J.G. Wang, M.J. Kim, Y.N. Xia,, *Chemcatchem*, **4**: 1668-1674, (2012). - Selected as VIP article, highlighted as the Front Cover.
"Degradation of a thin Ag layer induced by poly(3,4-ethylenedioxythiophene):polystyrene sulfonate in a transmission electron microscopy specimen of an inverted polymer solar cell," Y.J. Suh, N. Lu, S.H. Lee, W.S. Chung, K. Kim, B.S. Kim, M.J. Ko and M.J. Kim, *ACS Appl. Mater. Interfaces* **4**, 5118-5124 (2012).
"Control Over the Branched Structures of Platinum Nanocrystals for Electrocatalytic Applications," L. Ma, C. Wang, M. Gong, L. Liao, R. Long, J. Wang, D. Wu, W. Zhong, M.J. Kim, Y. Chen, Y. Xie and Y. Xiong, *ACS Nano* **6**, 9797-9806 (2012).
No. of Publications: 16 (2011), 21 (2010), 22 (2009), 20 (2008)

NAME:
Manuel Quevedo-Lopez

EDUCATION:
BS, Chemistry, University of Sonora, 1996
MS, Materials Science and Engineering, Saltillo Institute of Technology, 1998
PhD, Materials Science and Engineering, University of North Texas, 2002

ACADEMIC EXPERIENCE:
Associate Professor, University of Texas at Dallas, USA, 2010 – present
Adjunct Professor, University of North Texas, USA, 07/03 – present
Adjunct Professor, University of Sonora, Mexico, 01/06 – present
Research Professor, University of Texas at Dallas, USA, 2007 – 2010
Member Technical Staff, Texas Instruments, Inc., 2002 – 2007
Member Technical Staff, SEMATECH, 2004 – 2006
Research Assistant, University of North Texas, 2998 – 2002

NON-ACADEMIC EXPERIENCE:
Silicon Technology Development Group at Texas Instruments 2002-2007
SEMATECH 2004-2006

PROFESSIONAL REGISTRATION:
None.

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
America Vacuum Society (AVS).
Materials Research Society (MRS).
Society of Mexican American Scientist and Engineers
Member of Mexican National Research System (membership by invitation only)

HONORS & AWARDS:
SEMATECH "Corporate Excellence Award" 2005
Best Doctoral Dissertation award by the College of Arts and Sciences. University of North Texas. June 2002.
Inventor Recognition award by the Semiconductor Research Corporation (SRC). Raleigh, N.C. USA. June 2003.
UT-Dallas Inventor recognition 2011, 2012
Top 1% student in the Materials Science master programs (Institutes of Technology) in Mexico, June 1998.

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST FIVE YEARS:
Journal of Applied Physics, Applied Physics Letters, Applied Surface Science, Electrochemical and Solid-State Letters, Electron Device Letters, Transactions on Electron Devices, Organic Electronics, Journal of the Society for Information Display, Materials Chemistry and Physics.
Liaison/Advisor for the US-Mexico student exchange program between Mexico and Texas.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Co-Editor of the February 2011 MRS Bulleting Issue "Contacts for Nanoelectronics"
Chair of the "flexible electronics session" of the XIX AND XXI International Materials Conference (2010, 2012 Cancun MX). Meeting organized by the MRS.
Co-organizer of the 2007, 2008, 2009 and 2010, advanced materials workshop in organized by the Mexican Materials Society.
Member of the Scientific Board. Nanoholdings LLC.
Mexican National Research System Investigator (Level 2)

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

Israel Mejia, Ana L Salas-Villasenor, Dongkyu Cha, Husam N Alshareef, Bruce E Gnade, **Manuel A Quevedo-Lopez**. "Fabrication and Characterization of High-Mobility Solution-Based Chalcogenide Thin-Film Transistors IEEE Transactions on Electron Devices 60 (2012) 327-332.

AL Salas-Villasenor, I Mejia, M Sotelo-Lerma, BE Gnade**, MA Quevedo-Lopez**. "Performance and stability of solution-based cadmium sulfide thin film transistors: Role of CdS cluster size and film composition" Applied Physics Letters 101 (1) (2012) 262103-262103-5.

Jung, U., Lee, Y.G., Kim, J.J., Lee, S.K., Mejia, I., Salas-Villasenor, A., **MA Quevedo-Lopez**., Lee, B.H. "Indicators of mobility extraction error in bottom gate CdS metal-oxide-semiconductor field-effect transistors" Applied Physics Letters 101 (18) (2012) 182106

D Mao, I Mejia, AL Salas-Villasenor, M Singh, H Stiegler, BE Gnade, **MA Quevedo-Lopez** "Ferroelectric random access memory based on one-transistor–one-capacitor structure for flexible electronics" Organic Electronics 14 (2) (2012) 505-510.

Perez M., Mejia I., Salas A., Gnade BE., **Quevedo-Lopez MA**. "Hybrid CMOS Thin-Film Devices Based on Solution-Processed CdS n-TFTs and TIPS-Pentacene p-TFTs: Organic Electronics 13(12) (2012) 3045-3049

Ramos-González, R., García-Cerda, L.A., and **M. A. Quevedo-López.** "Study of the surface modification with oleic acid of nanosized HfO2 synthesized by the polymerized complex derived sol-gel method." *Applied Surface Science* 258 (2012): 6034-39.

Gutierrez-Heredia, G., Gonzalez, L., Berman, D., Bon, R.R. and **M. A. Quevedo-Lopez**. "A flexible organic active matrix circuit fabricated using novel organic thin film transistors and organic light-emitting diodes." *Semiconductor Science and Technology* 25 (2011).

Devine, R. A. B., Mee, J. K., Hjalmarson, H. P., **Quevedo-Lopez, M. A.,** and Alshareef, H. N. "A simplified approach to estimating total trap contributions in negative bias temperature instability." *Journal of Applied Physics* 106 (2009).

NAME
Walter E. Voit

EDUCATION
B.S., Computer Science, University of Texas at Dallas, 2005.
M.S., Intelligent Systems, University of Texas at Dallas, 2006.
Ph.D., Materials Science and Engineering, The Georgia Institute of Technology, 2009.

ACADEMIC EXPERIENCE
Assistant Professor, University of Texas at Dallas, Richardson, TX, June 2010 – present.

NON-ACADEMIC EXPERIENCE
Chief Technology Officer (25%), Syzygy Memory Plastics, Dallas, TX, 2007-present.
Research Scientist, MedShape Solutions, Atlanta, GA, summer: 2007.
Computer Programmer, Zyvex, Richardson, TX, 2004-2006.
Undergraduate Researcher, Los Alamos National Labs, Los Alamos, NM, summers: 2002, 2003.

CERTIFICATIONS / PROFESSIONAL REGISTRATIONS
N/A.

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS
Session Chair, The Metals, Minerals and Materials Society (TMS), 2008-present.
Member, Materials Research Society, 2008-present.
Member, Council on Ionizing Radiation Measurements and Standards (CIRMS), 2008-present.
Member, Tau Beta Pi, 2009 – present.
Member, Phi Kappa Phi, 2011 – present.
Member, Society for Biomaterials, 2011.

HONORS AND AWARDS
McDermott Faculty, University of Texas at Dallas, 2010-present.
NSF IGERT-Funded TI:GER Fellow, The Georgia Institute of Technology, 2007-2009.
Presidential Fellow, Georgia Institute of Technology, 2006–2009.
Erik Jonsson Fellow, University of Texas at Dallas, 2005-2006.
McDermott Scholar, University of Texas at Dallas, 2001-2005.

SERVICE ACTIVITIES
2nd Vice President, CIRMS 2012 - present
Science and Technology Chair, CIRMS 2011-2012.
Treasurer, CIRMS, Oct. 2010-2012.
Founder, High School Community Outreach in Math, Engineering, Technology and Science (COMETS), 2010-present.
Associate Site Director, Center for Energy Harvesting Materials and Systems (CEHMS), 2012 - present

PRINCIPAL PUBLICATIONS
Simon, D, T Ware, R Marcotte, BR Lund, J Dennis W. Smith, MD Prima, RL Rennaker and W Voit (2012). "A Comparison of Polymer Substrates for Photolithographic Processing of Flexible Bioelectronics." Biomedical Microdevices in review

Ware, T, D Simon, C Liu, T Musa, S Vasudevan, A Sloan, EW Keefer, RLR II and W Voit (2012). "Thiol-Ene/Acrylate Substrates for Softening Intracortical Electrodes." Journal of Biomedical Materials Research in review

Dei, DK, BR Lund, J Wu, D Simon, T Ware, WE Voit, D MacFarlane, SM Liff and DW Smith Jr (2012). "High Performance and Multipurpose Triarylamine-Enchained Semifluorinated Polymers." ACS Macro Letters 2(1): 35-39

Adrian Avendano-Bolivar, Taylor Ware, David Arreaga-Salas, D Simon and W Voit (2012). "Mechanical Cycling Stability of Organic Thin Film Transistors on Shape Memory Polymers." Advanced Materials accpeted

Márcio D Lima, NL, Monica Jung De Andrade, Shaoli Fang, Jiyoung Oh, Geoffrey M Spinks, Mikhail E Kozlov, Carter S Haines, Dongseok Suh, Javad Foroughi, Seon Jeong Kim, Yongsheng Chen, Taylor Ware, Min Kyoon Shin, Leonardo D Machado, Alexandre F Fonseca, John DW Madden, Walter E Voit, Douglas S Galvão, Ray H Baughman (2012). "Electrically, Chemically, and Photonically Powered Torsional and Tensile Actuation of Hybrid Carbon Nanotube Yarn Muscles." Science 338(6109): 928-932

Taylor Ware, Dustin Simon, Robert Rennaker and W Voit (2012). "Smart Polymers for Neural Interfaces." Polymer Reviews accepted

Hearon, K, LD Nash, BL Volk, T Ware, JP Lewicki, WE Voit, TS Wilson and DJ Maitland (2012). "Electron Beam Crosslinked Polyurethane Shape Memory Polymers with Tunable Mechanical Properties." Macromolecular Chemistry and Physics early view online

Ware, T, D Simon, K Hearon, C Liu, S Shah, J Reeder, N Khodaparast, MP Kilgard, DJ Maitland, RLR II and WE Voit (2012). "Three-Dimensional Flexible Electronics Enabled by Shape Memory Polymer Substrates for Responsive Neural Interfaces." Macromolecular Materials and Engineering 297(12): 1193-1202

Ware, T, D Simon, DE Arreaga-Salas, J Reeder, R Rennaker, EW Keefer and W Voit (2012). "Fabrication of Responsive, Softening Neural Interfaces." Advanced Functional Materials 22(16): 3470-3479

Ware, T, K Hearon, A Lonnecker, KL Wooley, DJ Maitland and W Voit (2012). "Triple-Shape Memory Polymers Based on Self-Complementary Hydrogen Bonding." Macromolecules 45(2): 1062-1069

Ware, T, G Ellson, A Kwasnik, S Drewicz, K Gall and W Voit (2011). "Tough Shape-Memory Polymer—Fiber Composites." Journal of Reinforced Plastics and Composites 30(5): 371

Voit, W, T Ware and K Gall (2010). "Radiation Crosslinked Shape-Memory Polymers." Polymer 51(15): 3551-3559

Ware, T, W Voit and K Gall (2010). "Effects of Sensitizer Length on Radiation Crosslinked Shape-Memory Polymers." Radiation Physics and Chemistry 79(4): 446-453

Voit, W, T Ware, RR Dasari, P Smith, L Danz, D Simon, S Barlow, SR Marder and K Gall (2010). "High-Strain Shape-Memory Polymers." Advanced Functional Materials 20(1): 162-171

Chitturi, B, W Fahle, Z Meng, L Morales, CO Shields, IH Sudborough and W Voit (2009). "An (18/11)N Upper Bound for Sorting by Prefix Reversals." Theoretical Computer Science 410(36): 3372-3390

Chitturi, B, H Sudborough, W Voit and X Feng (2008). "Adjacent Swaps on Strings." Computing and Combinatorics 5092(1): 299-308

PROFESSIONAL DEVELOPMENT ACTIVITIES:

Attended seminars, workshops, and conferences.

NAME:
Amy V. Walker

EDUCATION:
BA(Hons), Natural Sciences (Experimental and Theoretical Physics), University of Cambridge, 1995
PhD, Chemistry, University of Cambridge, 1998

ACADEMIC EXPERIENCE:
Associate Professor, The University of Texas at Dallas, 2009 – present
Washington University in St. Louis, Assistant Professor, 2002-2009
Pennsylvania State University, Postdoctoral Scholar, 2000-2002
University of Pittsburgh , Postdoctoral Associate , 1998-2000

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Chemical Society, American Physical Society, American Vacuum Society

HONORS & AWARDS:
ACS PROGRESS/Dreyfus Lectureship, American Chemical Society and the Camille and Henry Dreyfus Foundation Special Grant Program, 2008
Dupont Young Professor Grant, 2006-2009
Ralph E. Powe Junior Faculty Enhancement Award, Oak Ridge Associated Universities, 2003
Research Studentship, Shell Research and Technology Centre, Amsterdam, The Netherlands, 1995-1998
Nuffield Foundation Undergraduate Research Bursary, 1994

SERVICE ACTIVITIES:
Societies: Director, AVS, 2013-2014; Chair, AVS Applied Surface Science Division Executive Committee, 2012 (Member-at-Large 2009-2011); Member, AVS National Membership Committee, 2012 - present; Chair, AVS Texas Chapter, 2011-present; Member SIMS International Committee, 2010-2016 (Secretary-Elect, 2011).
ISO: Member, Study Group on Nanomaterials Characterization, ISO Committee TC201.
Reviewer for several NSF programs including SBIR/STTR, Petroleum Research Foundation, NIH, Department of Energy (Basic Energy Sciences), and ~25 journals including Journal of Applied Physics, Journal of the American Chemical Society, Langmuir, and ACS Nano.
Conferences: Includes Program Chair, Applied Surface Science Division, AVS 60th International Symposium, Long Beach, CA, October 27th – November 1st, 2013; Member, Program Committee, SIMS XVII (17th International Conference on Secondary Ion Mass Spectrometry) held in Toronto, Canada, September 2009

Washington University
1. Member, Olin Fellowship Committee (2005 - 2008)
2. Member, Study Abroad Advising Committee (2004 - 2009)

Department of Chemistry:
1. Member, Mass Spectrometry Resource Committee (2002 - 2009)
2. Member, Workshops Committee (2002 - 2009)
3. Member, Graduate Admissions and Recruitment (2002- 2009)
4. Member, Undergraduate Laboratory Oversight Committee (2005 - 2009)
5. Member, Undergraduate Curriculum Committee (2006 – 2009)
6. Member of 20 Graduate Student Dissertation Committees.

University of Texas at Dallas

Extra-Departmental:

1. Member, Graduate Student Scholarship Committee, Erik Jonsson School (2010 - present)
2. Member, TX BRIDGE Admissions and Curricula Co-ordination Committee (2011 – 2012)
3. Faculty Advisor, McDermott Scholars Program, 2012 – present.
4. Member, External Review Committee for Public Policy and Political Economy (PPPE) Program (2012).

Department of Materials Science and Engineering:

1. Director of REU Program in REU Program in Surface Engineering for Sensing, Energy and Nanoelectronics (2012 – present).
2. Graduate Admissions Committee. Chair (2009 – present)
2. Recruiting Committee. (2009 – present)
3. Graduate PhD Qualifying Examination Committee. (2009 – present)
4. Curriculum Committee, Subcommittee on Undergraduate Curriculum. (2011-present)
5. Colloquium Committee. (2009 – present) Chair (2010 – 2011)
6. Diversity, Mentorship and Leadership Committee. (2009 – 2010)
7. Member of 11 Graduate Student Dissertation Comittees.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:

Invited talks at international and national conferences: 15
Invited seminars and colloquia at universities, national laboratories and companies: 14
Contributed presentations at international and national conferences: 29
Moderator/Chair of 10 sessions at international and national conferences.

PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS (out of 62 total, 2008-2012: 29):

1. Z.Shi, P. Lu, A.V. Walker, "UV Photoassisted Room Temperature CVD of Aluminum on Functionalized Self-Assembled Monolayers," *Langmuir* **28** (2012) 16909–16916.
2. P. Lu, Z. Shi, A.V. Walker, "Selective Electroless Deposition of Copper on Organic Thin Films with Improved Morphology", *Langmuir* **27** (2011) 13022-13028.
3. Z. Shi, A.V. Walker, "Synthesis of Nickel Nanowires Via Electroless Nanowire Deposition on Micropatterned Substrates", *Langmuir* **27** (2011) 11292-11295.
4. J.J.D. Fitzgerald, P. Kunnath, A.V. Walker, "Matrix-Enhanced Secondary Ion Mass Spectrometry (ME SIMS) Using Room Temperature Ionic Liquid Matrices", *Analytical Chemistry*, **82** (2010) 4413-4419.
5. C. Zhou, A. V. Walker, "Formation of Multilayer Ultrathin Assemblies Using Chemical Lithography", *Langmuir*, **26** (2010) 8441-8449.
6. P. Lu, Z. Shi, A.V. Walker, "Selective Formation of Monodisperse CdSe Nanoparticles on Functionalized Self-Assembled Monolayers Using Chemical Bath Deposition", *Electrochim. Acta*, **55** (2010) 8126-8134.
7. A.V. Walker, "Building Robust and Reliable Molecular Constructs: Patterning, Metallic Contacts and Layer-by-Layer Assembly", *Langmuir*, **26** (2010) 13778-13785.
8. C. Zhou, J.C. Jones, A.J. Trionfi, J.W.P. Hsu, A.V. Walker, "Comparison of Chemical Lithography Using Alkanethiolate Self-Assembled Monolayers on GaAs (001) and Au", *Langmuir*, **26** (2010) 4523–4528.
9. P. Lu, A.V. Walker, "Making Nanoflowerbeds: Reaction Pathways Involved in the Selective Chemical Bath Deposition of ZnS on Functionalized Alkanethiolate Self-Assembled Monolayers", *ACS Nano*, **3** (2009) 370-378.
10. A.V. Walker, "Why is SIMS Underused in Chemical and Biological Analysis? Challenges and Opportunities", *Anal. Chem*., **80** (2008) 8865-8870.

NAME:
Robert M Wallace

EDUCATION:
BS, Physics, Applied Mathematics, University of Pittsburgh, 1982
MS, Physics, University of Pittsburgh, 1984
PhD, Physics, University of Pittsburgh, 1988

ACADEMIC EXPERIENCE:
Distinguished Professor, Dept. of MSE, University of Texas at Dallas, 2010-present
Professor, Dept. of MSE, University of Texas at Dallas, 2003-present
Director, Cleanroom Research Laboratory, University of Texas at Dallas, 2004-2010
Director, Laboratory for Electronics Materials, University of North Texas, 1999-2003
Professor, Dept. of Materials Science, University of North Texas, 1999-2003

NON-ACADEMIC EXPERIENCE:
Manager, Advanced Technology Branch, Texas Instruments, 1997-1999
Sr. Member, Technical Staff, Central Research Laboratories, Texas Instruments, 1996-1997
Member, Technical Staff,Central Research Laboratories, Texas Instruments, 1990-1996

CERTIFICATIONS / PROFESSIONAL REGISTRATION:
N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
American Vacuum Society, Material Research Society, Institute for Electronic and Electrical Engineers, Electrochemical Society, American Chemical Society

HONORS AND AWARDS:
(2011) Appointed Erik Jonsson Distinguished Chair
(2011) IBM Faculty Award
(2010) Appointed Louis A. Beecherl, Jr. Distinguished Professor
(2010) Best Paper Award, 68th Device Research Conference, Notre Dame, South Bend IN
(2009) Named Fellow of the IEEE “for contributions to high-k gate dielectric materials for integrated circuits”
(2007) Named Fellow of the AVS “for significant contributions to high-k dielectric materials research enabling the scaling of integrated circuit technology”

SERVICE ACTIVITIES IN THE LAST FIVE YEARS:
IEEE Semiconductor Interface Specialists Conference Program Committee (2009-12)
AVS Physics and Chemistry of Surfaces and Interfaces Conference Program Committee (2011)
New Publications Products Subcommittee Chair for the Materials Research Society (2011-13)
Atomic Layer Deposition Conference International Advisory Committee (2011)
MRS Spring meeting, Post-CMOS Emerging Channel Materials symposium organizer (2011)
IEEE International Electron Device Meeting Process Technology Committee (2009-11)
Associate Editor, Journal of Vacuum Science and Technology B (2009-10)
Director of the UTD Cleanroom Research Laboratory (2004-10)
Program Chair, Electronics Materials and Processing Division, AVS (2009)

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Reviewer activities - IEEE Elec. Dev. Lett., IEEE Trans. Elec. Dev., Appl. Phys. Lett., J. Appl. Phys., J. Vac. Sci. Technol., Surf. Sci., Appl. Surf. Sci., Thin. Sol. Films, J. Electronic Mat., J. Cryst. Growth, J. Mat. Res., J. Electrochem. Soc., Electrochem. Sol. St. Lett., IEEE IEDM Conf., IEEE VLSI Conf., IEEE SISC, Science.

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:
1. Y. Zhu, S. Murali, M.D. Stoller, K. J. Ganesh, W Cai, P. J. Ferreira, A. Pirkle, R. M. Wallace, K.A. Cychosz, M. Thommes, D. Su, E. A. Stach, R. S. Ruoff, "Carbon-based Supercapacitors Produced by Activation of Graphene," Science, 332(6037), 1537 (2011)
2. C. Gong, G.Lee, B. Shan, E.M. Vogel, R. M. Wallace, and K.J.Cho, "First-principles study of metal-graphene interfaces," Journal of Applied Physics 108, 123711 (2010).
3. C. L. Hinkle, M. Milojevic, B. Brennan, A. M. Sonnet, F. S. Aguirre-Tostado, G. J. Hughes, E. M. Vogel, and R. M. Wallace, "Detection of Ga suboxides and their impact on III-V passivation and Fermi-level pinning," Applied Physics Letters 94 162101(2009).
4. R.M.Wallace, P.C.McIntyre, J. Kim, and Y. Nishi, "Atomic Layer Deposition of Dielectrics on Ge and III-V Materials for Ultrahigh Performance Transistors," MRS Bulletin 34(7) 493 (2009).
5. C. L. Hinkle, M. Milojevic, E. M. Vogel, and R. M. Wallace, "The significance of core-level electron binding energies on the proper analysis of InGaAs interfacial bonding," Applied Physics Letters 95, 151905 (2009).
6. O. Seitz, M. Dai, F. S. Aguirre-Tostado, R. M. Wallace, and Y. J. Chabal, "Copper-Metal Deposition on Self Assembled Monolayer for Making Top Contacts in Molecular Electronic Devices," Journal of the American Chemical Society 131(50) 18159 (2009).
7. C. L. Hinkle, A. M. Sonnet, E. M. Vogel, S. McDonnell, G. J. Hughes, M. Milojevic, B. Lee, F. S. Aguirre-Tostado, K. J. Choi, H. C. Kim, J. Kim, and R. M. Wallace, "GaAs interfacial self-cleaning by atomic layer deposition," Applied Physics Letters 92, 071901 (2008)
8. B.Lee, S.-Y. Park, H.-C. Kim, K. Cho, E. M. Vogel, M. J. Kim, R. M. Wallace, and J. Kim, "Conformal Al_2O_3 dielectric layer deposited by atomic layer deposition for graphene-based nanoelectronics," Applied Physics Letters 92, 203102 (2008).
9. M. Milojevic , F. Aguirre-Tostado , H.C. Kim , J. Kim, and R.M.Wallace, "Half-cycle atomic layer deposition reaction studies of Al_2O_3 on $In_{0.2}Ga_{0.8}As$ (100) surfaces," Applied Physics Letters 93 202902 (2008).
10. M. Milojevic, C.L.Hinkle, F. Aguirre-Tostado , H.C. Kim , E,M,Vogel, J. Kim, and R.M.Wallace, "Half-cycle atomic layer deposition reaction studies of Al_2O_3 on $(NH_4)_2S$ passivated GaAs(100) surfaces," Applied Physics Letters 93 252905 (2008).
11. A. M. Sonnet, C. L. Hinkle, M. N. Jivani, R. A. Chapman, G. P. Pollack, R. M. Wallace, and E. M. Vogel, "Performance enhancement of n-channel inversion type $In_xGa_{1-x}As$ metal-oxide-semiconductor field effect transistor using ex situ deposited thin amorphous silicon layer," Applied Physics Letters 93, 122109 (2008).
12. A. M. Sonnet, C. L. Hinkle, M. N. Jivani, R. A. Chapman, G. P. Pollack, R. M. Wallace, and E. M. Vogel, "Performance enhancement of n-channel inversion type $In_xGa_{1-x}As$ metal-oxide-semiconductor field effect transistor using ex situ deposited thin amorphous silicon layer, "Applied Physics Letters 93, 122109 (2008).
13. C. L. Hinkle, A. M. Sonnet, M. Milojevic, F. S. Aguirre-Tostado, H. C. Kim, J. Kim, R. M. Wallace, and E. M. Vogel, "Comparison of n-type and p-type GaAs oxide growth and its effects on frequency dispersion characteristics ," Applied Physics Letters 93, 113506 (2008).
14. F. S. Aguirre-Tostado, M. Milojevic, C. L. Hinkle, E. M. Vogel, R. M. Wallace, S. McDonnell, and G. J. Hughes, "Indium stability on InGaAs during atomic H surface cleaning," Applied Physics Letters 92, 171906 (2008).

NAME:
Chadwin D. Young

EDUCATION:
BS, Electrical Engineering, University of Texas at Austin, 1996
MS, Electrical Engineering, North Carolina State University, 1998
PhD, Electrical Engineering, North Carolina State University, 2004

ACADEMIC EXPERIENCE:
Assistant Professor, The University of Texas at Dallas, Richardson, TX, 09/2012 – present

NON-ACADEMIC EXPERIENCE:
- Senior Member of Technical Staff, SEMATECH, Albany, NY, 2011 to 09/2012
- Member of Technical Staff, SEMATECH, Albany, NY, 2008-2011
- Engineer, SEMATECH, Austin, TX, 2004-2008
- Post Doc, SEMATECH, Austin, TX, 2003-2004
- Ph.D. Intern, SEMATECH, Austin, TX, 2001-2003

CERTIFICATIONS / PROFESSIONAL REGISTRATION:
N/A

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
IEEE, Senior Member

HONORS AND AWARDS:
- Corporate Excellence Award, SEMATECH
- National Member of the Year, National Society of Black Engineers
- Friar Society
- NC State Chancellor's African-American Leadership Award
- Presidential Leadership Award, University of Texas Ex-Students Association
- Outstanding Student Award, UT-Austin
- Student Leadership Award in the College of Engineering

SERVICE ACTIVITIES IN THE LAST FIVE YEARS:
- Materials Science and Engineering Graduate Admissions Committee
- Materials Science and Engineering Colloquium Committee
- Electrical Engineering Graduate Committee
- Served on the management or technical program committees of IIRW, IRPS, SISC, IEDM, WoDiM
- Guest Editor for IEEE Transactions on Device and Materials Reliability
- Reviewer for professional journals (IEEE Transactions on Electron Devices, IEEE Electron Device Letters, IEEE Transactions on Device and Materials Reliability, Microelectronics Reliability, Microelectronics Engineering, Solid-State Electronics)

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST FIVE YEARS:
Attended Certification Series (at UTD), seminars, workshops, and conferences.

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

C. D. Young, K. Akarvardar, M. O. Baykan, K. Matthews, I. Ok, T. Ngai, K.-W. Ang, J. Pater, C. E. Smith, M. M. Hussain, P. Majhi, and C. Hobbs, "(110) and (100) Sidewall Oriented MugFETs: A Performance and Reliability Investigation," *Solid-State Electronics*, **78**, pp. 2-10, 2012.

C. D. Young, G. Bersuker, M. Jo, K. Matthews, J. Huang, S. Deora, K. W. Ang, T. Ngai, C. Hobbs, P. D. Kirsch, A. Padovani, and L. Larcher, "New insights into SILC-based life time extraction," in *IEEE International Reliability Physics Symposium*, 2012, pp. 5D.3.1-5D.3.5.

C. D. Young, K. Akarvardar, K. Matthews, M. Baykan, J. Pater, I. Ok, T. Ngai, K. Ang, M. Minakais, G. Bersuker, C. Hobbs, P. Kirsch, and R. Jammy, "*Invited Talk*: Electrical Characterization and Reliability Assessment of Double-gate FinFETs," *PRiME 2012 Fall Meeting of the Electrochemical Society*, abst #2597, 2012.

K. Akarvardar, C. D. Young, M. O. Baykan, I. Ok, T. Ngai, K. W. Ang, M. P. Rodgers, S. Gausepohl, P. Majhi, C. Hobbs, P. D. Kirsch, and R. Jammy, "Impact of fin doping and gate stack on FinFET (110) and (100) electron and hole mobilities," *IEEE Electron Device Letters*, vol. 33, pp. 351-353, 2012.

C. D. Young, M. O. Baykan, A. Agrawal, H. Madan, K. Akarvardar, C. Hobbs, I. Ok, W. Taylor, C. E. Smith, M. M. Hussain, T. Nishida, S. Thompson, P. Majhi, P. Kirsch, S. Datta, and R. Jammy, "Critical discussion on (100) and (110) orientation dependent transport: nMOS planar and FinFET," in *Symposium on VLSI Technology (VLSIT)*, pp. 18-19, 2011.

Invited presentation: C. D. Young, K. Akarvardar, G. Bersuker, I. Ok, T. Ngai, K.-W. Ang, C. Hobbs, P. Kirsch, and R. Jammy, "Performance and Reliability Investigation of (110) and (100) Sidewall Oriented MugFETs," presented at *International Semiconductor Device Research Symposium*, p. TP5-01, 2011.

C. D. Young, D. Veksler, S. Rumyantsev, J. Huang, H. Park, W. Taylor, M. Shur, and G. Bersuker, "Evaluation of the N- and La-induced defects in the high-κ gate stack using low frequency noise characterization," *Microelectronic Engineering*, vol. 88, pp. 1255-1258, 2011.

Invited/Review paper: Chadwin D. Young, Dawei Heh, Rino Choi, Byoung Hun Lee, and Gennadi Bersuker, "Pulsed I_d-V_g methodology and Its Application to the Electron Trapping Characterization of High-k gate Dielectrics," *Journal of Semiconductor Technology and Science*, **10**, pp. 79-99, 2010.

C. D. Young, A. Neugroschel, K. Matthews, C. Smith, D. Heh, H. Park, M. M. Hussein, and G. Bersuker, "Gated Diode Investigation of Bias Temperature Instability in High-κ FinFETs," *IEEE Electron Device Letters*, 31, pp. 653-655, 2010.

C. D. Young, Y. Zhao, D. Heh, R. Choi, B. H. Lee, and G. Bersuker, "Pulsed Id - Vg Methodology and Its Application to Electron-Trapping Characterization and Defect Density Profiling," *IEEE Transactions on Electron Devices*, vol. 56, no. 6, pp. 1322-1329, 2009.

C. D. Young, G. Bersuker, J. Tun, R. Choi, D. Heh, and B. H. Lee, ""Smart" TDDB algorithm for investigating degradation in high-κ gate dielectric stacks under constant voltage stress," *Microelectronic Engineering*, vol. 86, pp. 287-290, 2009.

Chadwin D. Young, Ji-Woon Yang, Kenneth Matthews, Sagar Suthram, Muhammad Mustafa Hussain, Gennadi Bersuker, Casey Smith, Rusty Harris, Rino Choi, Byoung Hun Lee, and Hsing-Huang Tseng, "Hot carrier degradation in HfSiON/TiN fin shaped field effect transistor with different substrate orientations," *J. Vac. Sci. Technol. B*, 27, No. 1, pp. 468-471, 2009.

C. D. Young, G. Bersuker, J. Tun, R. Choi, D. Heh, and B.H. Lee, " "Smart" TDDB Algorithm for Investigating Degradation in High-k Gate Dielectric Stacks under Constant Voltage Stress," *Microelectronic Engineering*, pp. 287-290, 2008.

Appendix 7

“18+ Characteristics of MSEN MS Program”

Texas Higher Education Coordinating Board
University of Texas at Dallas
Erik Jonsson School of Engineering and Computer Science
Characteristics of MS Programs

Materials Science and Engineering
CIP code 14.1801.00

1. Number of Degrees Awarded per Academic Year

Academic Year	Degrees Awarded
2012-13	4*
2011-12	7
2010-11	12
2009-10	3

2. Percent of First-year Master's Students Who Graduate Within Five Years

	Fall 2007 Cohort
Number of new Master's students	7
Number of students who graduated within five years	7
Five Year Graduation Rate Master's Program	100%

3. Average Time to Degree

Academic Year	Average Time To Degree
2012-13	2.75 *
2011-12	2.47
2010-11	2.58
2009-10	2.50

* Fall 2012

4. Graduation Placement

At time of graduation, 51.43% of the graduates indicated they would be entering into the PhD program.

5. Admissions Criteria

A student lacking undergraduate prerequisites for graduate courses in Materials Science and Engineering must complete these prerequisites or receive approval from the graduate adviser and the course instructor. A diagnostic exam may be required. Specific admission requirements are as follows:

- Student has met standards equivalent to those currently required for admission to the Ph.D. or Master's degree programs in Materials Science, Electrical Engineering, Chemistry, Physics, or Biology.
- A grade-point average in undergraduate-level course work of 3.5 or better on a 4-point scale.
- GRE scores of 500, 700 and 4 for the verbal, quantitative and analytical writing components, respectively, are advisable based on our experience with student success in the program.

Students, who fulfill only some of the above requirements, if admitted conditionally, will be required to take graduate level courses as needed to make up any deficiencies.

6. Applied, accepted, enrolled

Academic Year	MS Program		
	Applied	Accepted	Enrolled
2012-13	46	16	4
2011-12	33	9	6
2010-11	19	6	3
2009-10	12	5	2

7. Enrollment

Academic Year	Enrollment
2012-13	19
2011-12	18
2010-11	27
2009-10	19

8. Retention

Retention MS Program	
Enrolled in Fall 2011	19
Re-enrolled in Fall 2012	17
Change in enrollment status (MS to PHD)	2

9. Percentage Full-Time Students

Academic Year	% Full Time Attendance
2012-13	84.21%
2011-12	55.56%
2010-11	74.07%
2009-10	73.68%

10. Student Diversity

Ethnicity	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
African American						1	
Asian		1			2	1	
Hispanic		1	1	3	5	5	1
International		3	5	7	12	4	12
Two or more						1	1
Unknown					1	2	2
White		8	10	9	7	4	3
Total		13	16	19	27	18	19
Male %		76.92%	87.50%	73.68%	74.07%	72.22%	78.95%
Female %		23.08%	12.50%	26.32%	25.93%	27.78%	21.05%

11. Number of Core Faculty

15 (Fall 2012)

12. Student-Core Faculty Ratio

Student-Core Faculty Ratio	2008-09	2009-10	2010-11	2011-12
MSEN MS program	2.29	2.11	1.93	1.38

13. Core Faculty Publications

Faculty Publications	2008	2009	2010	2011	2012
Refereed Articles	66	115	150	165	155
Books	3	2	3	1	5
Scholarly Presentations (Talks & Posters)	62	123	134	171	165
Invited Presentations	40	50	67	88	106
National/International Awards, Offices	8	16	25	45	47
Research Proposals Submitted as PI	29	33	68	62	90
Research Proposals Submitted as CO-PI	30	23	49	33	39

14. Core Faculty External Grants

Category	2008-09	2009-10	2010-11	2011-12
Total Number of Contracts and Grants	49	55	72	76
External Research Grants and Contract Expenditures	$6,928,015	$13,565,809	$17,349,934	$11,911,619

15. Faculty Teaching Load

Faculty Teaching Load (MS)			
2008-09	**2009-10**	**2010-11**	**2011-12**
57.29	47.33	25.29	33.92

16. Faculty Diversity

MSEN Faculty							
Ethnicity	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**
African American							1
Asian			3	3	4	4	4
Hispanic					1	1	2
International							
Two or more							
Unknown							
White			4	6	9	8	8
Total			7	9	14	13	15
Male %			100.00%	88.89%	85.71%	84.62%	86.67%
Female %			0.00%	11.11%	14.29%	15.38%	13.33%

17. Date of Last External Review

The program has not yet been externally reviewed.

18. External Program Accreditation

In the United States, the engineering accreditation agency, ABET, does not accredit engineering doctoral programs. All of our current Bachelor's programs with graduated students in engineering and computer science are ABET-accredited. The Jonsson School's doctoral programs were reviewed recently as part of the successful reaffirmation of UTD's accreditation by the regional accrediting agency, the Southern Association of Colleges and Schools.

19. Student publications/presentations

Few students publish or present independently; they primarily do this activity in collaboration with their mentoring professors.

Appendix 8

“18+ Characteristics of MSEN PHD Program”

Texas Higher Education Coordinating Board
University of Texas at Dallas
Erik Jonsson School of Engineering and Computer Science
18 Characteristics of Doctoral Programs

Materials Science and Engineering
CIP code 14.1801.00

1. Number of Degrees Awarded per Academic Year

Academic Year	Degrees Awarded
2011-2012	12
2010-2011	1
2009-2010	4
3-year average	5.67

2. Percent of First-year Doctoral Students Who Graduate Within Ten Years
10-year data are not available. The degree program was authorized in 2006.

3. Average Time to Degree

Average Time to Degree* (3 most recent years)
4.0

*At the University of Texas at Dallas, there are three semesters in every calendar year.

4. Employment Profile

Employment status	First Position	Current Position
Academia	44.00%	33.00%
Industry	56.00%	67.00%

5. Admissions Criteria

- Student has met standards equivalent to those currently required for admission to the Ph.D. or Master's degree programs in Electrical Engineering, Chemistry, Physics or Biology.
- A grade-point average in graduate-level course work of 3.5 or better on a 4-point scale.
- GRE scores of 500, 700 and 4 for verbal, quantitative and analytical, writing components, respectively, are advisable based on our experience with student success in the program.

6. Percentage Full-Time Students

	Enrolled	FT Students	% FT Students
Fall 2012	47	44	93.62%
Fall 2011	49	48	97.96%
Fall 2010	30	29	96.67%
Fall 2009	27	26	96.30%

7. Average Financial Support

$1,950 monthly stipend (tuition & fees not included)

8. Percentage of Full-time Students with Financial Support

93%

9. Number of Core Faculty

15

10. Student-Core Faculty Ratio

	Enrolled					
	Fall 2010	Fall 2011	Fall 2012	3-year Average	Core Faculty	Student-Core Faculty Ratio
Total	30	49	47	42.00	15	2.80
FTS	29	48	44	40.33	15	2.69

11. Core Faculty Publications:

Year	Publications
2011	166
2010	153
2009	117
3 Year Average	145.33

12. Core Faculty External Grants

Year	External Grants
2011-2012	$11,911,619
2010-2011	$17,349,935
2009-2010	$13,565,809

13. Faculty Teaching Load

Semester Credit Hours	Number of Core Faculty	Faculty Teaching Load
1150	15	76.67

14. Faculty Diversity

MSEN Faculty							
Ethnicity	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**
African American							1
Asian			3	3	4	4	4
Hispanic					1	1	2
International							
Two or more							
Unknown							
White			4	6	9	8	8
Total			7	9	14	13	15
Male %			100.00%	88.89%	85.71%	84.62%	86.67%
Female %			0.00%	11.11%	14.29%	15.38%	13.33%

15. Student Diversity

MSEN PhD Program							
Ethnicity	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**
African American	1	1	1		1	1	
Asian						2	1
Hispanic					1	1	3
International	2	7	13	21	23	39	45
Two or more							
Unknown							
White	2	1	4	6	5	7	5
Total	5	9	18	27	30	49	54
Male %		77.78%	66.67%	74.07%	76.67%	73.47%	75.93%
Female %		22.22%	33.33%	25.93%	23.33%	26.53%	24.07%

16. Date of Last External Review

The program has not yet been externally reviewed.

17. External Program Accreditation

In the United States, the engineering accreditation agency, ABET, does not accredit engineering doctoral programs. All of our current Bachelor's programs with graduated students in engineering and computer science are ABET-accredited. The Jonsson School's doctoral programs were reviewed recently as part of the successful reaffirmation of UTD's accreditation by the regional accrediting agency, the Southern Association of Colleges and Schools.

18. Student publications/presentations

Student Publications/Presentations/Awards	2009	2010	2011
Publications	69	94	111
Presentations	67	106	166
Awards	3	9	10

Additional Variables:

19. Student Retention

Retention PhD Program	
Enrolled in Fall 2011	42
Re-enrolled in Fall 2012	41
Re-enrolled in Spring 2013	1

20. Student Enrollment

Academic Year	Doctoral Program
2012-13	54
2011-12	49
2010-11	30
2009-10	27
2008-09	18
2007-08	9
2006-07	5
2005-06	3

21. Graduate licensure rates

Data not available

22. Program Curriculum and Duration relative to Peer Programs

	University of Texas at Dallas	University of Texas El Paso	University of Delaware	University of Virginia
Minimum Required School Credit Hours Courses/Research	30/45	35/39	36/18	38/25
Minimum SCH required for graduation	75	74		

***** 19 graduates from MSEN department and 5 graduates from other departments but supported by MSEN faculty

Appendix 9

PROGRAM ASSESSMENT PLAN

Appendix 9

PROGRAM ASSESSMENT PLAN

FOR ACADEMIC YEAR: 2012-2013
PROGRAM: Master's of Science and PhD in Materials Science and Engineering
SCHOOL: Erik Jonsson School of Engineering and Computer Science
SUBMISSION DATE: August 31, 2012

UNIVERSITY MISSION: The University of Texas at Dallas serves the Metroplex and the State of Texas as a global leader in innovative, high quality science, engineering, and business education and research. The University is committed to (1) producing engaged graduates, prepared for life, work, and leadership in a constantly changing world, (2) advancing excellent educational and research programs in the natural and social sciences, engineering and technology, management, and the liberal, creative, and practical arts, and (3) transforming ideas into actions that directly benefit the personal, economic, social, and cultural lives of the citizens of Texas.

PROGRAM MISSION:
The mission of the Materials Science and Engineering master's degree program is to provide students with an advanced education in materials science and engineering and prepare them for long and successful careers in industry and government. We prepare our graduates to be key contributors to materials science and engineering research in industry and/or academia and to further their education by entering a doctoral degree program.

STUDENT OUTCOMES:
A. Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise.

B. Develop solutions to practical problems: Students will apply their knowledge and analytical skills to create effective and novel solutions to practical problems.

C. Communicate effectively and work collaboratively: Students will communicate effectively and work both collaboratively and independently.

ASSESSMENTS:
For courses in the Department of Materials Science, the faculty currently teaching each course confer with those who most recently taught it to confirm or establish the Course Learning Outcomes (CLOs) and how they are mapped on to the Student Outcomes. The CLOs for each course are subject to review by the departments' Curriculum Committee. For purposes of assessment and coordination whoever is currently teaching the course is considered the course owner. Currently, the Erik Jonsson School's academic programs use performance vectors to measure the performance, on each CLO, of the students enrolled in each course and section. The components of a performance vector are the numbers of students who have attained each of four

levels of performance on each CLO. The performance levels are the following: Exceeding the performance criteria for a given CLO, meeting the criteria, progressing to the criteria, and below expectations. The faculty assessment process is direct, based on quantitative data collected through the assessment of CLOs. At the end of every semester, each instructor of a course is required to fill out a course assessment form for that course. The course assessment form carries quantitative information on the extent to which the each student has attained each CLO that has been defined for the course. The course instructor is also required to provide information on what rubrics are used to evaluate the performance on each CLO. The information used to evaluate a CLO can vary from one CLO to another, but is never based on the final grades in the course. The information used for assessment and evaluation of the CLOs is only a subset of the information used to determine the final course grade. We use the performance vectors of selected core classes to assess program-level SOs. The Erik Jonsson School contracted with UNTRA Corporation to become a partner in the application and development of the AEFIS (Academic Evaluation, Feedback and Intervention System) software platform to meet the evolving requirements of assessment and accreditation. AEFIS will provide unified documentation of all aspects of the SACS assessment processes, and will permit instructors, course owners, department heads and the Office of Assessment to input, analyze and evaluate all assessment information. AEFIS will be used for course and program assessments for the 2012-2013 academic terms.

DOCUMENTATION:
Assessment documentation is stored on the on-campus, secure, pass-word protected AEFIS server. Additional assessment material is stored securely in the department offices.

DISSEMINATION/DISCUSSION OF RESULTS:
To evaluate the CLOs for a course, the course owner and the instructor (or instructors when there are multiple sections) review whether the students have satisfactorily attained the CLOs of the course. The course owner examines the course evaluation forms filled out by the instructors, the sample course material (exams, quizzes, homework, etc.), and the student course evaluations. The course owner then completes a course update form that summarizes the evaluation of the CLOs, and may include improvements to the teaching of that course. Further, the assessment results are reviewed in a mandatory faculty-wide assessment meeting every semester.

RESULTS:
The program assessment report will provide a summary of the attainment of SOs and will show the percentage of student meeting the criteria of each CLO that map to the outcomes.

MODIFICATIONS AND RECOMMENDATIONS:
The program is currently reviewing the CLOs to ensure that each outcome is written as a high-level conceptual statement.

TIMELINE, REQUIREMENTS, AND APPROVALS:
Program assessment is an ongoing process in the Erik Jonsson School. Course owners and instructors evaluate the attainment of the CLOs after every term. Departmental faculty meetings are also scheduled every semester to review the assessment results.

Appendix 10

PROGRAM ASSESSMENT REPORT

APPENDIX 10

Materials Science and Engineering - PROGRAM ASSESSMENT REPORT

(Spring 2010 – Fall 2012)

Materials Science and Engineering - PROGRAM ASSESSMENT - SUMMARY REPORT						
	Number of Students				Percentage Below Expectation	Percentage Meeting Criteria
Student Outcomes A, B, C	**Below Expectation**	**Progressing to Criteria**	**Meeting Criteria**	**Exceeding Criteria**		
A. Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise.	157	343	569	385	11%	66%
B. Develop solutions to practical problems: Students will apply their knowledge and analytical skills to create effective and novel solutions to practical problems.	100	285	497	354	8%	69%
C. Communicate effectively and work collaboratively: Students will communicate effectively and work both collaboratively and independently.	51	91	107	86	15%	58%

Student Outcome A: Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise.

MATERIALS SCIENCE AND ENGINEERING - PROGRAM ASSESSMENT							
Student Outcome A. Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise.		**Below Expectation**	**Progressing to Criteria**	**Meeting Criteria**	**Exceeding Criteria**	**Percentage Below Expectation**	**Percentage Meeting Criteria**
MSEN 5310	**Thermodynamics of Materials**						
	Demonstrate knowledge and the application of the laws of thermodynamics	10	19	30	9	15%	57%
	Demonstrate knowledge and the application of reaction equilibrium	9	19	28	12	13%	59%
	Demonstrate knowledge of and explain phase diagrams	10	16	30	12	15%	62%
	Demonstrate knowledge of chemical reactions	6	14	20	8	13%	58%
MSEN 5360	**Materials Characterization**						
	Understand when to apply the techniques of atomic and structural analysis	1	14	23	21	2%	75%
	Understand probe radiation	1	14	23	21	2%	75%
	Understand emitted radiation or particles	1	14	23	21	2%	75%
	Understand the physics/chemistry of the absorption process	1	14	23	21	2%	75%
	Understand the physics/chemistry of the emission process	1	14	23	21	2%	75%
	Understand the production of probe radiation	1	14	23	21	2%	75%
	Understand the detection of the emitted radiation/particles	1	14	23	21	2%	75%
	Understand volume sampled by the technique	1	14	23	21	2%	75%
	Understand the sensitivity of the techniques of atomic and structural analysis	1	14	23	21	2%	75%
	Understand quantification of elements/species detected	1	14	23	21	2%	75%
MSEN 6319	**Quantum Mechanics for Materials Scientists**						
(S10, S11)	Gain an understand of the nature and physical principles of Quantum Mechanics	1	2	10	13	4%	88%
	Understand application of Quantum Mechanics to describe the nature atoms, molecules and solids,	1	2	10	13	4%	88%

Student Outcome A: Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise. (cont'd).

MATERIALS SCIENCE AND ENGINEERING - PROGRAM ASSESSMENT							
Student Outcome A. Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise.		**Below Expectation**	**Progressing to Criteria**	**Meeting Criteria**	**Exceeding Criteria**	**Percentage Below Expectation**	**Percentage Meeting Criteria**
MSEN 6319	**Quantum Mechanics for Materials Scientists**						
(S12)	Understand the historical needs for a quantum mechanical description of Nature	6	7	6	7	23%	50%
	Understand the wave-like properties of matter and their description by Schroedinger equation	13	9	3	1	50%	15%
	Know how to apply and solve Schroedinger equation in one dimension	8	4	11	3	31%	54%
	Understand the quantization process: From Hamiltonian to Quantum Mechanics	4	8	9	5	15%	54%
	Understand theory of measurements, hermitean operators, state vectors, Hilbert spaces, and their physical meaning	9	4	12	1	35%	50%
	Understand the atomic structure and periodic table	1	10	7	8	4%	58%
	Understand approximation methods (perturbation theory, WKB)	1	14	10	1	4%	42%
	Understand the structure of crystals and their quantum mechanical description	2	4	9	11	8%	77%
	Understand the basic of quantum mechanical calculation applied to nanometer-scale structures	7	9	5	5	27%	38%

Student Outcome A: Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise (cont'd).

MATERIALS SCIENCE AND ENGINEERING - PROGRAM ASSESSMENT							
Student Outcome A. Broad knowledge of modern materials science and engineering: Students will demonstrate a broad knowledge of materials science and engineering and a focused understanding of their area of expertise.		**Below Expectation**	**Progressing to Criteria**	**Meeting Criteria**	**Exceeding Criteria**	**Percentage Below**	**Percentage Meeting Criteria**
MSEN 6324	**Electronic, Optical and Magnetic Materials**						
	Describe and explain the Thermal and Electrical Conduction Mechanisms in Solids	11	8	16	6	27%	54%
	Describe and apply Elementary Quantum Physics	11	8	16	6	27%	54%
	Describe and apply the Modern Theory of Solids	11	8	16	6	27%	54%
	Describe, explain and calculate Semiconductor Materials Properties	6	8	19	8	15%	66%
	Describe simple semiconductor devices from a materials perspective including capacitors, pn junctions, and transistors	6	8	19	8	15%	66%
	Describe, explain and calculate Dielectric Materials Properties	6	8	19	8	15%	66%
	Describe, explain and calculate Magnetic Materials Properties	4	7	17	12	10%	73%
	Describe, explain and calculate Optical Materials Properties	4	7	17	12	10%	73%
	Total for Student Outcome A	**157**	**343**	**569**	**385**	**11%**	**66%**

Student Outcome B: Develop solutions to practical problems: Students will apply their knowledge and analytical skills to create effective and novel solutions to practical problems.

MATERIALS SCIENCE AND ENGINEERING - PROGRAM ASSESSMENT							
Student Outcome B. Develop solutions to practical problems: Students will apply their knowledge and analytical skills to create effective and novel solutions to practical problems.		**Below Expectation**	**Progressing to Criteria**	**Meeting Criteria**	**Exceeding Criteria**	**Percentage Below**	**Percentage Meeting Criteria**
MSEN 5310	**Thermodynamics of Materials**						
	Demonstrate knowledge and the application of the laws of thermodynamics	10	19	30	9	15%	57%
	Demonstrate knowledge and the application of reaction equilibrium	9	19	28	12	13%	59%
	Demonstrate knowledge of and explain phase diagrams	10	16	30	12	15%	62%
	Demonstrate knowledge of chemical reactions	9	16	30	13	13%	63%
MSEN 5360	**Materials Characterization**						
	Understand when to apply the techniques of atomic and structural analysis	1	14	23	21	2%	75%
	Understand probe radiation	1	14	23	21	2%	75%
	Understand emitted radiation or particles	1	14	23	21	2%	75%
	Understand the physics/chemistry of the absorption process	1	14	23	21	2%	75%
	Understand the physics/chemistry of the emission process	1	14	23	21	2%	75%
	Understand the production of probe radiation	1	14	23	21	2%	75%
	Understand the detection of the emitted radiation/particles	1	14	23	21	2%	75%
	Understand volume sampled by the technique	1	14	23	21	2%	75%
	Understand the sensitivity of the techniques of atomic and structural analysis	1	14	23	21	2%	75%
	Understand quantification of elements/species detected	1	14	23	21	2%	75%
MSEN 6319	**Quantum Mechanics for Materials Scientists**						
	Understanding of its (QM) mathematical formulation	1	2	10	13	4%	88%
	Understand methods to obtain approximate solutions of problems of interest to materials science	4	4	11	7	15%	69%

Student Outcome B: Develop solutions to practical problems: Students will apply their knowledge and analytical skills to create effective and novel solutions to practical problems (cont'd.).

MATERIALS SCIENCE AND ENGINEERING - PROGRAM ASSESSMENT							
Student Outcome B. Develop solutions to practical problems: Students will apply their knowledge and analytical skills to create effective and novel solutions to practical problems.		**Below Expectation**	**Progressing to Criteria**	**Meeting Criteria**	**Exceeding Criteria**	**Percentage Below**	**Percentage Meeting Criteria**
MSEN 6319	**Quantum Mechanics for Materials Scientists**						
(S12)	Understand the atomic structure and periodic table	1	10	7	8	4%	58%
	Understand the structure of crystals and their quantum mechanical description	2	4	9	11	8%	77%
	Understand the basic of quantum mechanical calculation applied to nanometer-scale structures	7	9	5	5	27%	38%
MSEN 6324	**Electronic, Optical and Magnetic Materials**						
	Describe and explain the Thermal and Electrical Conduction Mechanisms in Solids	11	8	16	6	27%	54%
	Describe, explain and calculate Semiconductor Materials Properties	6	8	19	8	15%	66%
	Describe simple semiconductor devices from a materials perspective including capacitors, pn junctions, and transistors	6	8	19	8	15%	66%
	Describe, explain and calculate Dielectric Materials Properties	6	8	19	8	15%	66%
	Describe, explain and calculate Magnetic Materials Properties	4	7	17	12	10%	73%
	Describe, explain and calculate Optical Materials Properties	4	7	17	12	10%	73%
	Total for Student Outcome B	100	285	497	354	8%	69%

Student Outcome C: Communicate effectively and work collaboratively: Students will communicate effectively and work both collaboratively and independently.

MATERIALS SCIENCE AND ENGINEERING - PROGRAM ASSESSMENT							
Student Outcome C. Communicate effectively and work collaboratively: Students will communicate effectively and work both collaboratively and independently.		**Below Expectation**	**Progressing to Criteria**	**Meeting Criteria**	**Exceeding Criteria**	**Percentage Below**	**Percentage Meeting Criteria**
MSEN 5310	**Thermodynamics of Materials**						
	Demonstrate knowledge of and explain phase diagrams	7	14	20	7	15%	56%
	Demonstrate knowledge of chemical reactions	3	2	10	5	15%	75%
MSEN 5360	**Materials Characterization**						
	Understand when to apply the techniques of atomic and structural analysis	1	14	23	21	2%	75%
MSEN 6319	**Quantum Mechanics for Materials Scientists**						
(S10, S11)	Understand basic principles of Quantum Statistical Mechanics	1	6	7	12	4%	73%
	Understand matter-radiation interaction	1	8	2	15	4%	65%
MSEN 6319	**Quantum Mechanics for Materials Scientists**						
(S12)	Understand the historical needs for a quantum mechanical description of Nature	6	7	6	7	23%	50%
	Understand the wave-like properties of matter and their description by Schroedinger equation	13	9	3	1	50%	15%
	Understand theory of measurements, hermitean operators, state vectors, Hilbert spaces, and their physical meaning	9	4	12	1	35%	50%
	Understand approximation methods (perturbation theory, WKB)	1	14	10	1	4%	42%
	Understand the structure of crystals and their quantum mechanical description	2	4	9	11	8%	77%
	Understand the basic of quantum mechanical calculation applied to nanometer-scale structures	7	9	5	5	27%	38%
	Total for Student Outcome C	51	91	107	86	15%	58%