diversity
IN MATERIALS SCIENCE & ENGINEERING

Latino engineering faculty in the United States

Gerardo N. Arellano, **Oscar Jaime-Acuña**, and **Olivia A. Graeve**
Feature Editor: **Lynnette D. Madsen**

Engineering research is the catalyst of discovery that fuels the development of innovative products and services, in turn driving economic growth and global competitiveness. This innovation thrives on the capacities, talents, and experiences of people from various diverse backgrounds; however, engineering itself has a diversity problem on many fronts.

One critical concern is the low participation of ethnic minorities in engineering research, an example being US-born Latinos. Latinos are defined as individuals of Mexican, South American (including Brazil), Central American, and Caribbean origin residing in the United States. By contrast, the term Hispanic, as defined by the US government, refers to Spanish-speaking persons living in the United States, especially of Latin American origin, but also including persons from Spain and other Spanish-speaking countries.

Statistics show that the participation of US Latinos in engineering fields, including materials science and engineering, is dismal. The latest US census data (from 2016) indicate that 17.8% of the total US population is Hispanic or Latino.[1] However, Hispanics only represent 4.9% of engineering doctoral graduates and 9.8% of engineering bachelor's graduates, according to the 2016 S&T (*Science & Technology*) Indicators published by the National Science Foundation (see Figure 1).[2]

Additional data reveal that Hispanics hold approximately 3.6% of faculty appointments in engineering.[3] However, scant attention is given to Latino faculty members' birth country and other demographic characteristics. Thus, we decided to investigate characteristics, including academic rank, gender, and country of origin, of Latino engineering faculty at universities within the United States.

While the total number of Latino engineering faculty as of 2016 is close to 600, only 48 of the total number were born in the United States.

The root of the problem is in the extreme lack of pipeline of US-born Latinos into doctoral programs and academic careers.[4–7] Involving Latinos in the production of scientific and engineering leadership roles within US universities should be considered a national priority, as we should cultivate reliable domestic talent. The good news is that there are opportunities at research-intensive universities to work closely with the community, government, and industry to develop scalar institutional capacities in this area. Ignoring this issue will result in a continued lack of role models for US-born Latino youth, who look for successful examples in academia among people who share their heritage.

For our analysis, we collected information on Latino engineering faculty from all universities that have a College of Engineering or School of Engineering listed by the *US News & World Report* National Universities Ranking. This analysis includes all universities in the 50 states, excluding faculty residing and working in Puerto Rico.

By visiting the engineering department websites of each college, we began the assessment of the number of Latino faculty listed based on surnames. We also gathered the names of Latino faculty attending the annual meetings of the Society of Hispanic Professional Engineers (SHPE) over a 10-year period. Country of origin was determined based on the university from which each faculty member obtained his or her undergraduate degree. We made significant additions and corrections to our list based on referrals from Latino faculty that have participated in or currently participate in SHPE activities.

The list does not include faculty in the natural sciences or life sciences, even if their research areas are within the realm of engineering. We only looked at tenure or tenure-track faculty, and excluded lecturers, research professors, and adjunct professors,

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https://doi.org/10.1557/mrs.2018.23 Published online by Cambridge University Press

although these faculty groups appear to be overutilized among the ranks of the professoriate[8] and, thus, consideration of their numbers is of importance in developing a complete picture of the professoriate in engineering.

As of 2016, there were 587 Latino faculty members in the United States, of which 485 (83%) were men and 102 (17%) were women (see Figure 2). The number of women shows a distressing trend in that they stay more or less constant from Assistant ($n = 36$) to Associate ($n = 38$), but then fall to 28 at the Full Professor level. These results are in agreement with numbers in the S&T Indicators,[2] where the percentage of women faculty is significantly higher at the Assistant and Associate Professor levels, compared to the rank of Full Professor.

A plausible explanation is that the number of women in engineering faculty has been traditionally low, and even if more women faculty are currently being hired, insufficient time has passed for them to reach Full Professor status. As the number of female Assistant and Associate Professors continues to increase, the rank of female Full Professors could someday follow the trend of increasing numbers found for men. Studies have also shown that poor or nonexistent family-friendly policies in academia and lack of mentorship can result in the loss of women faculty at higher levels.[9–11] This drop in the number of women faculty is an issue that merits further consideration.

Figure 3 illustrates that the greatest representation of Latino engineering faculty hail from Mexico—152 individuals representing 25.9% of total faculty. This finding may not be surprising considering the geographic proximity of the United States and Mexico, as well as the significant economic ties between the two countries. In addition, among the 55.3 million Hispanics in the United States, as of 2014, nearly two-thirds, or about 36 million, self-identify as being of Mexican origin, according to the Pew Research Center.[12] Thus, Mexico is having an immense impact in the education of Latino engineering students in the United States via the highly educated Mexican diaspora that occupies the ranks of Latino engineering professors in the United States.

Argentina and Brazil are second and third, respectively, with 75 and 52 faculty members. There are 37 engineering faculty from Puerto Rico across the 50 US states. As the island is decidedly Latin American in nature, Puerto Ricans serving as engineering faculty within the states also serve as role models for Latino engineering students.

In total, there are only 48 (8.2%) US-born Latino faculty members, a number that is extraordinarily overshadowed by the 507 (86.4%) Latino engineering faculty who are foreign-born. By comparison, 49% of faculty (of all ethnicities) in science and engineering across the United States are foreign-born.[2] (We do not have country of origin information for 32 faculty members.) All US-born Latino faculty completed their undergraduate degrees in the United States, so it is likely that they were born in one of the 50 US states (or possibly Puerto Rico). Even if we add them to the number of US-born faculty, increasing this number to 80, that makes the share 13.6%, still far below the percentage of foreign-born faculty.

Universities across the nation are currently increasing the number of Latino engineering faculty from the highly qualified Latin American diaspora in numbers far higher than the average found in science and engineering. The United States is a country of immigrants, and the strategy of hiring the most qualified people from across the globe has served this country well. However, from the statistics listed, there is a pipeline issue affecting US-born Latinos in the United States. While we should continue to hire the best talent globally, we should not forget that we must invest, educate, and train our domestic talent.

A previous analysis[13] showed that 67% of bachelor's degrees awarded in the United States belong to the big four disciplines: civil, computer, electrical, and mechanical engineering; 20% belong to aerospace, biomedical, chemical, and industrial engineering; and 10% belong to the

Figure 1.

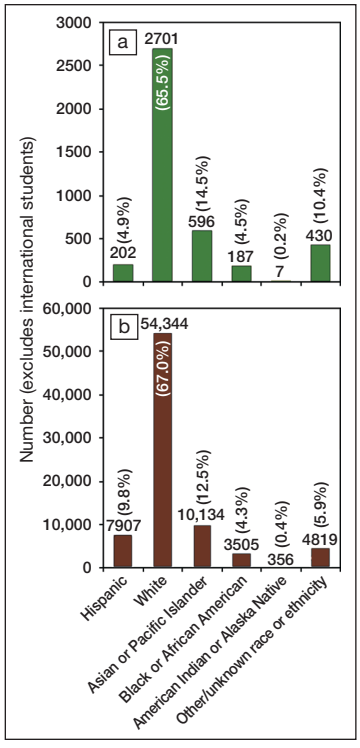

Figure 2.

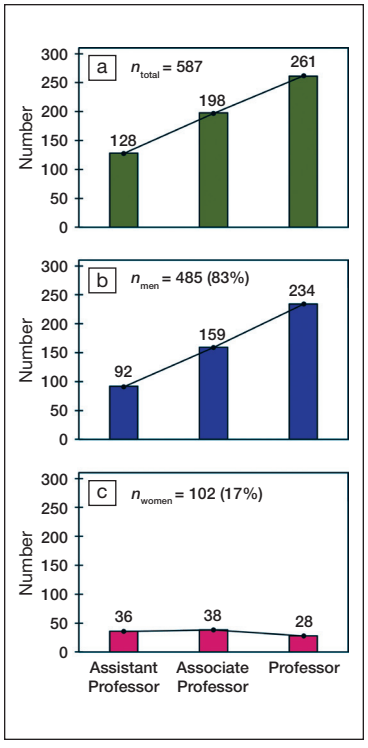

Figure 1. Number and percentage of US-born (a) doctoral graduates and (b) bachelor's graduates in engineering for 2013.[2]

Figure 2. (a) Total number of Latino engineering tenure-track and tenured faculty in the 50 US states by rank and the corresponding numbers of (b) men and (c) women. (Faculty in Puerto Rico are not included.)

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smaller 10 disciplines of materials, agricultural, architectural, engineering management, engineering physics/engineering science, environmental, general engineering studies, mining, nuclear, and petroleum engineering.

We found similar distributions among Latino faculty (see Figure 4). Traditional departments, such as civil engineering and electrical engineering, include a majority (35.57%) of all Latino faculty. Departments dedicated to areas such as materials engineering, aerospace engineering, and industrial engineering are lagging behind at 15.7% of all Latino faculty. Other areas, including biomedical engineering, petroleum engineering, and engineering technology, represent around 4.4% of the total Latino engineering faculty.

We propose that research-intensive universities should work closely with government (at federal, state, and local levels) and the corporate sector to develop evidence-based scalable institutional initiatives and incentives to increase the number of US-born Latinos eligible for graduate programs in engineering, including materials science and engineering. This could subsequently increase the numbers prepared to occupy faculty roles in the United States.

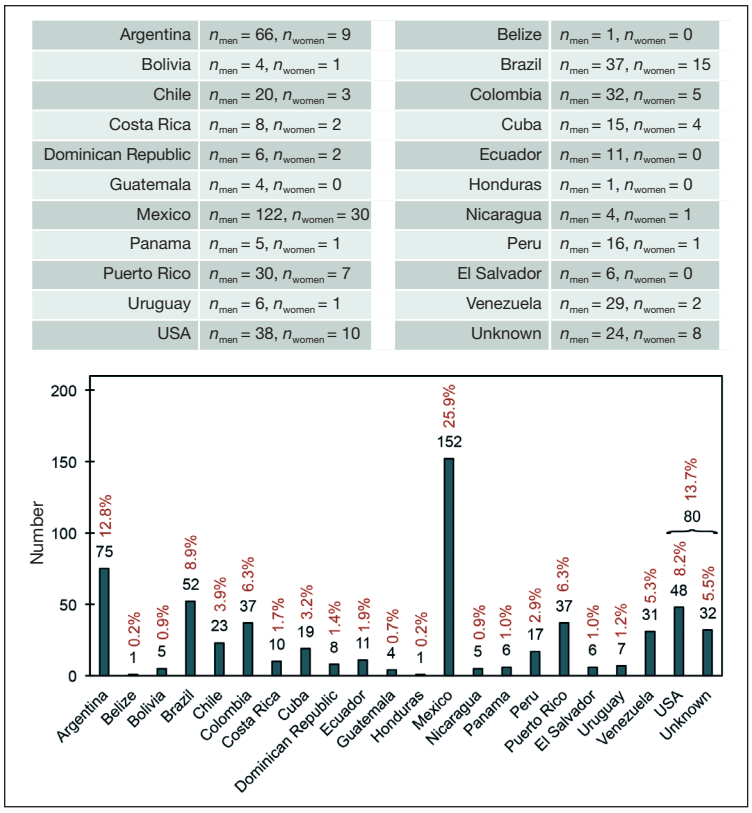

Figure 3. Latino engineering faculty by country of origin.

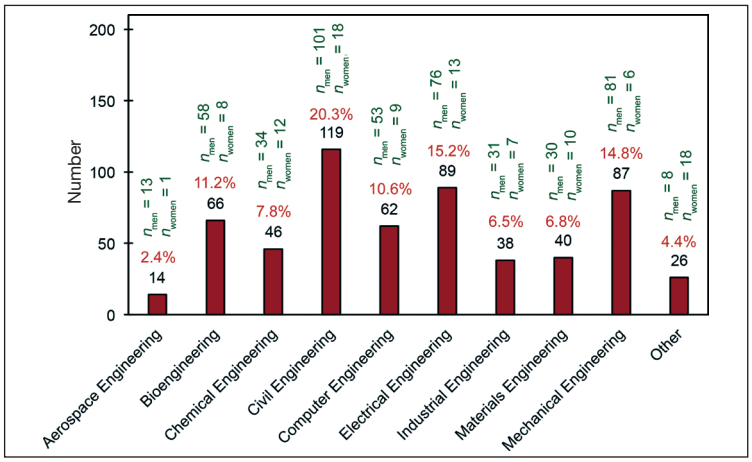

Figure 4. Distribution of Latino faculty by engineering subdiscipline.

Acknowledgments

This work was funded with support from the National Science Foundation (Nos. 1360561, 1262095, 1138329, 1038461, and 0932173). We are grateful to Prachi Patel for support in editing the document.

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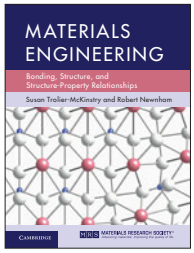

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AUTHORS: Susan Trolier-McKinstry and Robert E. Newnham
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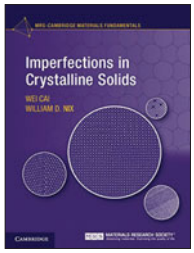

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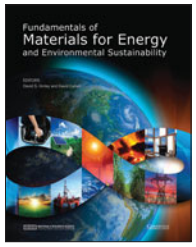

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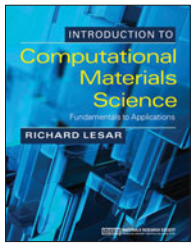

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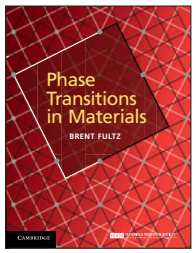

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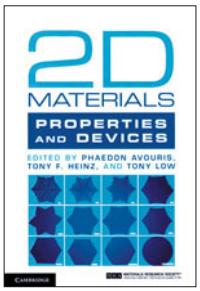

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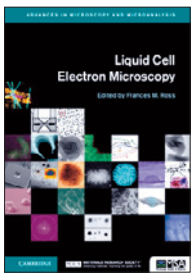

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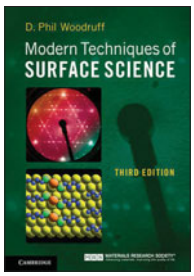

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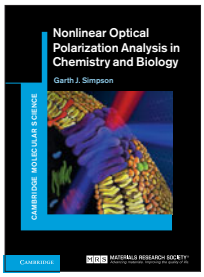

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AUTHOR: Garth J. Simpson
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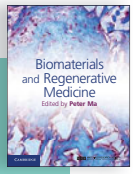

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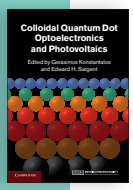

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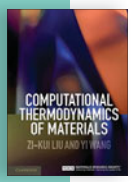

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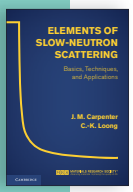

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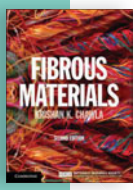

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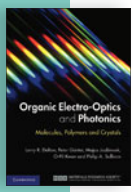

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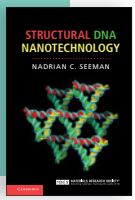

2016 PROSE Award Winner in Biological Science

Structural DNA Nanotechnology

AUTHOR: Nadrian C. Seeman
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MRS OnDemand®

MRS OnDemand hosts engaging topical webinars, newsmaker interviews, select presentations from past MRS Meetings, plenary talks and more. Increased capabilities have allowed us to capture the brightest minds from industry and academia discussing topics surrounding materials science, and provide **FREE access to MRS Members**—complete with presentation slides.

MRS OnDemand also hosts MRS TV—an interview series dedicated to news and views from MRS Meetings. Each series features a mix of well-established, popular topics as well as leading-edge research and interviews with Meeting attendees—from MRS and Kavli Prize winners and experts in the field, to first-time attendees and long-time MRS volunteers.

MRS OnDemand® WEBINAR SERIES

Presented by *MRS Bulletin,* the MRS OnDemand Webinar Series features free, live webinars throughout the year that provide valuable educational information on timely, interdisciplinary topics. Expert speakers deliver knowledge on a variety of cutting-edge topics, and answer questions submitted by live viewers. This format provides a great opportunity to learn while networking with other researchers from around the world. See the *MRS Bulletin* section on page 138 for the list of 2018 Webinar Wednesdays that complement each issue's theme topic. For the most up-to-date webinar calendar, visit **www.mrs.org/webinars.**

From your home, office, or on the go, MRS OnDemand makes viewing important materials science content free and easy to our Society members and the materials community at large. **It's Your MRS, Your Way!**

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GAIN RECOGNITION

MRS AWARDS

The Von Hippel Award is the Materials Research Society's highest honor and recognizes those qualities most prized by materials scientists and engineers—brilliance and originality of intellect, combined with a vision that transcends the boundaries of conventional scientific disciplines. **Nominations are due April 1 of each year.**

The MRS Fellow honors members who are notable for their sustained and distinguished contributions to the advancement of materials research worldwide. This designation is highly selective. The maximum number of Fellows that may be appointed in each year is limited to 0.2% of the current professional MRS Membership. **Nominations are due August 1 of each year.**

The David Turnbull Lectureship recognizes the career of a scientist who has made outstanding contributions to understanding materials phenomena and properties through research, writing and lecturing, as exemplified by the life work of David Turnbull. **Nominations are due April 1 of each year.**

The Innovation in Materials Characterization Award honors an outstanding advance in materials characterization that notably increases our knowledge of the structure, composition, *in situ* behavior under outside stimulus, electronic, mechanical, or chemical behavior, or other characterization feature, of materials. **Nominations are due August 1 of each year.**

The Mid-Career Researcher Award recognizes exceptional achievement in materials research made by mid-career professionals. This annual award is intended to honor an individual who is between the ages of 40 and 52 at the time of nomination and has demonstrated notable leadership in the materials field. **Nominations are due August 1 of each year.**

The Materials Theory Award recognizes exceptional advances made by materials theory to the fundamental understanding of the structure and behavior of materials. This award is intended to honor both those who have pioneered the development of a new theoretical approach and those who have used existing approaches to provide significant new insight into materials behavior. **Nominations are due April 1 of each year.**

The MRS Medal recognizes an exceptional recent achievement in materials research that is expected to have a major impact on the progress of any materials-related field. **Nominations are due April 1 of each year.**

The Outstanding Young Investigator Awards recognize outstanding interdisciplinary scientific work in materials research by young scientists or engineers. The award recipients must also show exceptional promise as developing leaders in the materials area. **Nominations are due August 1 of each year.**

The Kavli Foundation Early Career Lectureship in Materials Science recognizes an early-career scientist who has made a significant contribution to the science of materials through experimental and/or theoretical research. **Nominations are due April 1 of each year.**

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NEW MRS AWARD

MRS Nelson "Buck" Robinson Science and Technology Award for Renewable Energy recognizes a student, postdoc or other young professional for the development of novel sustainable solutions for the realization of renewable sources of energy. **The Inaugural award will be presented at the 2018 MRS Fall Meeting. Nominations are due April 1 of each year.**

The MRS Postdoctoral Awards recognize postdoctoral scholars who show exceptional promise that may include, for example, excellence in scientific research, leadership, advocacy, outreach, or teaching, during their postdoc assignment. These awards are presented at each Spring and Fall Meeting. **Nominations are due August 1 of each year.**

MRS Graduate Student Awards honor and encourage graduate students whose academic achievements and current materials research display a high order of excellence and distinction. Finalists compete for Gold and Silver Awards at the MRS Spring and Fall Meetings. **Applications are due approximately five months preceding each MRS Meeting.**

The Arthur Nowick Graduate Student Award, which honors the late Dr. Arthur Nowick and his lifelong commitment to teaching and mentoring students in materials science, recognizes a Graduate Student Award finalist who shows particular promise as a future teacher and mentor. **This award is presented at each Spring and Fall Meeting.**

The MRS Impact Award honors outstanding individuals who have displayed excellence in areas of science communication, education, advancing diversity, mentoring, or community engagement, which reflect the Society's pursuit to advance materials science and technology to improve the quality of life. **Nominations are due August 1 of each year.**

The MRS Woody White Service Award honors outstanding individuals who have embodied MRS's mission, vision and values for an egalitarian interdisciplinary community advancing materials science and technology to improve the quality of life. It may be given in recognition of long-term, impactful service to the Society, as well as for special projects/programs that significantly impacted the Society. **Nominations are due August 1 of each year.**

MRS CONGRESSIONAL SCIENCE & ENGINEERING FELLOWSHIPS

The United States Congress is one of the primary policy drivers affecting the progress of science, technology and society. MRS Congressional Science and Engineering Fellows leverage their scientific and technical experience to shape and inform policy made in the Legislative Branch. **Now's your chance to make a difference!**

The Materials Research Society sponsors two materials scientists to engage in the federal policymaking process, while learning firsthand about the intersection of science and policy.

During your one year as a Fellow you will:

- be fully immersed in congressional policymaking through placement in a specific congressional office
- contribute widely to the effective use of materials science knowledge in government
- broaden awareness about the value of scientist- and engineer-government interaction among society members and within government
- network with more than 300 other participants of science and technology fellowship programs

Information and application deadlines may be found online.

www.mrs.org/congressional-fellows

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BECOME A VITAL PART

MATERIALS RESEARCH SOCIETY FOUNDATION

The Materials Research Society Foundation was created in 2012 to enhance and expand support for projects that are timely and meaningful to the materials community.

In just over five years, the Foundation has helped us to:

- enhance our **career and professional development portfolio** with essential tools for today's graduate students and young professionals
- provide **free or discounted MRS Memberships** for individuals working or studying in developing countries
- expand our **MRS University Chapters Program** globally, now with 117 Chapters in 17 countries
- honor outstanding contributions to the progress of materials research through **15 annual MRS Awards,** including the **newly endowed MRS Nelson "Buck" Robinson Science and Technology Award for Renewable Energy**
- establish the ***MRS Bulletin* Postdoctoral Publication Prize,** which recognizes postdoctoral researchers for their intellectual merit, the impact of their research and scholarship, and their interest in science writing and communication
- support a **Materials Research Video Competition (SciVid),** that uses short, high-impact videos to spur student and public interest in materials science and engineering
- introduce **students and teachers in underprivileged and underrepresented areas to the world** of materials science through hands-on activities, virtual lab tours, interactive instructional modules, and other mentoring opportunities
- and so much more!

But there is still a lot of work to do. With your help, we can fund even more exciting and innovative initiatives—from student chapter proposals, to local or regional education/outreach projects, to those with the potential to impact the materials enterprise worldwide.

To learn how you can help make a difference, we invite you to explore the Foundation website.

www.mrs.org/foundation

University Chapters

University Chapters are a vital part of MRS, facilitating discussion between students and faculty and promoting student interest in materials science. As a student member, the international University Chapters Program provides the opportunity to network among over **117 active Chapters from around the world,** compare notes on recent activities and brainstorm with other students on new projects and issues of common concern.

www.mrs.org/university-chapters

FOCUS ON Sustainability

Putting a materials spotlight on sustainability

Focus on Sustainability is an MRS initiative designed to raise awareness of the nexus between materials research and sustainable materials practice.

Meeting the challenges of sustainable development requires an integrated approach that places materials science in the context of societal, environmental and economic drivers. In recognition of this need, **MRS has increased its emphasis on sustainability to help members discover the valued role of sustainable materials practices to a sustainable world,** and to develop members' technical expertise and understanding of the complex interrelationships between materials science and other disciplines.

Help build an MRS community of shared practice on all things sustainable, including research, funding, education, public outreach, corporate social responsibility, and MRS Meeting activities and publications.

www.mrs.org/sustainability

IMPACT of Materials on Society

MRS is partnering with faculty from engineering, liberal arts and science and education departments at the University of Florida to develop an introductory-level materials science course suitable for undergraduate and community college students. **This project produced a collaborative, project-based and interdisciplinary undergraduate course that connects the humanities with science.** Due to the success of the IMOS course, an Impact of Chemistry on Society course is in development and will bring chemistry, materials science and engineering studies into dialogue with the humanities.

www.mrs.org/imos-course

Strange MATTER

Now in its 15th year of touring, Strange Matter is a traveling interactive exhibition where users enter the **fascinating, practical, occasionally bizarre and often beautiful world of materials science** through over a dozen hands-on experiences. Targeting 4th–8th grade students and families, two sizes of the exhibition are currently touring international science centers. The large version just completed a four-month visit at the National Science Museum in Pathum Thani, Thailand, visited by 107,000 attendees, and at a local science fair in Pathum Thani attended by over 1.1 million visitors. Total museum attendance since its inception has reached over 5.5 million.

MRS Members have opportunities to contribute and/or volunteer their services in each of the museum's local communities. For more information, contact Richard Souza at souza@mrs.org. An interactive website (www.strangematterexhibit.com) and a teacher curriculum/activity guide also accompany the exhibit.

The exhibition and its tour are made possible by the National Science Foundation, Dow, Ford Motor Company Fund, Intel Innovation in Education, Rio Tinto Alcan and 3M.

www.mrs.org/strange-matter

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Public Advocacy

MRS strives to contribute to the development of science and technology policy by responding to, and initiating, opportunities to interact nationally and internationally with government officials as well as public and private organizations. Led by the Government Affairs Committee (GAC), these efforts have been far-reaching, consistent and unbiased, building trust and respect in Washington, DC, both on Capitol Hill and within government agencies. **Ultimately, however, the key constituency is you—the MRS Member—and GAC is working hard to make your voice heard!**

For 2018, MRS will continue to build on its accomplishments—strengthening relationships and building new ones through Congressional visits, establishing itself as a scientific resource for policymakers, extending its relationships with leadership in federal agencies, and collaborating in the U.S. and abroad with sister societies and other advocacy organizations when a larger voice for science is required.

www.mrs.org/advocacy

Society Member Volunteers

The tremendous growth and success of our Society is the result of member input and the energetic efforts of many MRS Member volunteers. **The MRS committees and task forces offer members an invaluable opportunity to participate in, and influence profoundly, the operation of the Society.** If you have an interest in working on any aspect of MRS activity, contact volunteer@mrs.org.

www.mrs.org/get-involved

Broadening Participation in Materials Science

Supporting the MRS core value of "being broadly inclusive and egalitarian," MRS is committed to identifying strategies to promote diversity and inclusion within the broad professional community and to share ideas and approaches that help support and encourage people who are currently underrepresented in materials science and engineering.

Under the leadership of the Broadening Participation in Materials Subcommittee, programming that extends the influence of scientific research to the quality of life and society at large is developed for MRS Spring and Fall Meetings. **Broader Impact programming augments topical symposium programming and vendor exhibits by providing attendees with a complete Meeting experience that captures all aspects of the materials research profession.** MRS Meetings offer a robust slate of Broader Impact events including:

- Women in Materials Science & Engineering Breakfast
- Green Cards for Scientific Researchers
- Undergraduate Student Mentoring Program
- International Summit of the MRS University Chapters on "Sustainability and Nanotechnology"
- Bringing Modeling and Simulation into My Classroom

Visit **www.mrs.org/broadening-participation-in-materials** to learn more about the variety of the Society initiatives and activities designed to promote diversity and inclusion

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NEW—FREE electronic membership available for qualified students and professionals in developing countries. Visit www.mrs.org/dev-countries-member to learn if you are eligible and how to apply.

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Donations to the **Materials Research Society Foundation** support the MRS Mission, encouraging scientific study and innovation—and allow MRS to enhance and extend its awards, honors, education and outreach programs, as well as fund new member-driven grassroots projects.

I am pleased to support the Materials Research Society Foundation.

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☐ University Chapter Special Projects
☐ Graduate Student Awards

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The Materials Research Society Foundation operates as a program of the Materials Research Society. The official registration and financial information of the Materials Research Society Foundation may be obtained from the Pennsylvania Department of State by calling toll-free, within Pennsylvania, 1.800.732.0999. Registration does not imply endorsement.

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Signature Date

Member Demographics (optional)

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☐ Retired
☐ Unemployed

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☐ Master's degree /equivalent
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☐ Other _____

Year of Highest University Degree Earned
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Expected Graduation Date

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☐ Postdoc
☐ Scientist/Engineer
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☐ Department Chair
☐ Executive/Management
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☐ Press
☐ Retired
☐ Other _____

Gender
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Race/Ethnic Origin
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☐ Black or African Descent
☐ Hispanic
☐ Native American or Alaskan
☐ Native Hawaiian or Pacific Islander
☐ White (Caucasian)
☐ Other _____

International Members Only
Do you belong to a group (ethnic, gender, or other) that is considered underrepresented in the fields of Materials Science and Engineering (including Physics, Chemistry, Engineering) in your country?

☐ Yes ☐ No

If yes, please specify your underrepresented group

☐ I am interested in volunteer opportunities with MRS

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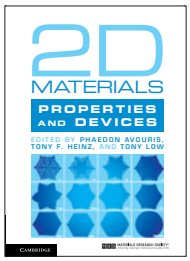

2D Materials—Properties and Devices

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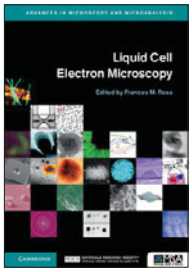

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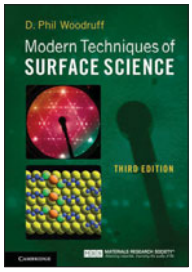

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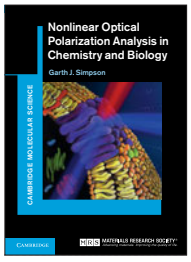

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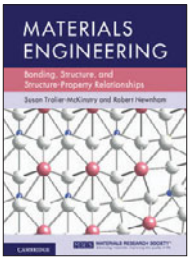

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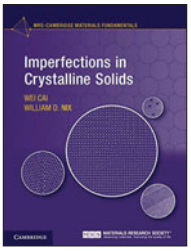

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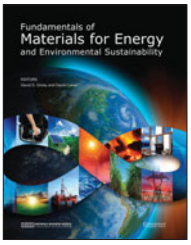

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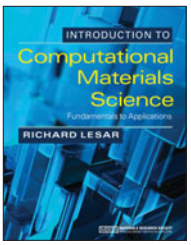

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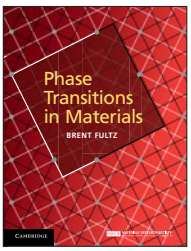

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https://doi.org/10.1557/mrs.2018.23 Published online by Cambridge University Press