



Rensselaer

2018 MATERIALS SCIENCE AND ENGINEERING

Polymer Microgel Particles by Apostolos Karanastasis



David Duquette

Professor and
Department Head,
Department of
Materials Science and
Engineering (MSE)

WELCOME

IT IS MY GREAT PLEASURE TO PRESENT OUR NEWSLETTER AS ACTING DEPARTMENT HEAD THIS YEAR. SOME TEN YEARS AGO, I STEPPED ASIDE AS DEPARTMENT HEAD, PASSING THE BATON TO ROBERT HULL, WHO SERVED FOR SEVEN YEARS UNTIL HE BECAME DIRECTOR OF THE CENTER FOR MATERIALS, DEVICES, AND INTEGRATED SYSTEMS (CMDIS) AND WAS THEN REPLACED BY PAWEŁ KEBLINSKI.

Paweł is spending the 2018 calendar year on sabbatical in Poland, where he was awarded a prestigious Marie Skłodowska-Curie Fellowship by the Polish National Science Centre in conjunction with European Commission action. He will return to service as Head in January 2019. In the meantime, I have re-donned the harness during Paweł's absence.

04 J. Shi Awarded AFOSR YIP Award

06 Undergrad Spotlight

07 Dr. Siegel Elected to NAI

10 Research Focus

11 Founders Award

WELCOME [CONT.]

These are exciting times for the Department, the School of Engineering (SoE) and RPI. President Jackson has launched a major capital campaign to expand the academic assets of the Institute. Perhaps the most important aspect of the campaign is a thrust to increase the numbers of tenure track faculty. The successful completion of the campaign will see an increase in the SoE faculty from its current ranks of 140 to 200. While final plans for the MSE department are still being formulated, it is anticipated that at least two or three new faculty will be added over the next few years. As part of the campaign, IBM has already committed to support as many as 25 new faculty positions in the artificial intelligence area and the MSE department has targeted at least two of those positions. Exciting indeed!

Still another change in the academic experience at RPI is the introduction of the Arch at Rensselaer program. This is an innovative change in the academic experience for all students at the Institute that will have a profound and beneficial impact on our program. Students in the Arch will remain on campus during the summer between their sophomore and junior years. They will then choose to be on campus either during the fall term or the spring term, remaining off campus in the alternate term. During this off-campus term, the students will participate in some intellectual activity such as an internship at a company, a research experience, a volunteer experience, a study abroad, etc. The concept is being introduced so that our

students will have much more than just a classroom experience during their tenure at the Institute.

In this newsletter, you will find many exciting stories about our students, faculty and staff. You will learn about Anahit, who won the Founder's Award of Excellence, Yiping, who won the MRS Silver Medal, and Prof. Jian Shi, who won the Air Force Young Investigator Award. Our established faculty members continue to reach new heights as well; Prof. Ramanath was elected as a fellow of the MRS and Prof. Dick Seigel was elected to the National Academy of Inventors.

The life of a department is never static, and we have had some changes in faculty responsibilities. Robert Hull has been appointed Senior Associate Vice President for Research as well as continuing to act as Director of the cMDIS. Professor Liping Huang has accepted a position as Associate Dean for Research in the School of Engineering and will share her time between the School and the Department. Finally, with considerable regret, I must announce that Linda Schadler has accepted a position as the Dean of Engineering and the Mathematical Sciences at the University of Vermont. Professor Schadler has been a pillar and a major force in the Department since her arrival at the Institute and she will be sorely missed. We wish her all the best in her new position.

*David Duquette, Professor and Department Head,
Department of Materials Science and Engineering*



On the Cover. Polymer microgel particles by Apostolos Karanastasis (postdoc, Ullal group). See page 13 for a brief description of this work.

DOCTORATES AWARDED IN 2018 | CONGRATULATIONS AND BEST OF LUCK!



Congratulations to our newest Ph.D. recipients. L-R: Marisa Giovino, Ainsley Pinkowitz, David Duquette (Department Head), Siddharth Sundararaman, We Peng, Binghui Deng, Siva Priya Jaccani, Yongjian Yang.

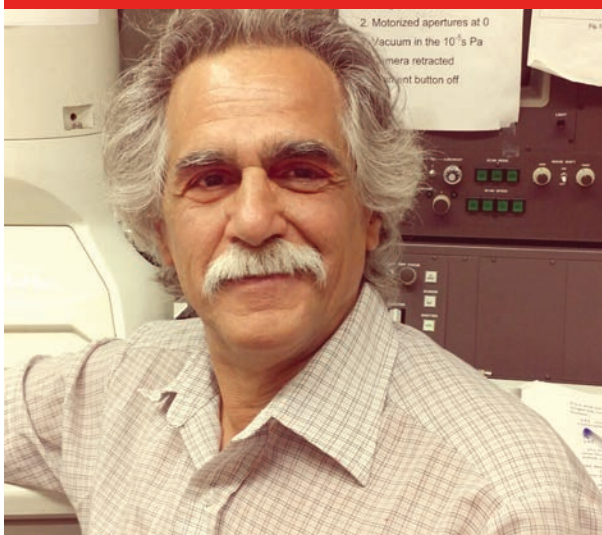
GRADUATING CLASS OF 2018 | CONGRATULATIONS AND BEST OF LUCK!



We are enormously proud of our freshly-minted graduates, who are bound for post-graduate studies (MIT, Cornell, Carnegie Mellon and RPI), industry (IBM, Northrop Grumman, Micron Technology, Global Foundries, Precision Castparts Corp., Lucideon) and government positions (Naval Surface Warfare Center).

Awards. Matthew Fields (Matthew Albert Hunter Prize), Heritage Weems (Scott Mackay Prize), Patrick Aselin (Materials Design Award), Eric Leith (Istvan S. Moritz Award, given to a cotermin student for academic excellence and service contribution), Krista Biggs (Doreen Ball-DiFazio Award, given to a female senior for academic excellence and outstanding service).

STAFF SPOTLIGHT RAYMOND P. DOVE



Ray Dove is the facility manager for our electron microscopy laboratory and the MRC building coordinator. Ray has been a cherished member of the materials science community at RPI since 1987, following industry positions at Georgia Pacific, Valtec Inc., and Norton Co. Ray got his undergraduate degree in Forest Biology at the SUNY College of Environmental Science and Forestry (Syracuse, NY) in 1977. Here at RPI, Ray maintains the electron microscopy labs and trains new graduate students on the SEMs and TEMs. In the early 1990s he worked with Prof. Linda Schadler to develop a centralized

Raman lab for polymer research, and in 2015 worked with Prof. Robert Hull on the purchase and installation of our newest SEM, the FEI VERSA 3D which has three vacuum levels including Environmental Mode and is a Dual Beam FEG/FIB. So, why is he here? In his words: "Science is great, discovery is great, but, getting to work with students on a daily basis, helping them educate themselves towards their respective goals, helping them and being a part of their growth as human beings is the best reward I can think of."

ASSISTANT PROFESSOR JIAN SHI IS AWARDED A 2018 AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) YOUNG INVESTIGATOR AWARD!

Professor Jian Shi received the Air Force Office of Scientific Research (AFOSR) Young Investigator Research Program (YIP) award. The AFOSR YIP award is one of the

most competitive awards for young assistant professors and researchers in the US. This year among all AFOSR technical areas, 43 scientists and engineers across all US research institutes and small businesses

have received the YIP awards. The YIP award of a total of \$450,000 for three years will support studies on “Nanoscale Pyroelectric Hybrid Materials Undergoing Structural Phase Transition” and pursue fundamental research on nanoscale

complex materials involving electronic symmetry breaking and hybrid domain physics.

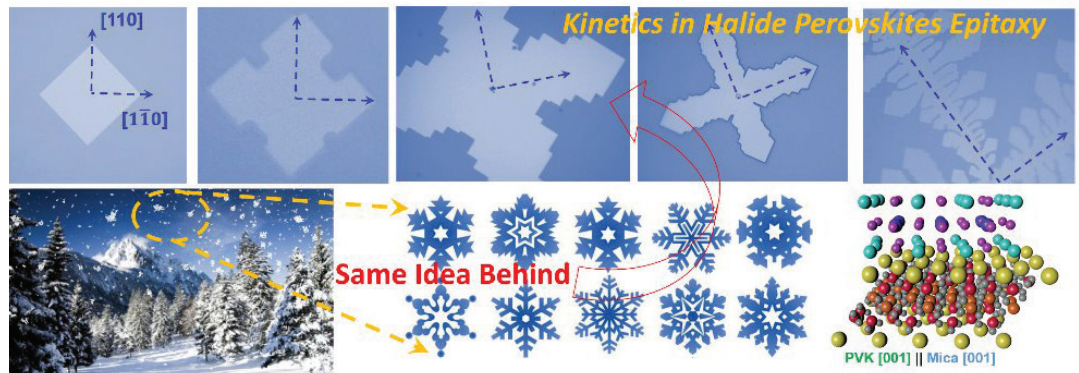
Dr. Shi is an Assistant Professor in the Department of Materials Science and Engineering. Prior to this appointment, he was a postdoctoral research fellow at Harvard University from 2013 to 2014. He received his Ph.D. degree in Materials Science at the University of Wisconsin at Madison in 2012, his M.S. degree in Mechanical Engineering at the University of Missouri at Columbia in 2008 and his B.S. degree in Materials Science and Engineering at Xi'an Jiaotong University in 2006.

Carrying a quite broad research interest in materials science, the Shi group focuses on: fundamental

understanding on atomic scale symmetry science and engineering of low-dimensional electronic and optical materials and their structure-property relationships; adaptive electronics and optics; materials engineering for energy transformation. In addition to this AFOSR YIP award, Dr. Shi has also received three NSF awards and one IBM contract all with him as the PI supporting exciting research and education activities. Within three years after he joined RPI MSE, Dr. Shi's group has published more than 30 journal articles in such top journals as Nature, Science, Advanced Materials, Nano Letters, and ACS Nano. For more info, see his webpage: <http://homepages.rpi.edu/~shij4/publications.html>



Jian Shi





Ravishankar
sundararaman

ASSISTANT PROFESSOR RAVISHANKAR SUNDARARAMAN MAKES HIS MARK WITH RESEARCH EXCELLENCE

Professor Ravishankar Sundararaman, (“Shankar” for short) joined the MSE faculty ranks here at RPI in 2016. In the short time since his hire, Shankar has been a highly prolific and impactful researcher, having co-authored 22 peer-reviewed publications in top-tier journals, including Nature Communications, Physical Review Letters, Angewandte Chemie Int. Ed., ACS Photonics, and the Journal of Chemical Physics.

One of Shankar’s many recent papers, in collaboration

with the Archer group at Cornell, was selected as an Angewandte Chemie HOT Paper! The co-authors investigated hybrid lithium-indium anodes for lithium-ion batteries. They show that coating lithium anodes with indium provides high chemical stability and results in increased battery durability (charge-discharge cycles). Using joint density-functional theory calculations of diffusion barriers, they show that Li ions can diffuse extremely quickly on Indium surfaces compared to other metals, and that the diffusion

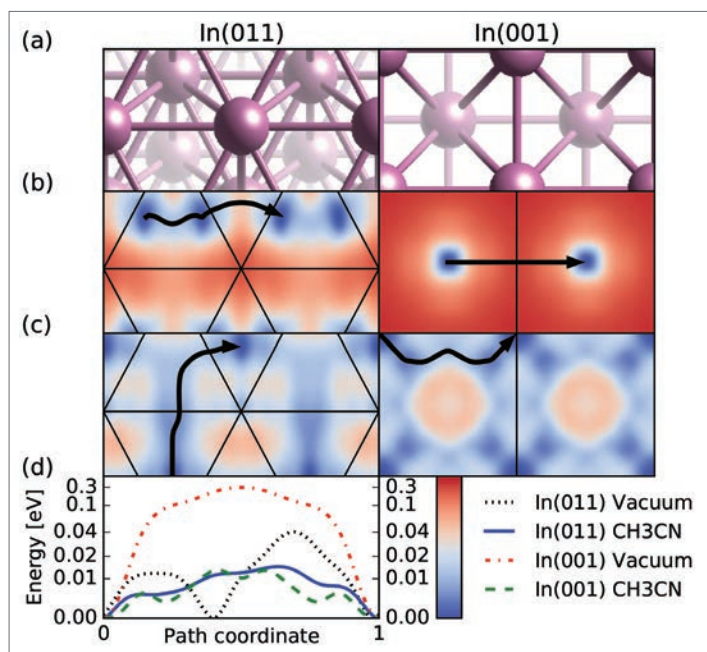
is substantially faster at an indium-electrolyte interface compared to an indium surface in air/vacuum. This fast diffusion could mitigate dendrite formation in the battery, contributing to the increased durability.

Another paper (J. Chem. Phys. 2017, 146, 114104) was selected for the 2017 JCP Editor’s Choice collection. In this work, they developed new algorithms to perform electronic structure calculations using DFT in the grand

canonical ensemble, where the number of electrons in

the quantum calculation automatically adjusts to attain a given electron chemical potential. This makes realistic treatment of electrochemical systems now possible in DFT, where describing changes in charge is critical for correctly predicting structures and reaction mechanisms. As an example, they apply this method to the underpotential deposition of copper on platinum, and resolve an old electrochemical mystery about the identity of a second voltammetric peak that appears in the presence of chloride ions.

Biographical. After growing up in Mumbai, Shankar moved to upstate NY to experience the great outdoors. He got his Ph.D. in Physics from Cornell in 2013 with Prof. Tomas Arias and then moved on to a postdoctoral position at CalTech with Professors Harry Atwater and William Goddard III. Outside of work, Shankar is an avid cyclist and hiker with the goal of becoming an Adirondack 46er (someone who has climbed to the summit of all 46 Adirondack “high peaks” in the region). He also dabbles in baking and piano.



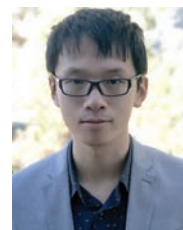
“Electroless Formation of Hybrid Lithium Anodes for Fast Interfacial Ion Transport”, Angewandte Chemie 2017, DOI: 10.1002/anie.201707754

YIPING WANG RECEIVES GRAD STUDENT AWARD

In 2017, Yiping Wang received the MRS Graduate Student Silver Award, which is to recognize and honor “graduate students whose academic achievements and current materials research display a high level of

excellence and distinction.” Also in 2017 he received the IEEE Nanotechnology Symposium Best Poster People’s Choice Award and he is a recipient of prestigious RPI Presidential Fellowship. Supervised by Prof. Jian Shi,

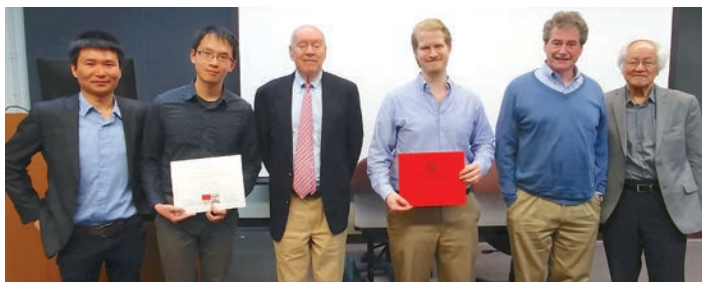
Yiping’s research is focused on epitaxy and elastic strain engineering of emerging functional materials and phases. Yiping has joined Micron Tech Ltd as a process engineer, starting in August 2018.



2018 NORMON S. STOLOFF RESEARCH EXCELLENCE AWARD

MSE graduate students Dustin Andersen (advisor: Prof. Robert Hull) and Yiping Wang (advisor: Prof. Jian Shi), are the winners of the 2018 Norman S. Stoloff Research Excellence Award. The award is given annually to two MSE graduate students in recognition of outstanding research accomplishments, as evidenced by a submitted or published journal article in the past twelve months. Each recipient receives a \$500 cash prize and a certificate of the achievement.

The winners each gave a talk as part of the department spring seminar series, followed by the presentation of the awards by the committee. Dustin presented a talk on “Distributions of Kinetic Pathways in Strain Relaxation of Heteroepitaxial Films”. Yiping presented a talk on “Understanding and Exploring the Hidden Photo Physics and Carrier Dynamics in Epitaxial Halide Perovskite Nanostructure and Thin Film.”



From the left: J. Shi, Y. Wang, D. Duquette, D. Andersen, R. Hull, M. Tomozawa

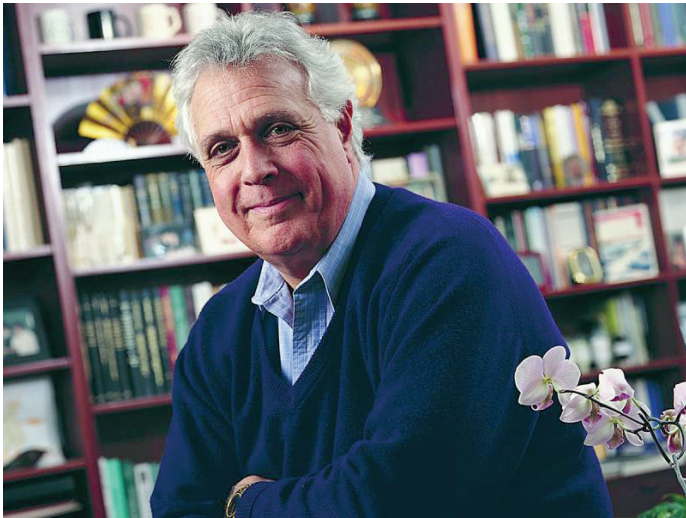


Krista Biggs is a graduating senior in MSE. Her many outstanding achievements at RPI have been recognized by the Founders Award of Excellence and election to the Alpha Sigma Mu and Tau Beta Pi professional societies. She did undergraduate research on metallographic preparation of dilute Zn-Sn and Ti-6Al-4V alloys with

Prof. Dan Lewis, and an internship at Lucideon M+P. This Fall, she will embark on her graduate school journey at MIT.

Krista enjoys yoga, exercise, exploration of new fields (especially food science!), and occasionally crafting. She rowed for eight semesters with Rensselaer Crew Club.

Dr. Richard W. Siegel Elected to the National Academy of Inventors



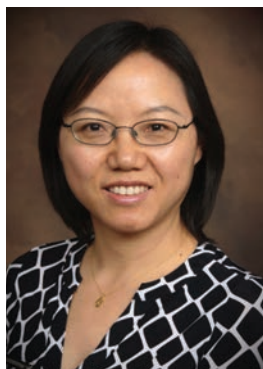
Dr. Richard W. Siegel, Robert W. Hunt Professor of Materials Science and Engineering at Rensselaer Polytechnic Institute, was elected to

the National Academy of Inventors.

Election to NAI fellow status is the highest professional distinction accorded solely to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society. Active in materials research for over 50 years, Siegel has studied the properties of defects in metals, atomic diffusion, and the synthesis, processing, characterization, properties, and applications of nanostructured ceramics, metals, composites, and biomaterials. His research

activities have garnered over \$60 million in funding from government, industry, and private sponsors, and his work is highly cited with about 14,000 citations to date. He has authored or co-authored more than 300 articles and 21 U.S. patents, edited 10 books, presented more than 500 invited lectures around the world. The past chair of the World Technology Evaluation Center worldwide study of nanostructure science and technology that led to the U.S. National Nanotechnology Initiative, Siegel also served on the Nanotechnology Technical Advisory Group of the U.S. President's Council of Advisors on Science and Technology (PCAST).

FACULTY ANNOUNCEMENT



Prof. Liping Huang was appointed Associate Dean for Research and Graduate Programs in the School of Engineering, in February 2018.

Liping comes into this important position with excellent research accomplishments in the areas of Advanced Materials and Computational Science and Engineering, a wealth of experience as the Graduate Program Director in Materials Science and Engineering.



Prof. Robert Hull was appointed Senior Associate Vice President for Research, in the Division of Research at Rensselaer Polytechnic Institute, effective February 1, 2018.

Dr. Hull also currently serves as the inaugural director of the Rensselaer Center for Materials, Devices, and Integrated Systems (cMDIS), where he leads basic and applied research initiatives across the broad spectrum of fields in engineering and the physical sciences.

Ramanath Named Fellow of Materials Research Society (MRS)



Nanomaterials expert Ganpati Ramanath, the John Tod Horton '52 Professor of MSE at RPI, has been named a fellow of the Materials Research Society (MRS) “for developing creative approaches to realize new nanomaterials via chemically directed nanostructure synthesis and assembly and for tailoring interfaces in electronics and energy applications using molecular nanolayers.”

Known throughout the global materials science and

engineering community as a research leader, inventor, and innovator, Ramanath focuses his research on developing a fundamental understanding of structure-processing-property relationships in nanomaterials and interfaces for emergent applications in energy and electronics. His discoveries include a new class of thermoelectric nanomaterials built from assemblies of sculpted nanostructures for high-efficiency solid-state refrigeration and electricity harvesting from waste heat, along with nanomolecular layers of “nanoglue” that can

join non-sticking materials, inhibit chemical intermixing, and boost thermal and electrical transport. A prolific researcher, Ramanath has published more than 170 articles in top journals including Nature, Science, Nature Materials, and Advanced Materials, and one book chapter, and he holds nine U.S. patents. His works have been cited more than 8,300 times.

FACULTY ANNOUNCEMENT



DANIEL GALL HAS BEEN NAMED A FELLOW OF THE AMERICAN VACUUM SOCIETY (AVS)

The Fellowship recognizes AVS members who have made sustained and outstanding scientific and technical contributions in areas of interest to AVS. The award will be presented at the AVS Awards Ceremony during the Symposium in Long Beach, California on October 24, 2018.



ED PALERMO HAS BEEN SELECTED AS A 2018 ACS PMSE YOUNG INVESTIGATOR

This distinction is meant to honor young researchers who have made significant contributions to their respective fields within Polymer Science and Engineering. Ed presented his work in the PMSE Young Investigator Symposium at the 256th ACS National Meeting in Boston.

SELF-HEATING-INDUCED HEALING OF LITHIUM DENDRITES

Rensselaer Professors Nikhil Koratkar, Yunfeng Shi, Jian Shi and their co-workers have teamed up to tackle one of the most intractable problems in the development of lithium metal battery technology: the dreaded dendrite formation phenomenon.



Nikhil Koratkar

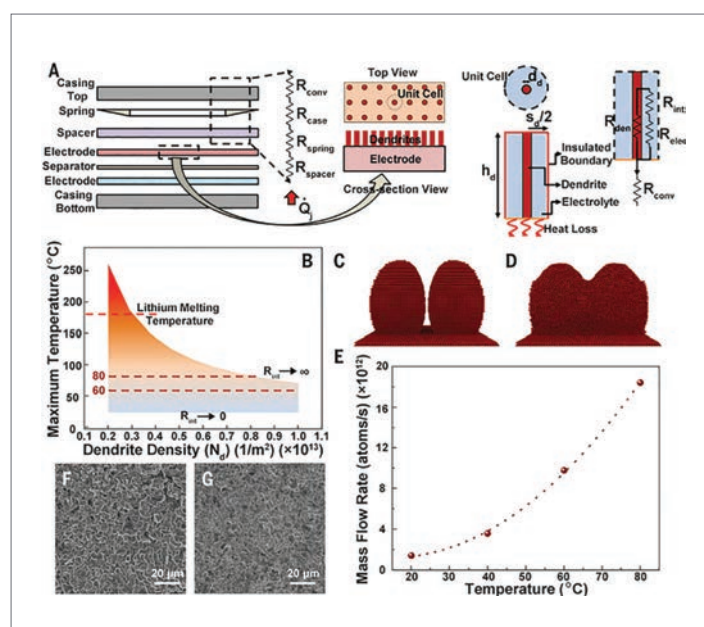


Yunfeng Shi



Jian Shi

The formation of lithium dendrites during charge-discharge cycles limits the development of lithium metal batteries, because the dendrites can cause electrical shorting of the cells. The RPI team operated their cells at higher current densities, under which one would expect dendrites to form owing to the higher nucleation rates. However, under these conditions, the dendrites that started to form heated up and annealed, leading to their disappearance. When the plating and stripping current density is raised above ~ 9 mAmp/cm², there is substantial self-heating of the dendrites, which triggers extensive surface migration of Li. This surface diffusion heals the dendrites and smoothen the Li metal surface. The authors showed that repeated doses of high-current-density healing treatment enables the safe cycling of Li-sulfur batteries with high coulombic efficiency. The results showcase a



Science 2018, 359 (6383), 1513-1516

promising path toward the effective deployment of Li metal electrodes in rechargeable batteries. Their groundbreaking discovery was recently published in Science.

This work was supported by several grants from the National Science Foundation, and the John A. Clark and

Edward T. Crossan endowed Chair Professorship at the Rensselaer Polytechnic Institute.

TUNGSTEN OFFERS NANO-INTERCONNECTS A PATH OF LEAST RESISTANCE

Professor Daniel Gall's research on tungsten-based nanoscale interconnects was featured by the American Institute of Physics (AIP).



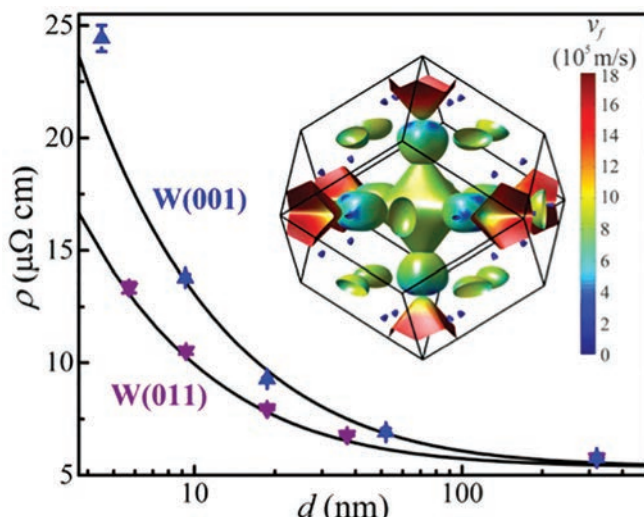
Daniel Gall



Pengyuan Zheng

As microchips become ever smaller and therefore faster, the shrinking size of their copper interconnects leads to increased electrical resistivity at the nanoscale. Finding a solution to this impending technical bottleneck is a major problem for the semiconductor industry. One promising possibility involves reducing the resistivity size effect by altering the crystalline orientation of interconnect materials. Prof. Daniel Gall conducted electron transport measurements in epitaxial single-crystal layers of tungsten (W) as one such potential interconnect solution. Gall and his student Pengyuan Zheng performed first-principles simulations, finding a definite orientation-dependent effect. The anisotropic resistivity effect they found was most marked between layers with two particular orientations of the lattice structure, namely W(001) and W(110). The work is published in the Journal of Applied Physics.

Pengyuan noted that both the 2013 and 2015 International Technology Roadmap for Semiconductors (ITRS) called for new materials to replace copper as interconnect material to limit resistance



Journal of Applied Physics 122, 135301 (2017)

increase at reduced scale and minimize both power consumption and signal delay. Zheng and Gall chose tungsten because of its asymmetric Fermi surface. This made it a good candidate to demonstrate the anisotropic resistivity effect at the small scales of interest. "The bulk material is completely isotropic, so the resistivity is the same in all directions," Gall said. "But if we have thin films, then the resistivity varies considerably."

To test the most promising orientations, the researchers grew epitaxial W(001) and W(110) films on

substrates and conducted resistivity measurements at 77 K and room temperature. "We had roughly a factor of 2 difference in the resistivity between the 001 oriented tungsten and 110 oriented tungsten," Gall said, but they found considerably smaller resistivity in the W(011) layers.

Although the measured anisotropic resistance effect was in good agreement with what they expected from calculations, the effective mean free path in the thin film experiments was much larger than the theoretical value for bulk tungsten.

FOUNDERS AWARD OF EXCELLENCE



Anahit Hovhannisyan, MSE Class of 2019, has received the Founders Award of Excellence and was honored at Rensselaer's 24th Annual Honors Convocation October 28, 2017. The Founders Award was established in 1994 and is given to only 1% of the students who embody qualities of creativity, discovery, leadership, and the values of pride and responsibility at Rensselaer.

Anahit is currently doing research in Prof. Liping Huang's group. For her research work on the development of structurally heterogeneous glass, she was

awarded the 2017 RPI DMSE Undergraduate Research Fellowship. During her sophomore year, she received the Corning Undergraduate Scholar Award (\$3000), which is funding her work in glass science.

She was the president for the RPI Material Advantage Student Chapter. She is also an associate features editor for The Polytechnic magazine, and part of the Professional Leadership Program (PLP) on campus.

ASM INTERNATIONAL FELLOWSHIPS



The local branch of ASM International has awarded two RPI Materials students with scholarships of \$1000. Dr. Ainsley Pinkowitz (B.S. '13, Ph.D. '18) won the graduate student award, and Krista Biggs (B.S. '18) won the undergrad prize. Congratulations to our two fantastic students!

The award is available to any currently enrolled student at any of the local colleges and universities who holds active membership in the national Material Advantage organization.

MATERIALS FACULTY HONORED BY RPI SCHOOL OF ENGINEERING EXCELLENCE IN RESEARCH AWARDS

ASSISTANT PROFESSOR JIAN SHI RECEIVED THE JUNIOR RESEARCH EXCELLENCE AWARD

Assistant Professor Jian Shi received the junior Research Excellence Award for significant contributions to the field of materials science with special

emphasis on transforming the fundamental understanding of soft semiconductors and establishing the research field of strain engineering of soft crystals.



PROFESSOR DANIEL GALL RECEIVED THE SENIOR SCHOOL OF ENGINEERING RESEARCH EXCELLENCE AWARD

Professor Daniel Gall received the senior School of Engineering Research Excellence Award for outstanding contributions in the field of electron transport in nanoscale metal

conductors, with a large impact on the semiconductor industry. Gall is pictured (center) with SoE Dean Shekhar Garde (left) and Associate Dean Liping Huang (right).



Siva is a 2018 PhD graduate of MSE at RPI. She joined our department in Fall 2013, after completing her BS in Metallurgical and Materials Engineering from IIT Madras. Her thesis, advised by Prof.

Liping Huang, improves the current understanding on the link between the structure, elasticity, viscosity and cracking in glass-forming systems by using in-situ high-temperature and high-pressure Raman and Brillouin light scattering. Her work has been published in Phys. Rev. B and the Int. J. Appl. Glass Sci. She presented her work at the Glass and Optical Materials Division Annual Meetings and at the MS&T Conference. In 2017, she

won the Norman S. Stoloff Research Excellence Award and the Graduate Excellence in Materials Science (GEMS) Sapphire Award at the MS&T conference by the Basic Science Division of the American Ceramic Society in recognition of her scientific and academic accomplishments. She was inducted into the Alpha Sigma Mu International Professional Honor Society in 2015.



GRADUATE
SPOTLIGHT

SIVA PRIYA JACCANI

GRAD STUDENT NEWS



GENEVIEVE KANE ELECTED TO SWE BOARD OF DIRECTORS!

Founded in 1950, the Society of Women Engineers (SWE) is an international professional, educational and service society that aims to support women's entry and advancement

through engineering careers. Starting in July 2019, Kane will serve as the board's collegiate director for the following fiscal year, acting as the collegiate advocate for the 40,000+ member

organization worldwide, joined by a 12 member board of seasoned professionals.

Genevieve works on controlling microstructure evolution in metal alloys

under different temperature and strain states. Her favorite moment of the year was ringing the opening bell of the NASDAQ, signifying a dedication to gender diversity in the workplace.

RESEARCH MILESTONES

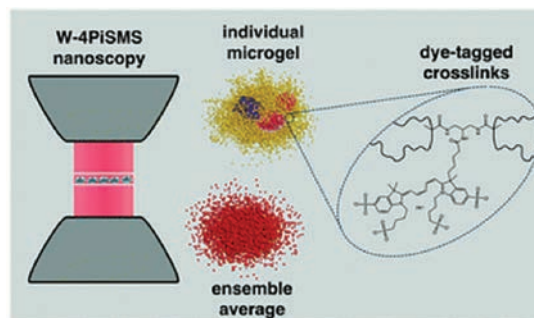
TINY PARTICLES, BIG IMPACT: MAPPING SPATIAL INHOMOGENEITY IN POLYMER MICROGELS WITH SUPER-RESOLUTION NANOSCOPY



Apostolis Karanastasis



Gopal Sankar Kenath



In most polymer networks and gels, the spatial distribution of crosslinks is not uniform on the nanoscale. Despite the technological importance of gels, understanding the real space distribution of crosslinks has been a long-standing and elusive challenge in materials science.

The Ullal group at RPI, in collaboration with researchers at Yale, recently cracked this cold case for

the first time! They precisely mapped out the nanoscale crosslink heterogeneities in colloidal gel particles, in 3D real space, using the most advanced super-resolution optical “nanoscopy” in the world. Their landmark achievement opens up the possibility of tying these crucial heterogeneities to their origin during the nucleation and growth process and establishing their impact on mechanical and transport properties.

Materials Horizons, 2018, Advance Article

Although scattering studies have provided valuable insights, the averaging inherent to scattering has obscured examining individual particles. Nascent demonstrations applying super-resolution microscopy to colloidal gels have pointed a way forward, but have not been privy to the morphologies that we can now study. Super-resolution imaging

of spatial heterogeneities in bulk hydrogels, which we also demonstrate, have not even been attempted. This work brings new physical insight to the materials science community regarding the incidence, nature and origin of fractal or self-similar materials. Congratulations to co-authors Apostolis Karanastasis (postdoc) and Gopal Sankar Kenath (MSE grad student)!

STUDENT ORGANIZATIONS



During the 2017-2018 academic year, Material Advantage continued to represent all that embodies materials science and engineering (MSE) at both RPI and around the Capital District. The RPI Material Advantage Executive Board has hosted a variety of events, touching on networking, community, and

outreach as areas of focus. The chapter has worked with industry speakers and professionals in the area for professional development events. In addition, social events for the community were hosted as means to relieve stress and connect with members of the MSE department as well as other departments at RPI. Outreach

volunteers were trained on new demonstrations, sent out to represent RPI and teach at local events in the community, reinforcing ties with schools in the area as well as working to form new ties and create new opportunity. Material Advantage has worked to ensure attendance and participation in the Materials Science and Technology conference in Pittsburg, PA. With participation in the ASM Geodesic Domes Design Competition (“Domes Day”), the Undergraduate Student Poster Contest, and the Undergraduate Student Speaking Contest, Material Advantage proudly supported RPI students. Material

Advantage proudly received the Chapter of Excellence Award among hundreds of candidates.

Materials Advantage is a student organization devoted to increasing awareness among members of the Rensselaer community of new developments in the area of materials science.

CURRICULUM NOTES

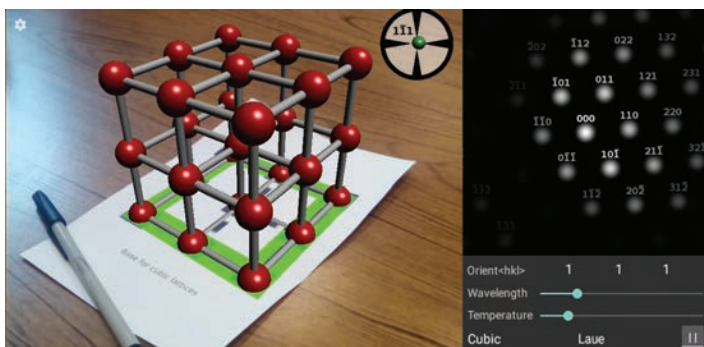
NEW COURSE UNVEILED: MATERIAL INFORMATICS AND DATA SCIENCE

“As a civilization, we are generating and accumulating data at a pace that far surpasses what we can meaningfully analyze. Over the years, materials scientists and engineers have amassed vast repositories of information relating to the connections between processing, structure, properties and performance of several classes of materials through careful experiments, theories and simulations. Can we now exploit this data to short-circuit the traditional pain-staking process, and directly predict properties or design new materials?” says Professor Ravishankar Sundararaman.

Starting with a brief introduction to the mathematical, statistical and computational frameworks underlying data science, this course will explore the most prevalent approaches in informatics including regression, clustering analysis, Bayesian inference and design of experiments using case studies in materials science.

TEACHING AND LEARNING COLLABORATORY: SEED FUNDING FOR AUGMENTED REALITY

Professors Lewis, Y. Shi, Ullal, and Sundararaman have secured seed funding from RPI to pursue a bold initiative that will bring Augmented Reality into the classroom for undergraduate students. “Immersive experiments in the engineering classroom using Augmented Reality applications” will bring virtual experimentation to the engineering classroom using Augmented Reality (AR) applications on students’ mobile devices.

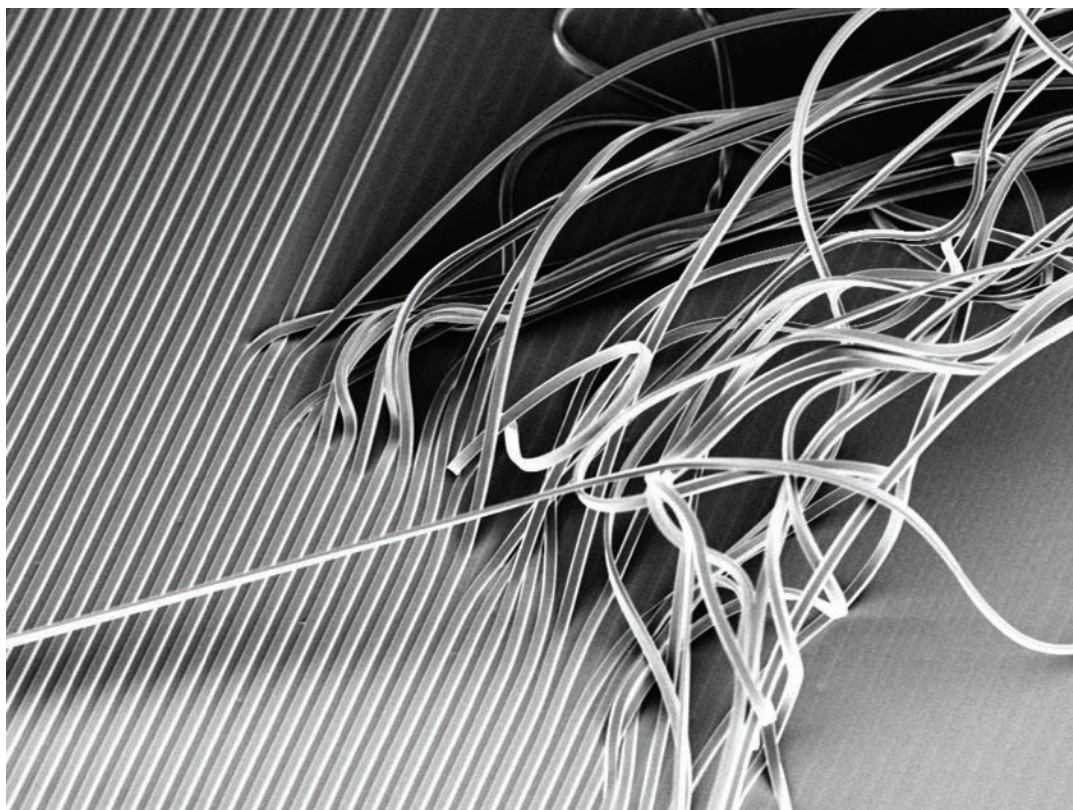


ART-IN-SCIENCE CONTEST WINNER

CHAOS FROM ORDER



Michael Deagen won the "Art-in-Science" contest at the cMDIS Fall 2017 Symposium; as a result of polymer lines that were too weakly adhered to a substrate.



Michael Deagen's submission, titled "Chaos from Order," is an SEM image of micro-scale polymer lines that delaminated from glass upon stamp removal.

Isn't it nice when a failed experiment at least gives you a pretty picture? MSE graduate student Michael Deagen (advised by Linda Schadler and Chaitanya Ullal) won the "Art-in-Science" contest at the cMDIS Fall 2017 Symposium; as a result of polymer lines that were too weakly adhered to a substrate. His submission, titled "Chaos from Order," is an SEM image of micro-scale polymer lines that delaminated from glass upon stamp removal. The award comes with a \$500 travel grant. Deagen

used the funds to NIST in Gaithersburg, MD, where he ran some experiments that were highly beneficial to his ongoing work.

Deagen is a 2015 awardee of the prestigious NSF Graduate Research Fellowship Program. His thesis focuses on wettability and adhesion of materials for low-cost, multi-layer nanofabrication using soft lithography. By studying roll-to-roll compatible coating and surface treatments, his work addresses the need for high-

throughput manufacturing of micro- and nanoscale structures that would otherwise be prohibitively expensive using conventional photolithographic techniques. As a student within Rensselaer's Center for Lighting Enabled Systems and Applications (LESA), Mike has created layer-by-layer mesoscale structures for refractive index engineering of next-generation optical diffusers.



Rensselaer

Materials Science and Engineering
Rensselaer Polytechnic Institute
110 8th Street
Troy, NY USA 12180

Non-Profit Org.
U.S. Postage

PAID
Rensselaer
Polytechnic Institute

mse.rpi.edu

We want to hear from you!

Please let us know what you are currently doing so we can include you in future newsletters. If you know of any MS&E alumni/ae who have not received this newsletter, please send us their names and addresses and we will add them to our mailing list.

Name: _____ Degree and Class _____

Address _____ City _____

State _____ Zip Code _____ Phone _____

Company _____ Position _____

How Long at Current Position _____ Area of Expertise _____

News: _____

Please mail form to: Meeli C. Leith, Department of Materials Science & Engineering,
Rensselaer Polytechnic Institute, MRC 103, 110 8th St., Troy, NY 12180-3590
FAX: 518-276-8554, E-mail: materials@Rensselaer.edu