

2024 MATERIALS SCIENCE AND ENGINEERING



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

Welcome

Greetings to our MSE alumni and friends,

Every year in early Fall I have the privilege and immense pleasure to share the highlights of our RPI Materials' achievements, activities and stories we experienced within last academic year. As is our tradition, we use this annual sharing to reflect the community spirit of materials endeavor at RPI.

Let me first share with you that Professor Minoru Tomozawa retired this past June – he discussed with me his retirement plans over the last decade but indicated that will do this once he has no research funds left – yet

04 Student Awards
& Honors

09 Undergraduate
Spotlights

11 Faculty Awards &
Grants

16 Professor Tomozawa
Retires

19 Alumni Spotlight

Welcome [cont.]

his proposals were continuously funded, so finally he decided to force his retirement by not writing new proposals. Quite remarkably, Prof. Tomozawa started at RPI at 1969 - the same year Neil Armstrong stepped on the moon! For over 60 years he tackled key problems of the glass science with a goal of revealing a number of century-old mysteries and making glass stronger. You can read more about the remarkable Prof. Tomozawa in this newsletter.

The 2024 edition of our newsletter also features Finley Donachie (24), who describes how RPI amplified his talents, and helped him secure a NSF Graduate Research Fellowship, which allowed him to pursue graduate study in area of his choosing at Caltech. Our Materials Advantage Chapter regained its strength after the Covid challenge and conducted numerous activities enriching community, professional, and leadership development of our undergraduate students. These and other stories project a deeply integrated community of students, faculty, staff, and alums at RPI Materials.

I am proud to report that our research endeavors are exhibiting significant growth, with our department research expenditure almost doubling in the last 2 years. The main driver of this development is our department's key role in the activities

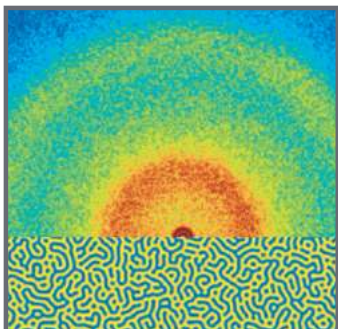
associated with the CHIPS and Science Act. Most significantly, Prof. Daniel Gall led numerous major new research programs in the area of interconnects for future semiconductor chips. In addition, several of our faculty secured CHIPS-related funding from IBM. Prof. Jian Shi, who once again established himself as the new star in the areas of ferroelectrics and spin transport, ventured to quantum materials and conducted a year-long research at the University of Chicago supported by the prestigious Simons Foundation's Pivot Fellowship. Prof. Wei Bao just started his second year at RPI, but already exhibits signs of greatness; his cutting-edge research in photonics led to a Nature Nanotechnology publication, and the Office of Naval Research awarding him with a Young Investigator Award as well as a DURIP equipment grant.

Please enjoy the stories we report to you and share any thoughts, ideas, and your own successes with us.

Thank you,

Pawel Koblinski
Professor and Department Head
Materials Science and Engineering Department
Rensselaer Polytechnic Institute

On the Cover: Associate Professor Edwin Fohtung was inspired to create this image from his work published in the high impact factor journal *Appl. Phys. Rev.* 11, 021302 (2024) and selected as the editor's choice.



In this work, he developed, for the first time, twisted coherent X-ray beams that can uniquely understand structure of chiral systems from DNA to magnetic domains, vortices and defects that mediate phase transitions.

Cover image: Developed for the first time, twisted coherent X-ray beams by Associate Professor Edwin Fohtung.

DID YOU KNOW?

NANOCOMPOSITE MATERIALS

Develop nanocomposite materials by combining nanoscale components such as carbon nanotubes and graphene with polymers.

Discover materials that offer enhanced properties such as electrical, optical, thermal, mechanical, and environmental characteristics.

COMMENCEMENT AWARDS 2024

Doreen Ball-DiFazio Award

– given to a female senior in Materials Science & Engineering with outstanding academic achievements and service to the community.



Winner
Emma Sponga

Istvan S Moritz Award

– given to a senior or co-terminal student in Materials Science & Engineering who has demonstrated a keen interest in materials field and shows further growth in their future career.



Winner
Connor Foreman

The Matthew Albert Hunter Prize in Metallurgical Engineering

– awarded annually to the senior in Materials Science & Engineering who has demonstrated outstanding ability in academic work leading to a career in that field.



Winner
Fin Donachie

Scott Mackay Award

– given to a senior in Materials Science & Engineering who has given time and effort to the service of others with-

out seeking recognition or acclaim, and who has completed the academic program at Rensselaer creditably.

Winner
Peter Crisileo

Duquette Capstone Award

– given to a senior student in Materials Science & Engineering based on their Materials Selection and/or Capstone performance.



Winner
Jack Coyle

Teaching Assistant Excellence Award

– given annually to a graduate student in Materials Science & Engineering who has exemplified the world-class pedagogical quality at Rensselaer through outstanding performance as a teaching assistant.

Winner
Julie Barringer

The Materials Science & Engineering Graduate Studies Award

– given to a graduating senior, who has exhibited outstanding academic performance and leadership abilities, and goes on to pursue graduate studies.



Winner
Krina Yaun

doctorate



Dr. Moishe
Azoff-Slifstein



Dr. Poyen Shen



Dr. Rajan Khadka

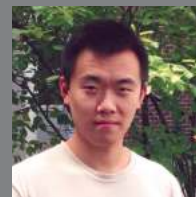


Congratulations to our newly minted PhD and Masters in Materials Science & Engineering

Congratulations and the best of luck!

We are so proud of our newest Materials Science & Engineering Masters and PhD graduates!

Someday you'll look back and think, Wow, I graduated at the most amazing time ever... Until then, we'll be here for you, cheering you on, looking forward to wherever life takes you next, and feeling so proud of you. Hard work, talent, drive and vision will always outlast tough times. That's how we know you're going to make the world what you want it to be.



Mingquan
"Dominic" Lu (DE)



Thi Le (ME)



Dan Syracuse
(ME)



Jason Huang
(ME)

masters

STUDENT AWARDS & HONORS

UNDERGRADUATE AWARDS



Fin Donachie received Design Lab Performance Excellence Award
Jack Coyle received Design Lab Individual Achievement Award



The Matthew Albert Hunter Prize in Metallurgical Engineering (1951) was bestowed the award to Fin Donachie.



2024 Duquette Capstone Award in Materials Science & Engineering was awarded to Jack Coyle

1ST PLACE, GRADUATE STUDENT POSTER COMPETITION



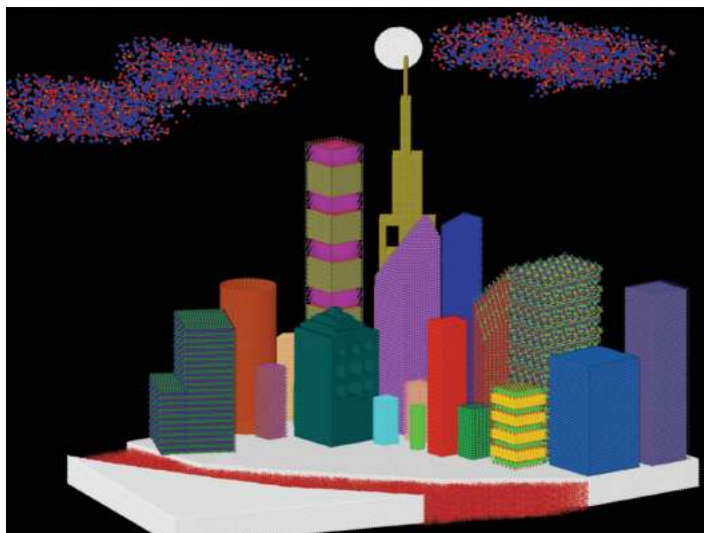
Daniel Syracuse



Professor Daniel Gall

Center for Materials, Devices and Integrated Systems Symposium, Troy, NY, November 17, 2023 selects M.S. Student Daniel Syracuse with Professor Daniel Gall for 1st Place, Graduate Student Poster Competition.

They received the award for their poster entitled "Resistivity Size Effect in Epitaxial Ta(001) and Ta(110) Layers".



Materials Graduate Student Rajan Khadka is also an artist!

"In an RPI-CMDIS Annual Research Symposium, I participated in the "Art in Science Competition" Artwork title: "Atomic City: A Vision in 2.5 Million Atoms" Description: Using visualization tools and crystal structures, I crafted an atomic city, embodying Richard Feynman's vision, "There's Plenty of Room at the Bottom." A fusion of science, art, and imagination, highlighting the potential at the nanoscale. Tools used : OVITO [Image rendering, Structure building], Materials project [Crystal structures] Atoms : ~2.5 million atoms Time taken: 8 hrs P.S: Not an AI-generated image."

— Rajan



Finley Donachie receives multiple awards for academic excellence and advancing Thermal Laser Epitaxy (TLE)

- National Science Foundation’s Graduate Research Fellowship Program (GRFP)
- School of Engineering Class of 1957 Spectrum Award
- AVS Hudson Mohawk Chapter Best Undergraduate Poster Presentation



MSE student Finley Donachie, one of six RPI students awarded fellowships from the National Science Foundation’s Graduate Research Fellowship Program (GRFP).

Finley Donachie plans to do research on advancing the Thermal Laser Epitaxy (TLE) system at Caltech. It is the only TLE system in the USA and still a work in progress, he says. “This novel method will allow us to synthesize materials that exhibit quantum phenomena using high-melting-temperature refractory metals, a technique only paralleled by a similar system in Germany.”

“The NSF Graduate Research Fellowship Program (GRFP) is highly competitive and supports outstanding graduate students who stand to make significant contributions in their fields,” said Dorit Nevo, Ph.D., vice provost and dean of graduate education. “Having RPI students receive this award is a testament to the quality and level of preparation of our undergraduate programs. We are very excited that some of the GRFP recipients have chosen to continue their education at RPI, and we look forward to seeing what they will accomplish.”

GRFP recognizes and supports outstanding graduate students who have demonstrated the potential to be high-achieving scientists and engineers, early in their careers. Applicants must be pursuing full-time research-based master’s and doctoral degrees in science, technology, engineering, and mathematics (STEM) or in STEM education at accredited U.S. institution.

GRFP Q & A

What is your vision for your future; what do you expect to be doing after your fellowship?

After completing my fellowship and PhD at Caltech, I am considering pursuing a postdoctoral position to further deepen my research expertise. Ultimately, I desire to become a professor and mentor future students. My experiences volunteering and working with students have instilled a deep appreciation for teaching and guidance. I am inspired by the role my professors have played in my academic journey and aim to become a role model one day, providing academic and personal support to aspiring scholars.

What do you anticipate the most about your fellowship experience?

The NSF GRFP fellowship represents a significant achievement in my academic career, facilitating my entry into one of the top research groups at Caltech, led by Professor Austin Minnich. Known for their work on TLE, this group initially seemed out of reach due to its competitive nature. However, securing the NSF GRFP marked a turning point, granting me the opportunity to work within his famous group and explore uncharted territories in TLE processes. I look forward to the freedom and resources this fellowship provides.

What’s your advice to current students considering applying to programs?

My advice to students considering applying to programs like the NSF GRFP is to persistently seek advice and feedback. I consulted with multiple professors at RPI, some of whom I was not initially close with, and their guidance was priceless. Even if you doubt your chances, as I once did, it is necessary to continue refining your application. The process of applying can feel draining, but it helped me get through my first in-depth literature review. Remember, confidence and perseverance are your best friends in achieving what might seem like a dream.



Class of 1957 Spectrum Award 2024 for Academic Achievement and Service to Rensselaer.

The Spectrum Award recognizes high academic achievement in engineering, coupled with generous service to Rensselaer and the greater community



AVS Hudson Mohawk Chapter – Best Undergraduate Poster Presentation: Harnessing Thermal Laser Epitaxy for Rapid Synthesis of Topological Insulators

Stoloff award winner Rajan Khadka was selected by the Journal of Applied Physics “On the nature of thermal transport in organic/inorganic nanolaminates”

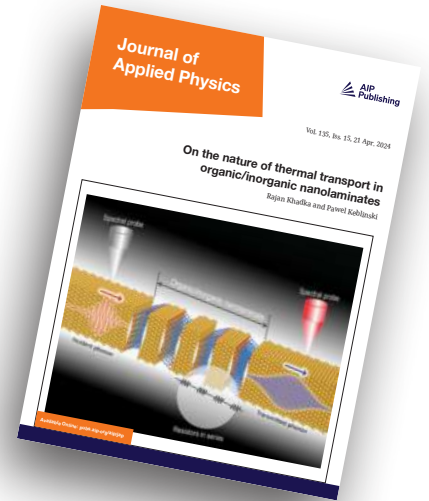
Precise control of heat flow in thin film nanolaminates, i.e. composite layered materials ultra-thin layers separated by heterogeneous interfaces, is critical for various engineering and technological advancements. Understanding how heat travels within these structures and the ability to fine-tune this process holds immense potential across diverse fields. This knowledge is essential for developing next-generation thermoelectric devices, thermal barrier coatings, or to limit thermal dissipation bottlenecks in microelectronic materials.

A new computation research work executed by Rajan Khadka, a materials science and engineering (MSE) student under the guidance of Dr. Pawel Koblinski, professor, and department head at the MSE department at Rensselaer Polytechnic Institute, has unveiled the interfacial bonding strategies for tuning thermal conductivity of organic/inorganic nanolaminates from low to ultra-low regimes. Via a detailed examination of how the individual thermal waves, i.e., phonons, propagate across multiple interfaces in nanolaminates, the research duo exposed the nature of thermal transport in nanolaminates and pointed towards a new approach for conversion of longitudinal to transverse acoustic waves. A combination of research significance and graphical appeal led their publication, entitled “On the nature of thermal transport in organic/inorganic nanolaminates” to be featured as a cover article in the Journal of Applied Physics. Rajan Khadka was recognized by the MSE

department by the 2024 “Norman S. Stoloff Research Excellence Award for this same work.

Dr. Koblinski, an expert on interfacial heat flow at the nanoscale, said that in addition to practical importance of interfacial materials and the central role of thermal dissipation in any active devices or systems generating heat, the results of this work provide yet another example of an interesting pattern: In materials with high density of interfaces, individual phonons scatter with high degree of coherence at multiple interfaces leading to strong interference effects. However, the overall thermal transport, which represent an integrated contributions over all phonons, behave as if each interface acts as an independent scattering center. This, despite a complexity of phonon scattering processes, allows the description of thermal transport in high interfacial density materials via a simple model of independent interfacial thermal resistors connected in series.

This work was inspired by Prof Ganpati Ramanath's research on organic/organic interfaces.



Rajan Khadka and Yang Lou receive the 2024 Norman S. Stoloff Research Excellence Award



Rajan Khadka was selected for “On the nature of thermal transport in organic/inorganic nanolaminates”



Yang Lou was selected for “Antibacterial polymers for biofilm removal”



This award recognizes two graduate students in our department each year who publish the most significant research papers that year. It was established by the Stoloff family in memory of Prof. Norman S. Stoloff (pictured above), a distinguished professor and internationally renowned researcher in the Rensselaer Materials Science and Engineering department for over thirty years, who passed away on Feb 21, 2013. The recipients of this award each present a half-hour seminar in a special event of the MSE seminar series at the end of each Spring semester.



MA toured the Globalfoundries manufacturing plant in Malta, NY.

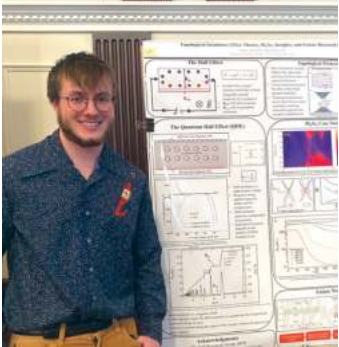


We at RPI Material Advantage are dedicated to encouraging and facilitating professionalism with a focus on Materials Science and Engineering.

During the 2023-2024 academic year, RPI Material Advantage had the chance to host "Matchchats" with Alumni like Carlos Pena and RPI MSE professors Dr. Chaitanya Ullal and Dr. Minoru Tomozawa. These speakers spoke about what they do in research or industry and how they got to that point. We had the chance to tour Globalfoundries manufacturing plant in Malta, NY. Events like these give RPI students a glimpse into their own futures and all the possibilities open to them with a degree in Materials Engineering!

structure, grains, and even fracture mechanisms! Along with our long-standing Engineering 1600 Review sessions, our Officers regularly practice their public speaking skills and stay grounded in the basics of MSE!

A group of MA officers attended the 2024 TMS conference in Tampa, Florida, and some presented at research poster fairs for both ASM and the RPI MSE department.



MA officers attend the 2024 TMS conference in Tampa, Florida, and presented at research poster fairs for both ASM and the RPI MSE department.

MA attended the Engineering Ambassador's STEM Fair in the Albany Million Air hangar. Our officers were able to talk to kids from K-12 about crystal

In 2024-25, we are looking forward to hosting Alumni Dr. Pinkowitz from Knolls Atomic Power Laboratory for our first Industry Hour, and facilitating Industry Hours and tours with SABIC and Dynamic Systems Inc.

~ MA President Ethan Booth



A recent career fair at Rensselaer Polytechnic Institute served as a bit of a family reunion for the Dalakos family.

Julia Dalakos, a materials science and engineering major who earned her bachelor’s degree in 2024, attended the event. Sarah Dalakos, who earned her bachelor’s degree in materials science and engineering in 2020, was recruiting for GE. Ted Dalakos, who earned his bachelor’s degree in electrical engineering in 2015, was recruiting for New York Independent System Operator (NYISO).

The Dalakos family’s connection to Rensselaer does not end there. Their father, George Dalakos, earned his bachelor’s, master’s, and Ph.D. from Rensselaer in chemical engineering.

What is his most memorable moment from Rensselaer? “Meeting my wife,” the elder Dalakos said.

Yes, Joanne Dalakos earned her bachelor’s degree in electrical engineering in 1994 from Rensselaer!

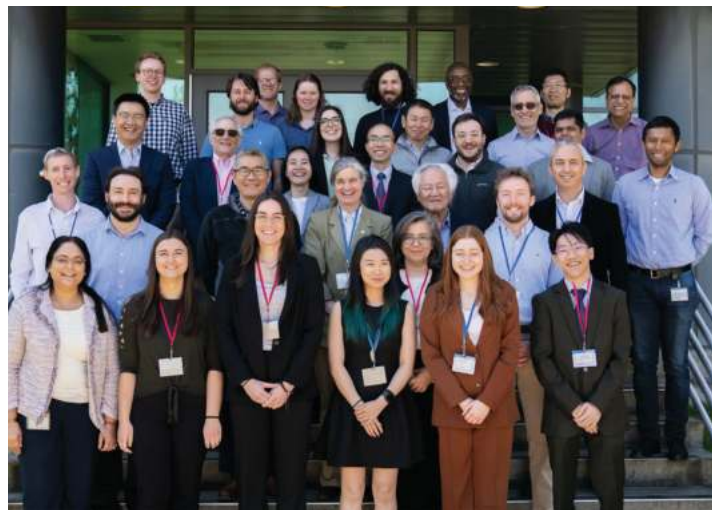
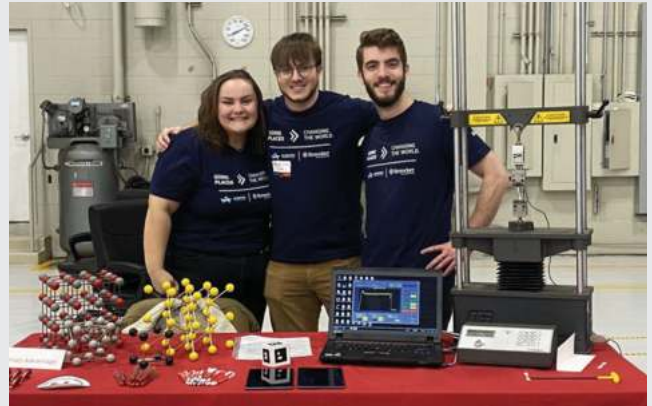
“RPI has been a big part of our lives,” George Dalakos said. “Sort of like an RPI circle of life!”



A Fall’23 Capstone student team recently visited Norsk Titanium (Plattsburgh, NY), a pioneer in metal additive manufactured titanium parts. The mechanical and materials Engineering students benefited from viewing the operations firsthand. Thank you to Norsk Titanium for sponsoring a Capstone design challenge, and for hosting the visit.

“Kaitlyn Castonguay, Ethan Booth and I volunteered in December 2023 at the Albany International Airport! We got to show off our tensile tester and unit cells to children ranging from preschool to high school. It was a blast and I hope that we were able to inspire some young minds to pursue a career in STEM. Plus, who doesn’t like to break stuff?!”

-Fin Donachie



On April 26, 2024 seven Rensselaer Polytechnic Institute undergraduate students showcased research projects in the areas of materials science, computer modeling, chemical engineering, and more at a symposium held at Corning’s Sullivan Park Science & Technology Center just outside of Corning, New York.

“Hearing and watching the presentations, I kept having to remind myself that I was learning from undergraduates, not graduate students in their last years of a Ph.D. That goes to show not just the caliber of our students but also the impact of giving undergraduates hands-on research opportunities along with dedicated mentorship from world-class experts,” said Shekhar Garde, Ph.D., dean of the RPI School of Engineering.



Aviah Dufek

Aviah Dufek • Materials Engineering '26

Why did you choose RPI for your studies?

I chose RPI as my university because I knew that a stem school would have a higher percentage of students who are passionate and dedicated to their studies. I guessed that more students would want to learn, and they would strive to succeed academically. The students that I have met have supported this hypothesis.

What RPI organizations are you a part of? (Polytechnic contributions, clubs, etc.)

I am an active part of the Rensselaer Christian Association. We meet for Bible studies and group social events. I am also part of the RPI Players. This past fall, I worked in the costumes department sewing costumes for She Kills Monsters and assisting in quick changes.

What aspect of Materials Science are you passionate about?

All of it! I enjoy learning how our world is designed on the atomic scale and seeing how that effects the properties that we interact with daily. I love seeing engineering that builds off the inherent properties of a material to guide the whole design.

What research interests you?

I am interested in research that is carried out by an enthusiastic individual. My favorite moments in the lab are when I am learning about someone's research. When I talk to someone who is passionate about their work, I grow more interested because I can see how it applies to the world around us through their eyes.

What career are you interested in?

Tough question. I would like a career that I enjoy, that I am passionate about, and where I can see the overall application of the work. I don't know what specifically that is right now. I am still learning about the opportunities through internships.

What is your favorite part of being at RPI?

I enjoy seeing what students come up with. They are very clever, quirky, and sometimes more than a bit silly which leads to some interesting and entertaining events. For example, a paper airplane made of poster sized paper does not fly.

What are your spare time hobbies?

I love to read fiction when I am at home. I don't read at RPI because then I would get nothing done! I enjoy knitting, making chainmail, sailing, and spending time with friends.

How do you want to change the world?

I would like to obliterate use of disposable/temporary use plastic. Plastic has incredible properties and can be used to do great things (you can read about that outside of Professor Palermo's office: very interesting stuff). However, the widespread use of plastic as a cheap mass-produced material is causing a considerable amount of damage and can have alternatives. Granted, this is more of a societal habit and waste problem than a manufacturing materials problem.

What was your favorite memory of your time at RPI?

My favorite memories of RPI include the many card games played around the dining hall tables. That is how I made friends, spent meals, and been almost late for classes.

What are you doing this semester?

I am studying abroad in Denmark this semester. I have only been traveling so far and already it has been an incredible experience for me to learn about different cultures and talk to new people. I am excited for my classes because they are all fun technical electives. (corrosion, fiber composites, etc.)

"I would like to obliterate use of disposable/temporary use plastic... the widespread use of plastic as a cheap mass-produced material is causing a considerable amount of damage and [we] can have alternatives."

Jynene Alfay • Materials '25



Jynene Alfay

Why did you choose RPI for your studies?

I wanted a school that offered an undergraduate degree in Materials Science and Engineering as well as one where there was a lot of opportunity for undergraduates to do research. RPI allowed me to stay on the east coast and the funding provided was also very helpful in me choosing to study here.

What RPI organizations are you a part of?

NSBE, Materials Advantage, Caribbean Students Association, Embedded Hardware club.

What aspect of Materials Science are you passionate about?

Just the idea of making something new or altering a preexisting substance to obtain very specific characteristics. I think we can answer many problems of the world with a materials solution and room for innovation seems infinite!

What research interests you?

Coming into university I was very interested in nanomaterials

ranging anywhere from nanoelectronics to nanomedicine. The thought of working on something that small just felt unreal to me and I had only seen it in media so I decided it would be the main thing I wanted to work on. After taking a few of my MSE classes and also being in Professor Palermo's Research group for a year, I have gained a greater appreciation for more other areas of materials science. I am not sure what my main interest is yet but I am hoping to settling on one as I continue my schooling in RPI. I will be joining Professor Gall's research this school year so that would be the perfect opportunity to gain insight in the different areas of materials science and various types of research.

What is your favorite part of being at RPI?

It is a relatively small campus, so I feel familiar with everyone, at least everyone in my major. When you start have the same classes with the same people for three semesters straight, and you begin to feel more comfortable. I also like the location, I enjoy taking walks and especially around autumn, the campus is a pretty place to be.

How do you want to change the world?

In short, I want to contribute to the raising and creation of STEM opportunities in the Caribbean, and draw us away from the tourism industry being our main income sector.

STAFF SPOTLIGHTS



Kate Swed,
Administrative Specialist

Kate is from New Hampshire, and has lived in New York for the last 5 years.

She has a Master of Fine Arts in Creative Writing from Pacific University, a Master of Music in Performance from Ithaca College, and a Bachelor of Music from the University of Maine.

After school, she moved into arts administration after studying music, working for the Hangar Theatre in Ithaca and The Joyce Theater in NYC. She then moved into academic administration for Teachers College, Columbia University. She also writes and publishes science fiction, fantasy, and superhero novels!



Craig Pine,
Laboratory Manager for
Mechanical Testing & Metallography

Craig grew up in Hoosick Falls, NY, and has lived in Rochester NY and San Jose CA. He got his BS in Materials Engineering right here at RPI in 1990 then on to Kettering Institute (GMI) for M.S. Manufacturing Management in 1996. He later worked for General Motors, then RockShox manufacturing mountain bike suspensions in San Jose, then NSK Steering

Systems, Mack Molding, Plasan North America, Crystal IS, and Brown's Brewing over the past 25 years.

"My experience working with the Capstone project teams and lab groups doing self driven labs has been a highlight of my recent experiences. The creativity and drive of RPI students has always impressed me."



With Pivot Fellowship, RPI's Jian Shi Tackles Big Quantum Computing Challenge

Jian Shi

MSE's Prof Jian Shi has been selected for the Simons Foundation's Pivot Fellowship. The Pivot Fellowship program aims to "support researchers who have a strong track record of success and achievement in their current field, and a deep interest, curiosity, and drive to make contributions to a new discipline. The fellowship will enable today's brightest minds to apply their talent and expertise to a new field and will consist of one training year where the fellow will be embedded in a lab of a mentor to learn the new discipline and its culture."

During his fellowship, Shi will study the design, fabrication, and testing of superconducting quantum bits, which are the basic building block of some quantum computers. These superconducting quantum bits — known by experts as superconducting transmon qubits — perform the computations in many of today's quantum computers.

Shi hopes his work will lead to a better understanding of how the materials components of this basic building block affect quantum decoherence. Understanding why quantum decoherence is one of the most important topics for quantum computing requires a short primer on quantum computing. "In quantum computing, precise control of superimposed or entangled quantum states is required," he said. "The control may become ineffective when unintentional quantum decoherence appears. Suppose that at one moment the quantum state is 1 in a superconducting qubit; as time goes, without any intentional control, if the quantum state 1 gradually changes to state 0, this is known as quantum relaxation. Such a process is due to the exchange of energy between the quantum state and the environment."

Under this fellowship, Jian Shi will investigate the fundamental mechanisms associated with materials issues

underlying the quantum decoherence phenomena observed in superconducting qubits.

"This fellowship provides such a great opportunity for me to help answer one of the most fundamental questions in the field of superconducting quantum computing," Shi said. "Quantum decoherence is a long-standing topic in the field of quantum mechanics and quantum engineering. It is its mystical nature, and if we could master it, the sheer magnitude of the potential technological impact on humanity, that got me interested."



Rensselaer is home to the world's first IBM quantum computer on a university campus. In the walls above the new computer are beautiful stained-glass windows: The Doctors of the Latin (Western) Christian Church. Their names were Jerome, Ambrose, Augustine, and Gregory, and they were four distinguished individuals from the Greek (Eastern) Church who were honored with the title "Doctor".

RPI will lead the \$1.2 million grant from the National Science Foundation

With New Grant, RPI Works To Shrink Microchips, Expand Semiconductor Workforce

By Samantha Murray

Transistors — the tiny on-off switches inside microchips — have gotten smaller and smaller over the years, increasing computing power and enabling smaller devices. During that time, the copper wires that connect these switches have likewise shrunk.

However, smaller, thinner wires create a big problem, said Daniel Gall, professor of materials science and engineering at Rensselaer Polytechnic Institute.

“The job of the wire is to conduct electrons — electricity. Imagine a wire as a crowded hallway that the electrons have to get through. The narrower the hallway, the more the electrons bump into things and scatter. We call that resistance,” Gall explained. As the wires in chips get smaller and thinner, resistance increases, and efficiency goes down. “Today, resistance is the biggest barrier to more efficient chips,” Gall said.

Thanks to a new, three-year \$1.2 million grant from the National Science Foundation, Gall will lead collaborators at RPI, Notre Dame University, and Cornell University are on a hunt for new materials that can be made even smaller than current copper wires while offering far less electrical resistance.

“Gall will lead collaborators... on a hunt for new materials that can be made even smaller than current copper wires while offering far less electrical resistance.”

— Professor Daniel Gall, Principal Investigator

Discovery of such materials may one day lead to smaller, faster, more energy-efficient computer chips, Gall said. This component of the project will advance semiconductor curriculum, generate immersive industry-led courses, and, at RPI, launch an interdisciplinary master’s degree program in semiconductors technology.

“No one person or institution alone will be able to effect the changes needed to support a thriving domestic chip industry, which is why RPI is proud to bring together researchers, educators, and students who represent the future of semiconductors in the U.S.,” said Shekhar Garde, dean of Rensselaer’s School of Engineering.

Dr. Palermo’s student brings bioinspired armor to Wikipedia

by Colleen McCoy



Liv Vizzini

Bioinspired armor – it may sound like something out of a science fiction novel, but what exactly is it? Thanks to the brand new Wikipedia article* created by Liv Vizzini and

her classmates at Rensselaer Polytechnic Institute this spring, our curiosity can be satisfied.

“Throughout our Biological Materials course, we explored the remarkable ways nature has evolved to provide living organisms with structure and protection,” said Vizzini. “We were surprised to discover that there wasn’t already a dedicated Wikipedia article on this topic!”

As the new Wikipedia article explains, bioinspired armor are human-created materials inspired by the microstructures found in nature’s defense mechanisms.

From mollusk and turtle shells to horns, hooves, and scales, naturally-occurring protections against high-speed collision, blunt impact, and puncture provide no shortage of inspiration for the creation of high-performance materials like helmets, military and sports equipment, and even medicinal applications.

“The materials and structures we discuss in the article have been perfected over millions of years through evolution,” explained Vizzini. “Even with all our modern techniques and technology, engineers and scientists still struggle to replicate them. It’s incredible that such complex and

effective designs can emerge from such humble origins.”

“Writing this article taught me a lot about various organisms – from sharks to spiders to goats – but more importantly, I learned how to present complex information to a broad audience in an accessible way,” reflected Vizzini.

“I wish I could do this assignment for every class!” emphasized Vizzini, who expressed gratitude to her professor, Dr. Edmund Palermo, for incorporating the Wikipedia assignment. “It’s truly a win-win: we gained a deep understanding of the subject, had the chance to share it with a broader community, and contributed to the already vast Wikipedia library.”

**wikipedia.org/wiki/Bioinspired_armor*



Daniel Gall

Chip Expert Daniel Gall Named Robert W. Hunt Endowed Chaired Professor

Rensselaer Polytechnic Institute's Daniel Gall has been named the Robert W. Hunt Professor of Metallurgical Engineering. Gall, a professor in the Department of Materials Science & Engineering and a world-renowned expert in advanced materials for computer chip interconnects, focuses on developing atomic level under-

standing of thin film growth and on the electronic and optical properties of advanced materials. He is studying electron transport in nanowires and epitaxial metal layers and is renowned for his work on the resistivity size effect and its impact on interconnect lines in integrated circuits.

An endowed chaired professorship is among the highest honors bestowed on a Rensselaer faculty member.

"Daniel is leading the way in development of sub 2 nanometer interconnects, which are a critical element of development of future computer chips," said Shekhar Garde, dean of the School of Engineering at Rensselaer. "Daniel is not only a top-notch scientist and an engineer, he is also a great mentor to our students,

and an exceptional teacher. His teaching of innovative courses in advanced materials for chips is adding depth to our chip-centric education and workforce development effort at RPI."

He has authored over 190 papers in peer-reviewed journals including Nature, Nano Letters, Advanced Materials, Physical Review B, Applied Physics Letters, Journal of Applied Physics, and IEEE Transactions on Electron Devices. Gall has presented more than 100 invited lectures, has contributed three book chapters, and holds two patents. His work has been cited over 10,000 times, with an H-index of 61. His students have won over 60 poster competitions, best paper awards, and best microscopy awards.

Gall received his Diploma (M.S.) from the University of Basel, Switzerland in 1994, and his Ph.D. from the University of Illinois at Urbana-Champaign in 2000. He served as a postdoctoral associate in the Materials Research Laboratory at UIUC for two years and joined RPI in 2002 as an assistant professor in materials. He was promoted to associate professor in 2008 and promoted to full professor in 2011.

Pawel Koblinski Named John Tod Horton '52 Professor of Materials Engineering

Pawel Koblinski, Ph.D., has been named John Tod Horton '52 Professor of Materials Engineering at Rensselaer Polytechnic Institute. An endowed chaired professorship is among the highest honors bestowed on a Rensselaer faculty member.

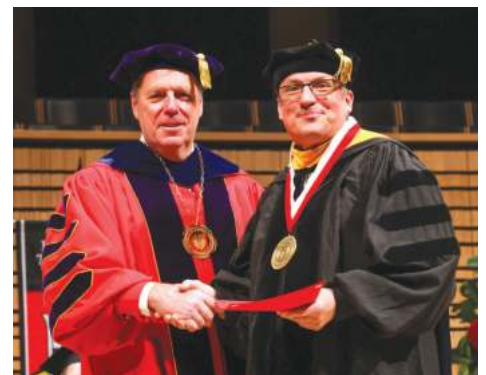
Koblinski is the head of the RPI Department of Materials Science and Engineering. He uses molecular simulations to investigate interfacial materials with applications to energy transport, nanotechnology, and integrated electronics. He is also a member of the Center for Materials, Devices, and Integrated Systems (CMDIS) and the Center for Computational Innovations.

Koblinski has published more than 200 journal papers and made numerous invited and keynote presentations. His research is published in some of the most presti-

gious journals, including Physical Review Letters, Science, Nature Materials, Applied Physics Letters, PNAS, and others. According to Google Scholar, Koblinski's work is cited over 30,000 times with an H-index of 75, numbers that place him among the top faculty members at RPI.

Koblinski's contributions to the field of materials engineering have been recognized with several awards. He was an Alexander von Humboldt Fellow (1996), an elected fellow of the American Physical Society (2014), a Marie Sklodowska-Curie Fellow (2017), and an elected fellow of the Materials Research Society (2020). He has received three School of Engineering Awards for Excellence in Research, the first in 2004 (junior category), the second in 2010 (senior category), and third in 2013 as a member of the Outstanding Research Team.

Koblinski received his master's degree from Warsaw University in 1990 and Ph.D. from Penn State University in 1995, both in physics. Before joining RPI in 1999, Koblinski was a postdoctoral fellow at Argonne National Laboratory and worked at Forschungszentrum Karlsruhe in Germany.



RPI President Martin A. Schmidt '81, Ph.D., left and Pawel Koblinski

FACULTY PROMOTIONS



Liping Huang

We are pleased to announce the appointment of Liping Huang, Ph.D., Professor of Materials Science and Engineering, as the new Associate Vice President for Research, effective January 1, 2024.

Prof Liping Huang comes into this important position with excellent research accomplishments in the areas of advanced materials, and computational science and engineering, with the goal of rationally designing materials with superior properties for energy, environment, and health care applications. She brings a wealth of leadership experience, and importantly, she comes with tremendous energy and ideas about growing multidisciplinary research aligned with the highest priorities of the Institute. She has published over 120 peer-reviewed papers and won numerous prestigious awards, including the NSF CAREER Award. She is an ELATE fellow and an American Ceramic Society fellow.

In her new role, she will coordinate administration and operations in the Office for Research, and will provide oversight and leadership for faculty and staff within Institute-wide research centers. She will lead faculty in the development of major interdisciplinary research proposals, and ensure all Institute-related research activities are supported; enhance the visibility of research programs; and develop and grow research partnerships working with the Office of Strategic Alliances and Translation and Institute Advancement.

Liping Huang has served as the Associate Dean for Research and Graduate Programs in the School of Engineering since February 2018. She has been a member of our faculty since 2008. She received B.E. and M.S. degrees in materials science and engineering from Zhejiang University and a Ph.D. degree in materials science and engineering from the University of Illinois, Urbana-Champaign.



Jian Shi

Jian Shi promoted to full professor rank in the Department of Materials Science and Engineering.

Professor Jian Shi earned this promotion for his sustained research excellence, national and international prominence and the impact he has made on numerous graduate and undergraduate students via classroom instruction and research mentorship.

**DID YOU
KNOW?**

For students who like to innovate and want to apply their knowledge to real problems of a modern technological society, MSE provides a broad range of exciting opportunities:

MATERIALS PROCESSING

MATERIALS FOR MICROELECTRONIC SYSTEMS

GLASSES AND CERAMICS

NANOCOMPOSITE MATERIALS

COMPUTATIONAL MATERIALS SCIENCE

NANOMATERIALS

BIOMATERIALS

Nanotechnology Expert Nikhil Koratkar Named American Physical Society Fellow



Nikhil Koratkar

Prof Nikhil Koratkar has been named a fellow of the American Physical Society (APS). Koratkar, who holds a joint appointment in mechanical engineering and materials science, joined the

Rensselaer faculty in 2001. He was recognized by the Division of Materials Physics “For his distinguished contributions to nanoscale science and technology, including the discovery of partial van der Waals transparency in graphene, and pioneering the use of nanostructured materials in

“Dr. Koratkar is a world leader in his field—his ability to translate fundamental molecular-level insights into solving some of the pressing energy storage challenges is exceptional. Dr. Koratkar is helping to create environmentally and economically sustainable solutions to our energy needs.”

—Shekhar Garde, dean, Rensselaer School of Engineering.

composites and energy storage devices.”

“The APS Fellow award holds special significance for me,” said Koratkar. “As a young teen, my mother gave me a book to read titled Surely You’re Joking Mr. Feynman. This book changed my life. Until

that point, I had wanted to emulate my father and become an Army Officer. The book had a profound impact on me and inspired me to pursue a career in academia and research. In 1946, nearly 77 years back to this day, my idol Richard Feynman was elected APS fellow.”

How a Tiny Device Could Lead to Big Physics Discoveries and Better Lasers

Rensselaer Polytechnic Institute researchers have created the first topological quantum simulator device in the strong light-matter interaction regime that operates at room temperature



Wei Bao

Prof Wei Bao has been awarded with the UAM Young Researcher Award in the area of Experimental Sciences 2023, recognizing outstanding contributions in the field of experimental sciences, potentially from a specific organization or institution that holds this award annually.

Bao fabricated a device no wider than a human hair that will help physicists investigate the fundamental nature of matter and light.

The device is made of a special kind of material called a photonic topological insulator. A photonic topological insulator can guide photons, the wave-like particles that make up light, to interfaces specifically designed within the material while also preventing these particles from scattering through the material itself.

“The photonic topological insulator we created is unique. It works at room temperature. This is a major advance. Previously, one could only investigate this regime using big, expensive equipment that supercools matter in a vacuum. Many research labs do not have access to this kind of equipment, so our device could allow more people to pursue this kind of basic physics research in the lab,” said Wei Bao, senior author of the Nature Nanotechnology study.

“It is also a promising step forward in the development of lasers that require less energy to operate, as our room-temperature device threshold,” Bao added.

The RPI researchers grew ultrathin plates of halide perovskite, a crystal made of cesium, lead, and chlorine, and etched a polymer on top of it with a pattern. They sandwiched these crystal plates and polymer between sheets of various oxide materials, eventually forming an object about 2 microns thick and 100 microns in length

“Being able to study quantum phenomena at room temperature is an exciting prospect. Professor Bao’s innovative work shows how materials engineering can help us answer some of science’s biggest questions.”

—Shekhar Garde, dean, Rensselaer School of Engineering.

and width (the average human hair is 100 microns wide).

When the researchers shined a laser light on the device, a glowing triangular pattern appeared at the interfaces designed in the material, as the result of topological characteristic of lasers.



Professor Tomozawa received a Ph.D. degree in metallurgy and materials science from the University of Pennsylvania in 1968, after working for the Nippon Electric Company for four years. He joined the faculty at Rensselaer in 1969. He served as the Director of the Center for Glass Science and Technology (1985-1992) at Rensselaer. He has published extensively in the area of glass science and edited several books on the subject.

Professor Tomozawa's research interests are the structure and properties of glasses and glass-ceramics. His research aims to characterize the structural changes of such glass in a controlled manner and to alter materials properties in a desired manner, lead to glass of improved mechanical stability. Professor Tomozawa current research interest is glass and water interaction. Through this work, he found fast surface relaxation process, which led to a new method of making stronger glass fibers and clarification of various mysteries of glasses such as fatigue limit.

Materials Science and Engineering hosts a Celebration in honor of Professor Minoru Tomozawa's Retirement

He retired in June but was named Professor Emeritus and is still in his office or lab almost every day and continue research at RPI, focusing on projects with undergraduate students.

He authored 295 technical papers, edited 9 books and holds 3 patents. His over a half century sustained research excellence in the area is glass science was recognized with numerous awards such as the International Contribution Award from the Ceramic Society of Japan in 1991. He has been a member of the American Ceramic Society, since 1969 and is a member of the Glass and Optical Materials Division. Dr. Tomozawa served as a Division Editor and Division Chair; became a Fellow of the Society in 1983; received the Ceramic Education Council's Outstanding Educator Award in 1988; the George W. Morey Award of the Glass and Optical Materials Division in 2011; and will be elevated to Distinguished Life Member of the American Ceramic Society in September 2019.



He educated and mentored numerous students that developed successful careers, most prominently in Corning Inc. a premier technology company that specializes in glass, ceramics, and related materials and technologies. At the retirement party his recent PhD advisee, Bronson Hausmann, shared that his immediate supervisor at Corning is Peter Lezzi and Peter's supervisor is Tim Gross, both former Tomozawa's

doctorate students! Tim Gross is a key contributor to the Gorilla Glass development and was named Corning Research Fellow when he was still in his thirties, the youngest ever in the Corning history. Another of Prof. Tomozawa's students, John Kelly III went to IBM, instead of Corning, where he held numerous top leadership positions and currently serves as the Chair of the RPI Board of Trustees.

"Sometimes he'll go on cool tangents about materials, which raised my interest in the subject greatly. Sit as close to the front as possible, though, to absorb his wisdom."

— former student

**RECOMMENDATION TO NAME
ROOM 136 OF THE MATERIALS RESEARCH CENTER
FRITZ V. LENEL STUDENT LOUNGE**

Loyalty, service and pride are qualities that Rensselaer values in its faculty. To honor persons who have personified these values is not only correct, but demonstrates the importance of these values to future generations.

The students in Materials Science and Engineering wish to recognize one such faculty member for his outstanding contribution to the Department, the School of Engineering and the Institute.

Dr. Fritz V. Lenel pioneered powder metallurgy research and education at American universities and established the program at Rensselaer. Dr. Lenel began his career at Rensselaer in 1947 and retired in 1973. During his tenure he served as a beloved teacher and respected researcher. Dr. Lenel's reputation is world-renowned. He is the recipient of many awards during his distinguished 25 year career including the Powder Metallurgy Pioneer Award. Dr. Lenel served as a guest lecturer throughout the country and around the world as was exemplified by his appointment as a guest scientist at the Max-Planck Institute for Metals Research in Stuttgart, Germany, on six different occasions during his career. For many years following his retirement he remained active in the Department, as Professor Emeritus, staying involved with students and faculty.

He is held in the highest regard by his former students and greatly admired by all the faculty, staff and students who are currently in the Materials Science and Engineering Department.

In accordance with Rensselaer's policy, the Advancement Committee recommends the adoption of the following resolution:

Resolved, that Room 136 of the Materials Research Center is hereby named the Fritz V. Lenel Student Lounge in honor of Dr. Lenel's contribution and commitment to the students, faculty and staff of Rensselaer.

On Tuesday, July 2, 1996, MSE Department Head Dr. Richard W Seigel formally opened the Fritz V. Lenel Student Lounge with a lively reception attended by Prof Lenel and his wife as well as students, staff and faculty.

The MRC had been lacking a good space where students could come together in an informal setting for both social and professional exchanges. The new Lounge was a great gathering place and honored the contributions of Prof Lenel to the Materials Science & Engineering Department, the School of Engineering, and the Institute throughout his 20-year career at RPI!

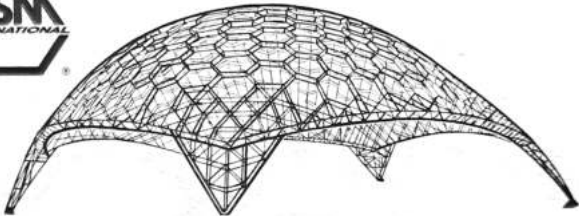
The Fritz V. Lenel Student Lounge includes a big table and comfortable chairs, a display of Prof Lenel's awards and a photo, a white board for studying, walls lined with the MSE dept free reference library, as well as a small kitchen area. In 2022, the department was able to fund the purchase of new red chairs to reflect our RPI pride and replace the old worn-out chairs.

The Lounge serves as a meeting place for the Material Advantage club and other MSE student organizations, a comfortable study area for students, and a venue for department celebrations such as Diwali and Lunar New Year.



Dr. Fritz V. Lenel (1907-2003) pioneered powder metallurgy research and education at American universities and established the program at Rensselaer. He began his career at RPI in 1947 and retired in 1973. During his tenure he served as a beloved teacher and respected researcher. Dr. Lenel's reputation is world-renowned. He is the recipient

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Fritz Lenel, FASM

In recognition of 60 years of membership

James H. Knapf
President

1994

Edward L. Sawyer
Managing Director



HISTORY



In 1893, George Washington Gale Ferris Jr., Class of 1881 unveiled a marvel of engineering that would become a cultural icon: the original Ferris Wheel!

During Ferris' time at Rensselaer, Materials Science and Engineering was included in the Civil Engineering curriculum. Metallurgy engineering courses were first established in 1933, and in 1962, the Materials Research Center was built

to support Materials Science and Engineering.

The Ferris wheel was first showcased at the World's Columbian Exposition in Chicago

Ferris' groundbreaking invention captured the imagination of a nation and earned a perpetual spot in history. This was no ordinary feat; it was an engineering marvel that encapsulated RPI's 200-year-long tradition of pushing the boundaries of what's possible. Ferris not only

brought joy to millions but also redefined the capabilities of structural and materials engineering.

As we commemorate our Bicentennial, Ferris' iconic "first" spins as a tribute to RPI's legacy: a legacy of pioneering minds and Materials Engineering, transforming not just the landscape of American entertainment, but also inspiring endless possibilities in the realms of science and technology.



Ainsley Pinkowitz
BS 2013 PhD 2018

I'd like to be a force for positive growth in the world, rather than just neutral stasis. I participate quite heavily in Diversity & Inclusion initiatives both at my company and in STEM in general, because the world deserves the creative effort of all people working for its betterment.

Why did you choose RPI for your studies?

I was a huge science nerd in high school, like competed on all of the Chemistry Olympics and Physics Olympiad teams we fielded kind of science nerd. It made engineering a very natural choice of profession. I'm from the northeast, and my godfather had attended RPI back when you got real beer with your GM week mug, so he talked it up nicely.

What RPI organizations were you a part of?

I was a member of RPI Fencing, Archery, and Genericon Staff. In graduate school I was part of leadership for an ECS student chapter and an AVS student chapter, as well as organizing an in-house graduate student organization that hosted seminars and social events.

What aspect of Materials Science are you passionate about?

My career is focused on corrosion of metallic materials, and while I am passionate about it, I think the things I love about Materials Science are much more fundamental. I've always appreciated how an understanding of structures and bonding can help you intuit how any material should behave—It's like knowing the secret recipe to the universe. Similarly, I love materials forensics because you have an end-state and you can use these fundamental under-

standings to work backwards to how you must've got here. I think my career will always circle around this fascination with materials performance and failure.

How did your experience at RPI help you choose your career?

RPI guided me into a Ph.D. at RPI and really changed my course from a wandering undergraduate to a person designing their own future. I had always liked research as a concept, but never tried to get an undergraduate research project. As a PhD student I signed on with Drs. Hull and Duquette for an NSF project studying pitting corrosion using a liquid cell in situ holder for the transmission electron microscope. After a decade of RPI, I set my sights on an employer that would let me stay forever, Naval Nuclear Laboratory (a.k.a., "Knolls Atomic Power Laboratory" or KAPL) where they do very interesting materials degradation research. I got my resume placed on the right desk by an RPI friend.

What was your favorite part of being at RPI?

How tightly bound the MSE family is. There were few enough students that you could really get to know people across years. Sitting in the student lounge was like being on the set of "Cheers"—everybody knew your name.

How do you want to change the world?

On the one hand, my career is tied to the longevity of the US Navy submarines and aircraft carriers, and providing a nuclear deterrent to the world seems to be a needed step in preventing future war. Perhaps I don't have the idea that will end world hunger or help us colonize Mars, but I can make sure the person who does has their chance to learn, work, and be heard when they share it.

What was your favorite memory of your time at RPI?

In my first year of grad school I helped engineer a best friend's engagement to her girlfriend. My friend came back to play for Big Red Freakout, and I secretly invited the girlfriend's twin sister and a couple of our undergrad friends into town for the engagement party under the guise of "big game party". Pep Band plays "Hey Baby (will you be my girl?)" at the end of a hockey game if RPI wins—the perfect proposal song. We also had to let the entire band in on the secret so they knew they were playing the song no matter what (but thankfully we won anyway!) and my friend dropped to one knee to a *wildly* surprised girlfriend who thought she'd figured out all the surprises we'd planned for the weekend. They've been married almost a decade now!

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: Tess Lecuyer, Department of Materials Science & Engineering
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