RPI

2026 MATERIALS SCIENCE AND ENGINEERING



Pawel Keblinski

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

Welcome

Every year in the Fall I have the privilege and immense pleasure to share the highlights of RPI materials, community achievements, activities, and stories we experienced within the last academic year. As is our tradition, we use this annual sharing to reflect the community spirit of materials endeavor at RPI. In this bulletin you can read many stories involving our undergraduate and graduate students, staff, faculty, and alumni. This year we also share with you several stories from the broader RPI community involving the RPI School of Engineering and the Institute, as our materials community is an integral part of both communities.

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Welcome [cont.]

Let me first focus your attention on our commencement awards which we celebrate at our graduation dinner. These awards reflect our deep history and recent history as well as current engagement. The Matthew Hunter Prize and The Scott Mackay Award are oldest awards and recognize the best academic performance and the best service contributions, respectively. Several more recently established awards include the Dr. Doreen Ball-DiFazio Award, recognizing top female graduates, Istvan Mortiz recognizing materials co-terms, the Duquette Capstone Award, and the Graduate Studies Award. Significantly, all mentioned more recently established awards involved organizational and/or financial contributions from our past Administrative Coordinator Meeli Leith. She is a proud and active RPI retiree that often surprises me with great homemade cookies and doughnuts. One of the most recent awards is a Teaching Assistant Excellence Award that recognizes the importance of graduate students' contribution to the RPI education process. All these awards paint a picture of time and space continuity within which our materials community exists.

Several pages of this newsletter describe various student focus activities, capstone and outreach activities, undergraduate and graduate research awards obtained at state and national levels. As always, we report on our Materials Advantage Chapter. The Chapter focuses on professional development via service and research leadership and is consistently one of the most active and often recognized as one of the best chapters nationwide.

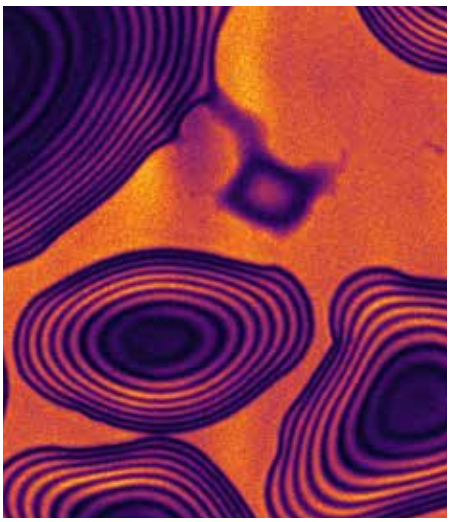
On the research front I want to mention "ultra" remote epitaxy demonstrated by the team lead by Prof. Jian Shi. Quite remarkably a buffer layer as thick as 7 nanometers between the substrate and growing crystal film did not prevent the growing film from "feeling" the substrate texture beneath, including substrate defects. This opens new avenues of substrate engineered thin film growth with potential applications to scalable membrane release and wafer recycling strategies in devices. Another highlight includes a project on AI-Guided Manufacturing of High-Performance Heavy Rare-Earth-Free Magnets for Critical Materials Security recently awarded via the Genesis Mission Program led by RPI team of materials scientist and engineers.

Please enjoy these and many other stories we report to you and please share any thoughts, ideas, and your own successes with us.

Thank you,

Pawel Keblinski

John Tod Horton '52 Professor of Materials Engineering
Department Head
Materials Science and Engineering Department
Rensselaer Polytechnic Institute



On the Cover: Fluorescence image of a dye tagged polymer system; the various contours appear because the system is trying to get rid of stress. Image by PhD Student Mrigaraj Goswami, a student of Professor Chaitanya Ullal. This image won best Image in the RPI CMDIS annual research symposium for the Art in Science Contest, in 2024.

~ 2026 MSE Newsletter ~

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COMMENCEMENT AWARDS 2026

Doreen Ball-DiFazio Award

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



Winner
Jynene Alfay

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
Ethan Han

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
Aviah Dufek

Scott Mackay Award

– given to a senior in Materials Science & Engineering who has given time and effort to the service of others without seeking recognition or acclaim, and who has completed the academic program at RPI creditably.



Winner
Thomas Onishi

Duquette Capstone Award

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



Winner
Nancy Wang

Teaching Assistant Excellence Award

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



Winner
Visalan Pallithazhath Sujith

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
Natalie Gavin

ADVANCED DEGREES AWARDED



EVENTS & CELEBRATIONS





Materials Science & Engineering faculty, staff & students celebrated the Year of The Horse with food and fellowship in the Materials Student Lounge.







Graduate Student Orientation & Welcome Dinner





Annual Holiday Party









PhD Student Mahima Sasikumar (second from the left) won the Best Student Oral Presentation Award at the Albany Nanotechnology Symposium in October 2025. Her presentation title : Nanomolecularly-induced wetting and layer-by-layer growth in ultrathin metal films for next-generation device wiring architectures.

Why Materials Science & Engineering?

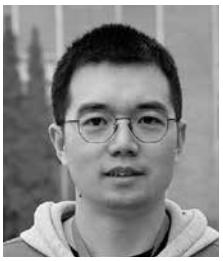
- You get to make cool stuff, break things, do fun hands-on science and graduate into a field where employers across every industry need you.
- Materials Engineering lets you understand how everyday objects behave.
- "You get to do fun, exciting science but still get paid the high salary of an engineer!" - *Prof Minuru Tomozawa*
- In MSE, you learn how to design and create new materials, probe their exotic physical properties and fabricate them into useful devices for computing, sensing, supporting and automation.
- All the sciences funnel into materials science and all the engineering disciplines rely on materials.

Prof Danial Gall's Students Win Poster Awards


Daniel Gall


Emma Sponga


Daniel Syracuse


Rui Shu


Ariful Islam


Sadiq Shahriar Nishat

Best Poster Award:
Emma Sponga, Daniel Syracuse, Rui Shu, and Prof. Daniel Gall, "Epitaxial TaP(001) Film Formation by Phosphorization of Epitaxial Ta(001)/MgO(001)," ASM Eastern NY Society Meeting, Troy, NY, March 24, 2026.

Best Presentation Award:
Ariful Islam, Sadiq Shahriar Nishat, Rui Shu and Prof. Daniel Gall, "Epitaxial growth of the topological semimetal NbAs," 2026 Spring Meeting of the Hudson Mohawk Chapter of the AVS, Troy, NY, April 29, 2026.

Stoloff Award Winners

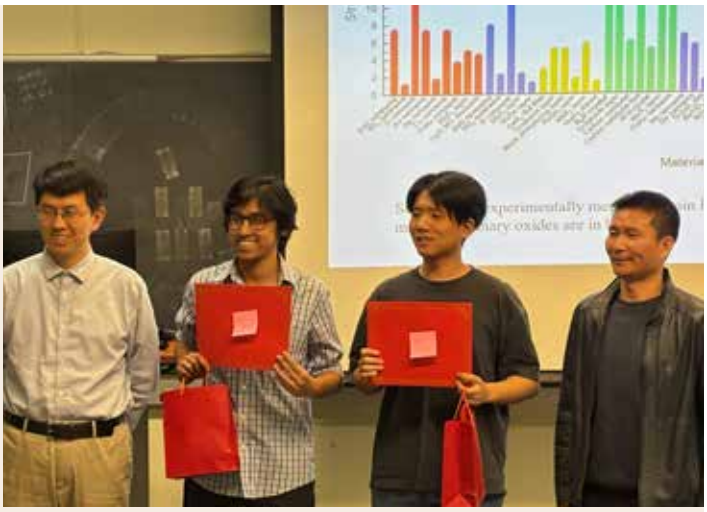
On April 22, MSE graduate students Yilin Meng and Ahmed Raiyan were recognized for their excellence in research when they received the 2026 Norman S. Stoloff Research Excellence Award. A cash award and certificate of achievement are presented to two students each year.

Meng, who joined Dr. Wei Bao's lab in Summer 2024, presented on "Hybrid perovskite–nanograting photonic architecture enables supersolidity at room temperature."

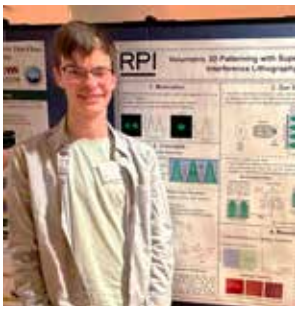
Raiyan, a member of Dr. Jian Shi's lab since Spring 2025, presented on "Strain-Enabled Chiral Phase and Berry Curvature in Wurtzite Semiconductors."

Following the presentation, the department shared a celebratory luncheon.

Congratulations to Yilin Meng and Ahmed Raiyan!



Prof Wei Bao, Raiyan, Meng, and Prof Jian Shi (L to R)



MSE's Shane Avenius wins best poster award

Shane Avenius received the TEL Best Poster Award at the 2026 New York Nanotechnology Network Symposium, "Shaping the Future – rising Stars, NYS Talent & Technology" in March 2026 at Syracuse University.

Shane Avenius, an MSE undergraduate student, received the TEL best poster award at the 2026 New York Nanotechnology Network Symposium held at Syracuse University.

> *Shane Avenius: "Volumetric 3D Patterning with Super-Resolved Interference Lithography"*
>
> *Authors: Shane Avenius, Visalan Pallithazhath Sujith, Shaheen Hasan, Mrigaraj Goswami*
>
> *Principal Investigator/Faculty Advisor: Chaitanya Kishore Ullal*
>
> *Department & Institution: Materials Science and Engineering, Rensselaer Polytechnic Institute*

Shane is an undergraduate Materials Engineering student at Rensselaer Polytechnic Institute researching nanoscale additive manufacturing through super-resolution lithography. His interests lie at the intersection of advanced manufacturing, mechanical design, and polymer chemistry.

Wei Li Invited Student Speaker for the 2026 NYS Nanotechnology Network Symposium – March 23, 2026 - "Shaping the Future – Rising Stars, NYS Talent & Technology"



Invited Student Speaker

12:10-12:20 p.m.

Wei Li

"Novel Quantum Phases in Perovskite Polaritonic Platforms at Room Temperature"

Authors: Wei Li, Yilin Meng, Kai Peng, Jianchen Dang, Xiaolong Wu and Wei Bao
Affiliation: Department of Materials Science and Engineering, Rensselaer Polytechnic Institute
Faculty Advisor/Principal Investigator: Wei Bao
Contact Email: liw24@rpi.edu

Exciton–polaritons in semiconductor microcavities provide a powerful platform for exploring collective quantum phenomena arising from strong light–matter interactions. Due to their hybrid photonic and excitonic nature, polaritons combine light effective mass with nonlinear interactions, enabling the realization of macroscopic quantum states under nonequilibrium conditions. In recent years, polaritonic systems have attracted increasing interest for studying exotic quantum phases such as topological states1 and supersolids2. However, many experimental demonstrations have relied on cryogenic semiconductor materials, limiting their practical applicability and scalability. Developing polaritonic platforms that operate under ambient conditions therefore remains an important challenge.

Here we present two recent advances in perovskite-based polaritonic systems that enable the observation of emergent quantum phases at room temperature. First, we demonstrate polariton condensation in a photonic topological insulator realized through a valley Hall lattice integrated with $CsPbCl_3$ halide perovskites. The engineered lattice supports a large topological bandgap that protects propagating edge states against backscattering. Above the excitation threshold, nonlinear polariton interactions drive coherent condensation within these edge modes, producing long-range spatial coherence and robust directional transport without an external magnetic field.

Second, we realize a room-temperature polariton supersolid in a hybrid nanograting structure supporting a bound-state-in-continuum (BIC) polariton mode. As the excitation density increases, optical parametric oscillation (OPO) redistributes the polariton population from the condensate into the side modes. This process leads to the spontaneous formation of a spatially modulated density pattern while preserving global phase coherence, a defining signature of the supersolid phase. The resulting striped lattice represents a self-organized state that emerges from nonlinear polariton interactions and mode competition.

Together, these results establish halide perovskite polaritonic systems as a versatile platform for studying nonlinear and topological quantum phases under ambient conditions. Such systems open new opportunities for investigating symmetry breaking, collective excitations, and driven many-body physics in hybrid light–matter systems.

Reference
1. Klembt, S. et al. Exciton-polariton topological insulator. Nature 562, 552–556 (2018).
2. Trypogeorgos, D. et al. Emerging supersolidity in photonic-crystal polariton condensates. Nature 639, 337–341 (2025).

Topological edge state (left) and supersolid state (right) at room temperature in perovskite polaritonic platforms.

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Capstone Team handles Molten Metal for a Medallion win!

MSE Seniors Nancy Wang and John Hollet were on the Capstone team who, in Spring of 2026, used a 3D printer to create the mold, and cast molten zinc to make RPI medals!



Glassblowing in the Materials Research Center

Michael 'Fox' Scupholm, formerly of Salam Art Works with some of our undergrad students. He helped us debug the furnace and conduct an initial glassblowing feasibility demonstration with some undergrad students.

- Prof Chaitanya Ullal

Undergrad Students:

- Andrea Rudea (27')
- Yurithzan Maltos Iriqui (28')
- Shane Avenius (26')

Graduate Students

- PhD Student Peter Zhang

The glass furnace is a recent acquisition of the Materials Science & Engineering Department.



Visitors tour the Nanoscale Characterization Core

The UPWARDS Summer Intensive Program in Microelectronics at RPI welcomed undergraduate and graduate students from the UPWARDS for the Future Network partner universities in the US and Japan to tour the Nanoscale Characterization Core.

The semiconductor industry requires a highly skilled and diverse workforce that can strengthen technology leadership and innovation across ecosystems in the U.S. and Japan. Partnerships between universities and companies are critical to developing semiconductor talent, cross-collaboration and expanding cutting-edge research.

The students who visited the Nanoscale Characterization Core were from:

Tohoku University ,Kyushu University, Hiroshima University, Institute of Science Tokyo, Nagoya University, Purdue University and RPI. Participants in the program, guided by Lab Managers Dr. Pascal Bassene, Dr. Chao Yang, and Dr. Leo Chen, conducted experiments with select RPI professors in their research laboratories, participated in tours of research labs and visits to semiconductor fabrication facilities, worked hands-on in RPI's cleanroom facility to learn the basic steps of deposition, lithography, etching, and metrology, and took part in field trips and cultural activities.



Micron and Tokyo Electron (TEL) launched the U.S.-Japan University Partnership for Workforce Advancement and Research & Development in Semiconductors (UPWARDS) for the Future Network alongside university partners. This partnership cultivates a more diverse, robust and highly skilled talent pipeline for the semiconductor workforce and drives emerging research while increasing the pipeline of students studying a semiconductor curriculum.

The collaboration amongst the universities will focus on developing the next generation of the workforce, enabling fundamental and emerging research, with a priority to expand opportunities to female students, researchers and leaders. The network will provide access to experiential learning in cleanrooms and memory-related research across institutions, with a particular focus on promoting opportunities for female students, staff and leaders.

For more information about UPWARDS, please email upwards4thefuture@gmail.com.

Shane Avenius and his Amazing Fresnel Lenses!



Fresnel lenses, being much lighter in weight than regular glass lenses, were used as the light sources in lighthouses around the world for over 150 years, and were known as "the invention that saved a million ships".

Shane Avenius, a Materials Science & Engineer Senior stated: "I have always been interested in lighthouses and optical engineering, specifically Augustin-Jean Fresnel's invention of the Fresnel lighthouse lens in 1822. A Fresnel lens is a type of composite compact lens which reduces the amount of material required compared to a conventional lens by dividing the lens into a set of concentric annular sections."

Fresnel lenses, being much lighter in weight than regular glass lenses, were used as the light sources in lighthouses around the world for over 150 years, and were known as "the invention that saved a million ships".

So, while at Formlabs as an SLA Print Optimization Intern this summer Shane wanted to see if modern SLA 3D printing could replicate the complex geometry and light-bending properties of a traditional glass 6th-order Fresnel lens, with 6th order referring to the size of the lens, which was the smallest used in lighthouses in the 19th and 20th centuries.

The lenses and catadioptric prisms are printed in Formlabs Clear V5. To get the optical clarity required to properly refract light, he wet-sanded every part to remove layer lines and finished them with a buffing process to achieve a glass-like finish. The structural frame is printed in Formlabs Black V5.

Everything is entirely custom-designed by Shane from scratch in CAD (Onshape). He manually calculated the exact refraction angles and did the ray tracing in CAD for each individual prism so that the light perfectly collimates into a horizontal beam. He made two of these large lenses in total, with the difference between the two being the flash pattern, which comes from the way the prisms are arranged.

He was invited to participate in a Lighthouse Society podcast (see QR code) and is currently in talks with the board of trustees for Nauset Lighthouse (the one on the Cape Cod chips bag) about making something that would replace their current beacon which is in need of replacement. He is also working on a lens that would go in a lighthouse on Lake Superior in Michigan. Shane's current plans are to do a PhD in materials science with a focus on additive manufacturing and then move on to a career in industry.

Podcast of Shane talking about the lenses

RPI Graduate Women's Club — New Community Launching



The RPI Women Grads Club launched its inaugural meeting, bringing together the club's founding leadership team: Mahima Sasikumar (MSE), President & Founder; Sowmya Srinivasan (MSE), Co-founder; Hannah Arnow (MANE), Vice President; Kairvi Lodhiya (MANE), Treasurer; Ayushi Gupta (CBE), Secretary; and Madison Stiefbold (BME), Events Coordinator. The club is a cross-department community supporting women and gender-diverse graduate students at RPI.

Grad school can feel isolating. The RPI Grad Women's Club is a new cross-department community for women, gender-diverse graduate students, and allies, centered on wellness and support, advocacy and voice, research and collaboration, and career development. Planned activities include monthly coffee meetups, speaker panels, writing accountability circles, mentorship pairings, and social celebrations - with the agenda shaped by member input as the group grows.

RPI Material Advantage

RPI Material Advantage is an international professional society for students interested in materials science, and RPI Materials Science & Engineering has for decades had a very active and successful MA Chapter.

This past year, Materials Advantage had many exciting events! We participated in the TMS Bladesmithing Competition, where we competed against 25 other teams from around the world. For this competition, we had to craft a knife or sword and then write a report, create a poster, and make a video about the materials science processes behind the blade. It was a fantastic opportunity for students to learn how to apply what we learn in class to a fun, hands-on activity!

Several of our team then traveled to the TMS National Conference in March, where we won a Special Citation for Multifunctional Design for our blade, Excelsior. Excelsior was a knork, a combination of a knife and fork, inspired by Upstate New York.

On the outreach end, we also visited KIPP Albany Charter School where we gave a presentation on food science and held a fun activity teaching kids how to choose healthy snacks.

Other events we held included a February fundraiser featuring chocolate-covered strawberries, a MatChat about undergraduate research with Professor Chaitanya Ullal, a panel with alumni, and participation in Exploring Engineering Day!

In the fall semester, we look forward to hosting new events and beginning work on our blade for the 2028 TMS Bladesmithing Competition.

2026 Board of Directors for RPI MSE Material Advantage:

President:
Mariana Gavilan (26', 27')
Vice President:
Isabelle Pepe (28')
Treasurer:
Yurithzan Maltos Iriqui (27')
Secretary:
Lauren Antao (28')
Outreach Director:
Evan Cheung (29')
Activity Director:
Kyle Pan (29')



Several of our team then traveled to the TMS National Conference in March, where we won a Special Citation for Multifunctional Design for our blade, Excelsior. Excelsior was a knork, a combination of a knife and fork, inspired by civil war soldiers from Upstate NY recovering from injuries, the knork is a multitool to help with everyday camp life.







Zander Zoia (BS '26)

Zander was awarded his degree in May 2026. He had already gotten a job at Braun Intertec in Minneapolis, MN.

Zander Zoia, BS ('26)

Why did you choose RPI for your studies?
I chose RPI for its academics and reputation as an engineering school. I was able to get in as an undeclared engineering major which allowed me to explore all the disciplines before making my decision for my major.

What RPI organizations are you a part of?
I am a part of the ACHA D2 men's hockey team, Theta Xi fraternity, and the club tennis team on campus.

What aspect of Materials Science are you passionate about?
There are numerous aspects of Materials Science that interest me which I have been able to learn about at RPI. The entire materials selection process is incredibly interesting to me and is both a fun and challenging way to apply the discipline in the real world. Within my classes I have been exposed to each category of material that is created, which encouraged me to continue learning about composites and pursue interests within the field. I have enjoyed it being a smaller major and that I feel like I know my cohort and professors better than other majors on campus.

What career are you interested in?
I am interested in high performance sports equipment manufacturing. Using my knowledge of materials and from further industry experience I hope to work on a team that designs that equipment.

What is your favorite part of being at RPI?
My favorite part of being at RPI has been all of the incredible people, both students and staff that are always engaging with the community and excited to help you whenever you need.

What are your spare time hobbies?
I like to stay active and get outside whenever I can on campus, both through club sports and fraternity activities as well as golfing whenever the weather allows.

How do you want to change the world?
I would want to change the world by improving upon carbon fiber recycling and manufacturing technologies.

What was your favorite memory of your time at RPI?
My favorite memory from my time at RPI is when our hockey team qualified for the ACHA National Tournament!



"My favorite memory from my time at RPI is when our hockey team qualified for the ACHA National Tournament!"

GRADUATE STUDENT SPOTLIGHT



Nikita Waskiewicz, PhD ('26)

Nikita Waskiewicz, PhD ('26)

Why did you choose RPI for your studies?
I chose RPI because of the two schools that I applied to and was accepted into, it was close to home, and I knew it had a great engineering program. Both of my parents are RPI alums, so I have grown up knowing about RPI's strong reputation amongst industry professionals.

What RPI organizations are you a part of?
I am a part of the Society of Women Engineers (SWE), Graduate Outdoor Recreational Program (GORP), Society of Plastics Engineers (SPE), Biomedical Engineering Graduate Council (BMEGC), and RPI Graduate Council.

"I do not know what my future career will look like, but I can say that I have developed not only my technical skills through my research, but soft skills as well."

What aspect of Materials Science are you passionate about?
I enjoy seeing the variety of applications that materials science encompasses. My degree is in Biomedical Engineering, with a focus in biomaterials, so it is neat seeing how polymers can be used in applications beyond medical settings (ex. sustainability and semiconductor fields).

What research interests you?
Polymers!

How did your experience at RPI help you choose your career?
Strangely, it was not my research project that is leading me toward a particular career path, but rather my involvement in my extracurriculars and as a TA. I have learned that I enjoy teaching, and that I have developed the ability to organize and manage well. I do not know what my future career will look like, but I can say that I have developed not only my technical skills through my research, but soft skills as well.

What is your favorite part of being at RPI?
My favorite part of being at RPI is seeing its potential. I have enjoyed working in the department and institute-wide graduate councils during my time here to see some of that potential realized, and I have hope that in time, the organizations will continue to thrive and build on this momentum.

What is special about the Materials Science & Engineering program at RPI?
I am not technically in the MSE department, although my PI and research are, so I have been adopted into the department. I think the most special part of the MSE program is how we host the holiday celebrations (thanks to Tess and Kate).

How do you want to change the world?
That is a loaded question… give me another 5 years to come up with a detailed answer.

What was your favorite memory of your time at RPI?
My favorite memories: MIT Polymer Day with Yang, BMES Conference with Payton, John's 60th birthday, getting to the semifinals for my IM volleyball team. Hosting the GC 2025 Summer Picnic. All the BMEGC social events and CBIS GPA themed parties. MSE potlucks during the holidays. Yang's master's and doctoral graduation. My master's degree graduation. Visiting Nashville, Italy, and Iceland. Learning to ski and having the best winter days.

What is a fun fact about your life away from RPI?



A fun fact about my life outside of RPI is that I am now an AUNT!!! My labmate and I got to walk together and take some cute graduation pictures with her new baby this May.

First Endowed Deanship at RPI Honors Alumnus' Formative Student Experience

A $5 million gift from Thomas and Patricia Farino will support new initiatives in the RPI School of Engineering

Thomas R. Farino Jr. '67 and his wife Patricia Farino have made a $5 million gift to the Rensselaer Polytechnic Institute (RPI) School of Engineering to establish the university's first endowed deanship. Their gift marks another milestone in RPI's yearlong Bicentennial celebration of the Institute's past, present, and future.

A named endowment for the dean will propel Rensselaer Engineering further in education, research, and the student experience. The Farino Deanship will provide the dean the flexibility to support transformative ideas in emerging interdisciplinary research areas (e.g., energy, health, chips, AI, quantum, and beyond), pedagogical innovations and programs for 21st century technological education, and student-led technical clubs and projects. The gift empowers the dean to nurture an inclusive and welcoming environment where students thrive, where faculty can pursue bold ideas, and where Rensselaer's mission of advancing knowledge and technology continues to shape the future.

Shekhar Garde, Ph.D., the dean of the School of Engineering, will be the first to hold the Thomas and Patricia Farino Endowed Deanship.

"Dr. Garde has done so much to elevate RPI on the world stage in STEM fields. We hope the endowment will ensure that RPI remains a beacon of innovation and leadership in engineering education and research, and empower the dean to be agile and forward-looking, launching new initiatives that help produce graduates who are not only capable engineers, but also global leaders who will shape the next century of progress," Farino said.

Farino grew up in central New Jersey, where his family operated a 100-acre vegetable farm. A varsity athlete, straight-A student, student council president, and valedictorian, he was the star of his high school class. Farino had always loved science and math and naturally set his sights on attending Rensselaer Polytechnic Institute to study engineering.

However, his freshman year at RPI did not go as planned.

"I was overwhelmed with RPI's rigorous academics," Farino said. At the six-week mark, he was not passing any of his engineering courses.



Thomas R. Farino, Dean Shekhar Garde, Patricia Farino at the Endowment Ceremony

If he was going to stay at RPI, he had to turn his grades around. Determined to succeed, Farino developed a disciplined study habit that enabled him to pass all his freshman classes.

Then, during his sophomore year, came the real test: Thermodynamics, a difficult course regarded as a rite of passage for all engineering majors. Farino stayed two or three chapters ahead of the coursework and aced all the exams. Not only did he earn an "A," but the professor, Andrew Devine, Ph.D., excused him from the final exam.

An "A" in Thermodynamics was rare. Today, a plaque recounting Farino's achievement hangs outside of the classroom in the Russell Sage Building where he took the course.

"I hope that plaque encourages all the students who pass it to stick with their studies," Farino said.

During his junior and senior years, Farino excelled academically and graduated with a degree in industrial engineering. Farino credits the successful career that followed to lessons learned as an undergraduate at RPI.

Farino has a daily reminder of his time at RPI. "When I was a freshman, struggling in my courses, I would see the upperclassmen with their class rings and wonder if I would be able to get one. By my junior year, I was making top marks, and I was so excited to order mine. I owe all my successes to RPI. My class ring hasn't left my hand in 57 years," Farino said.

New Semiconductor CoLab to Advance Microelectronics Research and Education



RPI President Martin A. Schmidt '81, Ph.D., gives remarks at the Semiconductor CoLab opening event on October 24, 2025

Rensselaer Polytechnic Institute (RPI) has launched the Semiconductor CoLab at NY Creates' Albany NanoTech Complex, establishing a dedicated 6,000-square-foot facility designed to advance semiconductor research and strengthen academic programming in microelectronics. The facility positions RPI as a key contributor to the nation's semiconductor research infrastructure.

The Semiconductor CoLab will host collaborative research projects, technical symposia, and workforce development programs aligned with national priorities in semiconductor manufacturing and innovation. The facility is operational and available for research activities and educational programming.

"When it comes to research and education in semiconductors, there's no other place like Albany NanoTech," said RPI President Martin A. Schmidt '81, Ph.D., at the October 24 ribbon-cutting event for the space. "We look forward to deepening our engagement with everyone here, and in so doing, driving the economic development of the region."

The Albany NanoTech Complex is a world-renowned hub for research, development, and commercialization of nanotechnology and semiconductor innovation. RPI's presence here strengthens the university's partnerships with major industry players including IBM, GlobalFoundries, Micron, Applied Materials, and Tokyo Electron (TEL) Technology Center, America, LLC.

"NY Creates is excited to welcome Rensselaer Polytechnic Institute to our Albany NanoTech Complex's ZEN building," said Paul Kelly, NY Creates' Vice President of Strategies, Partnerships, & New Ventures and Chief Operating Officer.

Semiconductor CoLab



RPI Ranks Among Nation's Top Universities for Patents

Rensselaer Polytechnic Institute (RPI) has been ranked 50th on the National Academy of Inventors' (NAI) 2025 Top 100 U.S. Universities Granted U.S. Utility Patents list, reaffirming the Institute's commitment to innovation and the translation of cutting-edge research into real-world impact.

Released annually, the NAI ranking recognizes U.S. academic institutions that play a significant role in advancing innovation by securing patents and protecting their intellectual property.

"This recognition speaks directly to the caliber of research happening across every corner of our campus," said Jonathan Dordick, Ph.D., Vice President of RPI's Office of Strategic Alliances and Translation. "Our faculty, researchers, and students are tackling some of the most complex challenges of our time in biotechnology, semiconductor and materials design, computing, and energy infrastructure. RPI innovators' ability to translate that work into patented technologies demonstrates both the depth and the real-world relevance of what we do here at RPI."

RPI's placement on the Top 100 U.S. Universities reflects the Institute's ongoing success in moving discoveries from the laboratory to the marketplace, creating tangible benefits for society and the broader economy. Forty-four patents were issued to RPI in 2025.

"These universities and their inventive faculty are at the forefront of driving national innovation and competitiveness," said Dr. Paul R. Sanberg, President of the National Academy of Inventors. "By moving their ideas to market and protecting their IP with patents, these institutions are ensuring that the U.S. not only remains competitive on the global stage, but directly shapes the future of innovation."

RPI Researchers Advance Understanding of Semiconductor Crystal Growth

A team led by researchers at Rensselaer Polytechnic Institute (RPI) has made a breakthrough in semiconductor development that could reshape the way we produce computer chips, optoelectronics and quantum computing devices.

The team, which also includes researchers from the National High Magnetic Field Laboratory, Florida State University and SUNY Buffalo, published their findings last month in Nature. Their work deepens the understanding of remote epitaxy, a manufacturing technique that entails growing high-quality semiconducting films on one substrate and then transferring them to a different one.

Remote epitaxy works by placing a thin buffer layer between a substrate and a growing crystal film. The substrate's atomic structure guides the crystal's growth through the buffer, but the buffer prevents permanent bonding — meaning that the finished crystal layer can be peeled off and moved elsewhere.

Until now, researchers believed that the remote epitaxy technique only worked with buffer layers less than one nanometer thick, and that a thicker layer would almost completely overshadow the subtle electrostatic forces from the substrate that guide the growth of the crystal film.

But recently-graduated RPI materials science Ph.D. student Ru Jia and her lab fellows grew crystals through carbon buffer layers up to seven nanometers thick — a 600% improvement — and found they still aligned well with the substrate beneath.

"This work shows that remote epitaxy could be mediated by substrate defects such as dislocation," said Jian Shi, Ph.D. a professor of materials science and engineering at RPI, Jia's Ph.D. advisor and a senior author on the paper. "Practically, that widens material choices, improves process windows, and aids scalable membrane release and wafer-recycling strategies in real devices."

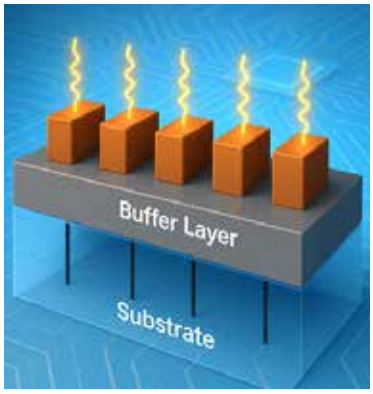
Using a zinc oxide/gallium nitride model system in conjunction with Yan Xin's team at the National High Magnetic Field Laboratory, Jia and her colleagues discovered that structural defects in the substrate may enable long-distance electrostatic interactions that can influence the structure of the crystal layer. RPI materials science professor Yunfeng Shi, Ph.D., and his team validated the findings with computations showing that defects called dislocations may mediate long-distance remote epitaxy.

"This work would not have been possible without close collaboration among experts in materials growth and characterization, advanced characterization, and atomistic-scale computational simulations," Jian Shi said.

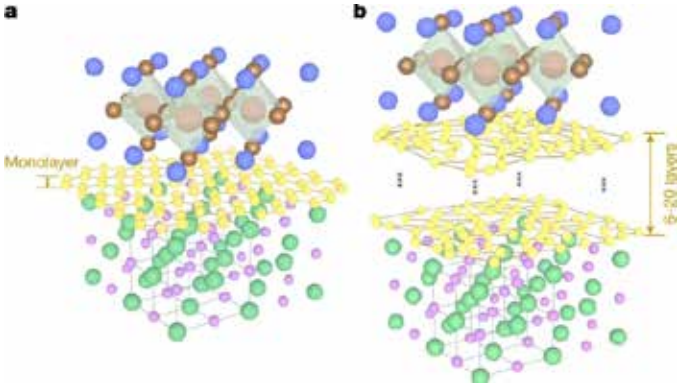
The researchers tested their approach with multiple crystal/substrate combinations, demonstrating the universality of their findings. As a proof of concept, they built working photodetectors by transferring perovskite crystal films to flexible substrates, demonstrating the technique's practical viability.

The work suggests that substrate defects, traditionally seen as quality control problems, might be deliberately engineered to control remote epitaxy processes. Manufacturers could, for instance, use the technique to program functional "islands" or epilayers in specific locations on their crystal films — a degree of precision that is necessary to fabricate quantum devices that require fine control of crystal growth.

"The paper offers a mechanism — defect-assisted, long-range remote electrostatic interactions — that engineers can intentionally harness to bring about nucleation and alignment in crystal films," Jian Shi said.



Growth of high-quality crystals using remote epitaxy could be realized through much thicker buffer layers than previously considered possible.



A schematic diagram of the remote epitaxy process. Panel a shows the conventional process with a graphene layer 0.35 nm thick, while panel b illustrates the process using a much thicker buffer layer.

RPI Selected for Two U.S. Department of Energy Genesis Mission Projects

RPI will lead one Phase I project and support a second, advancing AI applications in critical materials and particle accelerator research



"RPI's selection for two Phase I Genesis Mission projects reflects the university's commitment to research that connects computational and AI advances to disciplines that fuel emerging technologies, and advance scientific understanding and innovation," said Robert Hull, Vice President for Research at RPI.

Rensselaer Polytechnic Institute (RPI) researchers will contribute to two projects selected by the U.S. Department of Energy (DOE) for Phase I awards under the inaugural Genesis Mission, a national initiative designed to accelerate scientific discovery through artificial intelligence. RPI will lead one project, in collaboration with Ames National Laboratory, focused on developing next-generation permanent magnets, while contributing to a second project led by Brookhaven National Laboratory that will apply AI to improve the operation of particle accelerators.

The RPI-led project, AI-Guided Manufacturing of High-Performance Heavy Rare-Earth-Free Magnets for Critical Materials Security (AIM-MAG), will be led by Jie Lian, professor of Materials Science and Engineering, Mechanical, Aerospace, and Nuclear Engineering at RPI. Lian's team will combine AI, materials science, and advanced manufacturing to accelerate the discovery and development of high-performance, heavy rare-earth-free permanent magnets. The full research team includes RPI Materials Science & Engineering professors Liping Huang and Yunfeng Shi, as well as collaborators from Ames National Laboratory and GE Vernova.

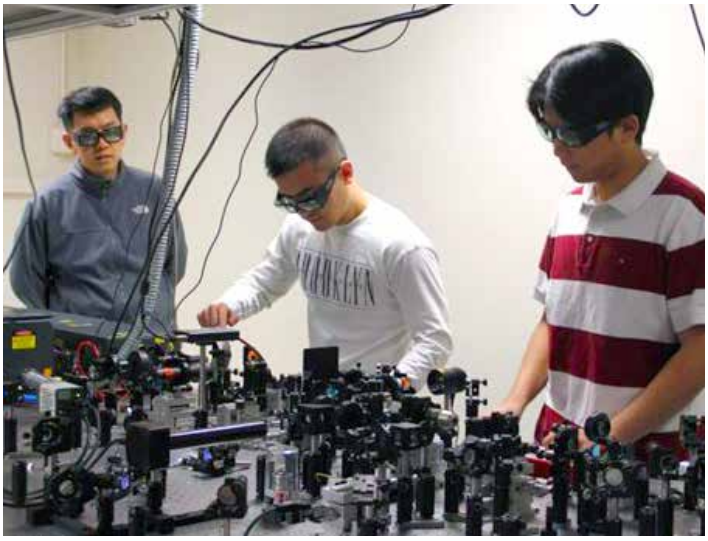
By integrating scientific literature, existing materials databases, computational modeling, and experimental data into an AI-powered knowledge platform, the researchers aim to uncover relationships between composition, processing, microstructure, and magnetic performance. These insights will guide the design and scalable manufacturing of next-generation permanent magnets with enhanced performance and reduced reliance on critical rare-earth elements.

"Some of today's most important scientific challenges are too complex for any one institution or discipline to solve alone," said Lian. "Being part of the Genesis Mission gives us the opportunity to work alongside leading researchers across the country and explore new approaches to designing the next generation of critical materials. By developing heavy rare-earth-free permanent magnets, our research aims to strengthen domestic manufacturing, enhance energy security, and build a more resilient U.S. critical materials supply chain."

RPI also is a partner on a second Genesis Mission Phase I project led by Brookhaven National Laboratory, AI-Driven, Self-Learning Digital Twins for Robust Operation of Particle Accelerators. The project will combine physics-based accelerator models with machine learning to create AI-enabled digital twins that can improve understanding of accelerator operations, account for uncertainty, and support real-time decisions. Yinan Wang, assistant professor of industrial and systems engineering, leads RPI's contribution alongside collaborators from Brookhaven National Laboratory, Thomas Jefferson National Accelerator Facility, Cornell University, RadiaSoft, and Cosylab.

"The Genesis Mission creates an opportunity to rethink how scientists interact with complex systems such as particle accelerators." said Wang.

Scientists Create a New State of Matter at Room Temperature Using Light and Nanostructures



From left to right: Professor Wei Bao, Ph.D. student Wei Li, and Ph.D. student Yilin Meng perform experiments in Bao's lab.

Researchers at RPI have created a new and unusual state of matter — known as a supersolid — by engineering how light and matter interact inside a nanoscale device. The work, published in Nature Nanotechnology, demonstrates that this exotic quantum phase can exist at room temperature, overcoming a long-standing limitation in the field.

Supersolids are unusual because they combine two seemingly incompatible properties: Like a solid, they form an ordered, crystal-like structure. At the same time, they behave like a fluid, meaning they can flow without resistance. Until now, such states have only been observed under extremely cold conditions, close to absolute zero. "Our work shows that you can create and control this exotic state using light," said MSE Professor Wei Bao in Materials Science & Engineering and senior author of the study. "What's especially exciting is that it happens at room temperature, in a platform that can be engineered and potentially scaled."

Turning light into a structured quantum fluid

The research team built a device by combining a high-quality perovskite crystal with a precisely patterned nanostructure that traps and shapes light. "We carefully controlled the fabrication process at the nanoscale to ensure the device could reliably confine light and behave as designed," said co-lead author Wei Li, a senior Ph.D. student in Bao's lab.

When illuminated by a laser, the system produces hybrid particles called polaritons, which are part light and part matter. These particles can behave collectively, forming a coherent quantum fluid. At low excitation power, the polaritons condense into a single, well-defined state. But as the input energy increases, the system undergoes a dramatic transformation. Instead of remaining uniform, it spontaneously reorganizes into a striped pattern — like a crystal — while still maintaining quantum coherence across the entire system.

"This is the defining feature of a supersolid," Bao said. "The system is both ordered and coherent at the same time."

A self-organizing quantum transition

Unlike ordinary solids, which form through equilibrium processes such as cooling, the supersolid in this experiment emerges dynamically. As more energy is pumped into the system, different quantum states begin to compete. Beyond a critical threshold, the system can no longer stay in a single state and instead redistributes into multiple synchronized states. This competition leads to the formation of a stable, periodic pattern. Remarkably, the exact pattern varies from one measurement to the next.

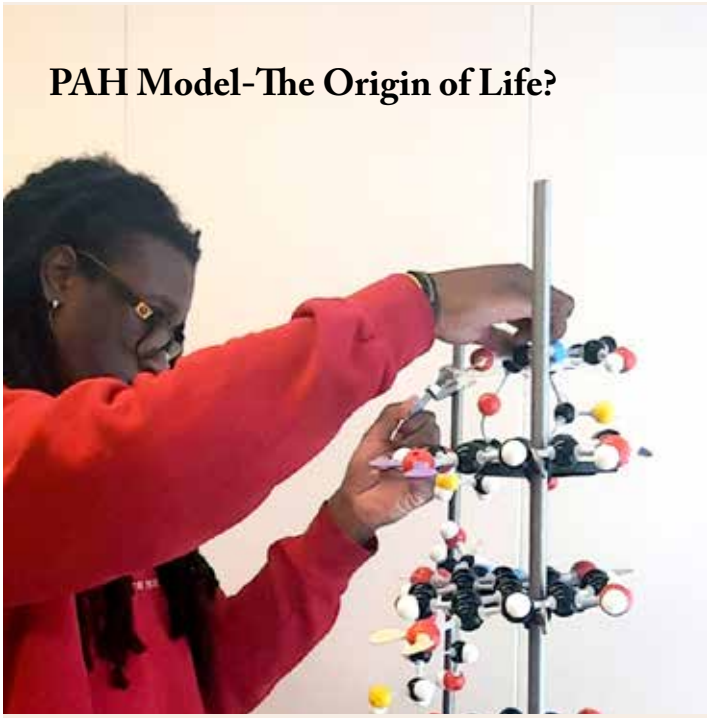
"Each time we repeat the experiment, the system chooses a slightly different configuration," Bao said. "That randomness is actually very important: It tells us the pattern is forming spontaneously, not being imposed from outside."

"It's exciting that our optical measurements let us observe this distinctive phase transition simultaneously in the emission spectrum and in real space," said Yilin Meng, a Ph.D. student in Bao's group and a co-lead author. "By synchronizing the laser pulses with single-shot real-space imaging, we can confirm that the variations are genuinely random and directly visualize different phase selections from run to run."

Making quantum phenomena more accessible

One of the most significant aspects of the discovery is that it occurs at room temperature in a compact, chip-scale device. "It brings phenomena that were once limited to specialized laboratories into a more accessible and controllable setting," Bao said.

PAH Model-The Origin of Life?



Kyiman Tinson, a senior undergrad in the Materials Science & Engineering department, assisted Professor Simon Nicholas Platts in building his PAH (Polycyclic Aromatic Hydrocarbons) Molecule physical model in the Materials Research Center.

The PAH world hypothesis is a speculative hypothesis that proposes that polycyclic aromatic hydrocarbons (PAHs), known to be abundant in the universe, including in comets, and assumed to be abundant in the primordial soup of the early Earth, played a major role in the origin of life by mediating the synthesis of RNA molecules, leading into the RNA world. What eventually went on to become called the "PAH World" model in origins-of-life science was first glimpsed on 11/19th/2001, by Australian chemist, Dr. Simon Nicholas Platts, at RPI.

The model was further developed collaboratively in the Spring & Summer of 2004, while on fellowship at the Carnegie Institution (Washington, DC). Exploratory dynamical molecular modeling was performed at RPI in mid-2006, which illustrated not only the essential stability but also the resiliency of scaffold-bound N-heterocyclic arrays to perturbations in-silico. Support for this work is kindly provided by RPI, the Carnegie Institution, and by the NASA Astrobiology Institute.

This model describes what would appear to be an ineluctable incipience-point, perhaps only millennia or mere centuries 'upstream' in time of the magnificent RNA World evolutionary 'kick-off' point for Biology's thence-inexorable trek towards the astounding variety of organisms which we know will eventually appear on the Earth 'down-the-track.'

Some intriguing implications stem immediately from the present model, particularly concerning the likelihood of life on other planets in habitable zones around their own stars far, far away...

The Palermo Group

The team of researchers, lead by Materials Science & Engineering Professor Edmund Palermo, is working towards building new materials that are composed chains called "polymers".

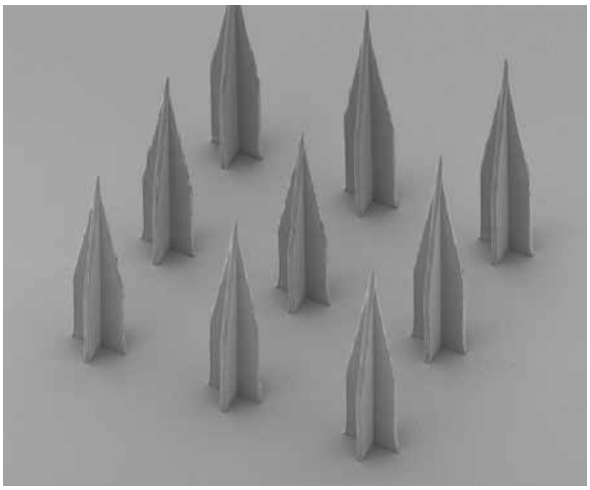
These polymerized drugs can act as a structural implant for supporting the growth of cells such as neurons from the brain and spinal cord, while gradually releasing small amounts of drug molecules locally at the site of implantation, as a function of their slow degradation and unleashing of drug molecules embedded within these bioplastic reservoirs. Specifically, they are using recently invented polymers of estrogen, which is known to promote regenerative effects in the spinal cord post injury. The team examines the fundamental scientific relationships between the structure of these materials and how critically important cells from the central nervous system respond to them, including neurons and other cells that assist in controlling neuron behavior, such as astrocytes. Many different types of material formulations have been invented by this group and studied in detail: one is an array of microscopic fibers, which mimic the fibrillar proteins that often guide cell growth in the body and another is a soft hydrogel material, which is basically like the pharmaceutical equivalent of Jello, similar in mechanical properties to the spinal cord tissue itself. The team has also created thermosets of cross-linked estrogen, in the molded form of a microneedle patch, which can be used for transdermal long-term hormone supplementation. The group hypothesized that combining many different kinds of drug-containing biomaterials together into a single hybrid conduit will help us understand how to coax hesitant neurons in the injured CNS to overcome scarring and inflammation and instead promote healing and regeneration of healthy tissue. The information gleaned from this work could someday pave the way for new therapeutic approaches to spinal cord injury and traumatic brain injury.

The central nervous system (CNS), which encompasses the

continued on pg 19

brain and the spinal cord, is a complex superhighway of information transport within the human body. Many drugs are available to treat spinal cord injury (SCI), but unfortunately the outcomes are still quite poor – in fact, more than 99% spinal cord injury patients do not make a full functional recovery and some loss of motor function is all but inevitable. Curiously, of the tiny percentage of patients who do make a full recovery, all of them are women. This interesting epidemiological fact led many scientists, bioengineers, and doctors to wonder if estrogen – the major female hormone – might be playing some key role in the injury recovery process. Indeed, when estrogen is injected into the spinal cord of rats with SCI, they make a much more robust recovery from the injury than untreated animals, which encourages researchers to try testing it in humans as well. Neither pill delivery, nor direct injection into the spinal cord are practical, due to the long time scale of the progressive chronic injury requiring repeated epidural injections over months to years. Therefore, there's an urgent need to develop ways to: (1) deliver estrogen directly to the injury site within the spinal tissue (2) extend the timescale of the drug action to span many years instead of a more typical timeframe for a drug to kick in, say minutes-to-hours. Thus, novel science and engineering approaches to figure out how to improve drug efficacy within the injured CNS are a top priority in the field.

This work has been supported by the National Science Foundation, the National Institutes of Health, the Department of Veterans Affairs, and New York State Department of Health.



"Microneedles composed of polymerized pro-estrogen for sustained transdermal hormone delivery, printed using two-photon polymerization. These biomaterials are produced by a collaboration between the Palermo and Ullal labs at RPI with Prof. Chris LaFratta at Bard College."



Top: Dr. Yang Lou in the fume hood, making molecules, Middle L: Julia and Nikita weigh out their compound, Middle R: Dr. John Leman shows off his glovebox technique with Payton O'Connor Bottom: the whole team as of Summer 2025

Nanomanufacturing Breakthrough Could Revolutionize Night Vision Technology, Other Fields

New method produces ultra-thin membranes with record-breaking sensitivity, promising to transform thermal imaging and night vision technology

Rensselaer Polytechnic Institute Professor Yunfeng Shi played a pivotal role in the development of a new manufacturing technique that could revolutionize infrared detection technology, making thermal imaging devices smaller, more accurate and far more affordable.

The research, published recently in Nature, introduces an innovative "atomic lift-off" method that creates ultra-thin crystalline membranes capable of detecting infrared radiation with high sensitivity, and without the need for expensive and bulky cooling systems.

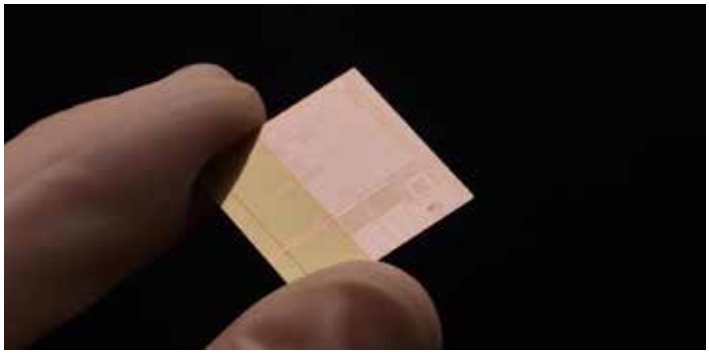
Prior efforts to mass-produce the fragile membranes had been stymied by the difficulty of keeping them intact while removing them from their manufacturing substrates. The team, which in addition to RPI included researchers from MIT and several other universities, were able to surmount that problem and achieve high-precision exfoliation of the membranes.

"This method offers an approach to manufacturing cooling-free detectors that can cover the full far-infrared spectrum, marking a notable advancement in detector technology," the researchers write.

Ultra-thin layers of semiconducting crystal material are typically "grown" atop a substrate with a similar crystal structure. But removing the ultra-thin films from the substrates has proven to be a formidable challenge. The films often bond too tightly to the substrates, making them virtually impossible to remove without damaging their delicate structure.

Yunfeng Shi, Ph.D., one of the lead authors on the paper, demonstrated with his colleagues that the process can be done without a buffer layer if the material used to make the ultra-thin film contains lead. Shi's group carried out density functional theory calculations showing that lead atoms reduce charge transfer across the film-substrate interface, weaking interfacial bonds and facilitating atomic lift-off.

"We demonstrate that the release layer used in conventional exfoliation is in fact not necessary for certain systems," Shi said. "This is paradigm changing."



The new technique to manufacture ultra-thin semiconducting membranes could lead to a breakthrough in night vision technology (Getty Images)

Using this technique, the researchers were able to bulk-produce thin films of a substance called PMN-PT, a pyroelectric material that generates electric currents in response to heat. They were able to achieve record levels of thermal sensitivity, made possible because they were able to shrink the membranes down to a thickness of just 10 nanometers.

In addition to night vision technology, the improvement in thermal sensitivity could lead to advances in biomedical and astronomical imaging technology, or in realms like autonomous driving, where it could be used to improve collision detection in low-light situations. The researchers also say the technique could be used to improve many different types of crystalline oxide membranes, not just infrared-detecting ones.

"This breakthrough underscores the transformative power of combining advanced materials synthesis and manufacturing with state-of-the-art computation," said Shekhar Garde, Ph.D., Thomas R. Farino Jr.'67 and Patricia E. Farino Dean of the School of Engineering. "Uniting experimental ingenuity with high-fidelity modeling through interdisciplinary collaborations, Yunfeng Shi and colleagues have demonstrated what has eluded experts for years. I look forward to the many practical applications that will come from this advance."

The work was supported by grants from the Air Force Office of Scientific Research, the U.S. Department of Energy, and other sources.

Two MSE Faculty Get Dean's Fellowships

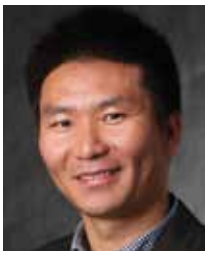
We are delighted to share that two Materials Science & Engineering faculty were recognized with the RPI School of Engineering Dean's Fellowships.



Ravishankar Sundararaman

Prof. Ravishankar Sundararaman was appointed as Sanford S. Sternstein '61 PhD Endowed Dean's Faculty Fellow in Materials Science and Engineering at Rensselaer Polytechnic Institute.

This appointment recognizes Shankar's outstanding accomplishments in first-principles modeling of advanced materials, with impact in areas such as chips and semiconductors, energy, and beyond. It also acknowledges his meaningful contributions to education and community within the MSE Department, the School of Engineering, and RPI. This appointment was made possible through a generous gift from Dr. Fred Myers '73G '77 PhD, in honor of his doctoral advisor, Dr. Sanford Sternstein, a legendary MSE professor.



Jian Shi

Prof. Jian Shi was appointed as the GlobalFoundries Endowed Dean's Faculty Fellow in Engineering at RPI. This honor recognizes Jian's outstanding research in the growth of materials with design functionalities with application to quantum materials, interconnects, energy and memory materials, spin transport and others, as well as his contributions to education and community.

Both appointments are for 3 years and come with annual discretionally funds to support research, educational, and professional activities of the fellows. Please join us in congratulations to Jian Shi and Ravishankar Sundararaman for these highly deserved recognitions.

Justine and Jim Mullen '80 Fund RPI Materials Science & Engineering Project



Jim Mullen (third from the left, second row) stands with awardees, including Dr. Edwin Fohtung (far right) during a campus visit

Justine and Jim Mullen '80 have generously donated to RPI in support of several research projects and a workshop in computational biology, with emphases in artificial intelligence, and quantum computing—all priorities outlined in the RPI Forward strategic plan.

"Deep Learning Framework for Dose-Constrained Cryo-XRF in Cellular and Vesicle Imaging" – Dr. Edwin Fohtung, associate professor in materials science and engineering, and graduate student, Jackson Anderson, was one of the seven research projects and one workshop selected for funding.

"Funding computational biology research at the place where I began my education, and ultimately my life sciences career, seemed like a full circle moment — giving to an area and place where it all started for me," said Jim Mullen '80. "Justine and I are thrilled to support research in an industry I built my career on. We hope this gift, which supports a key priority at RPI, will fuel the future of the biopharma industry and serve as a catalyst for faculty and student research."

"We are so grateful for the support from Jim and Justine, which will allow our faculty and students to remain at the forefront of rapidly growing fields in computational biology," said Robert Hull, Ph.D., vice president for research at RPI. "In addition to applying computational methods to biological research, these projects focus on global issues that affect humanity."

Materials Science & Engineering's Dr. Wei Bao was promoted to Associate Professor with Tenure.

This promotion recognized emerging excellence, leadership and promise of further growth in research, pedagogy, and service.



Associate Professor Wei Bao

Prof. Bao joined our department as an Assistant Professor in 2023. Prior to RPI he was a faculty at University of Nebraska-Lincoln. His education and research pedigree starts with the top science university in China, namely Peking University, continuing with an M.S. at UCLA and with a Ph.D. in MSE at University of California, Berkeley. From 2015 to 2019 he was a Postdoctoral Fellow at Nanoscale Science and Engineering Center at the University of California, Berkeley.

At every step of his career Dr. Bao has exhibited excellence. Highlights of his PhD research include first-authored Science and Nature Communications articles and 3 major student awards: (i) The MRS Graduate Student Gold Award in 2015, (ii) the Nanometer Scale Science and Technology Division Student Award from the AVS, and (iii) an R&D 100 Award (R&D Magazine 2013). Dr. Bao continued to excel as a Postdoctoral Researcher at UCB, developing into a leading expert in electromagnetic numerical simulation, optical spectroscopy, materials physics, and quantum optics.

Dr. Bao's career continued to flourish as a faculty at University at University of Nebraska–Lincoln and RPI. He is a World leader in demonstrating quantum behavior at room temperature which carrier significant engineering promise, as opposed to approaches based on quantum effects manifesting themselves only at cryogenic conditions. He realizes room temperature quantum behavior by exploiting strong coupling between light and materials inside laser cavity. Dr. Bao also revealed himself as a profoundly caring, inspiring, and effective mentor. Two of his former mentees are now professors at leading universities and research institutions. Dr. Bao is a recipient of prestigious research awards including Army Research Office Early Career Award and NSF Career Award.

Please join us in congratulating Dr. Bao on his highly deserved promotion!

DID YOU KNOW?

We can trace RPI's own Materials Science and Engineering department back to a metallurgy breakthrough. In 1910, RPI professor Matthew Hunter developed the first process to produce 99.9% pure metallic titanium. Some of his early experiments took place on the institute's football field.



Matthew A. Hunter (b.1878 d.1961)
Dean of Faculty
Academic Head 1943-1949



View of Rensselaer campus looking east. Horse and buggy and '86 Field in foreground; '87 Gym, unfinished Quad and Russell Sage Dining Hall in background. Circa 1916.



Veronica Hausmann, PhD Materials Science & Engineering '22

"The foundational thinking I developed in the MSE department's thermodynamics and kinetics courses have been invaluable in my work."

Veronica Hausmann, PhD ('22)

Why did you choose RPI for your studies?
My undergraduate advisor suggested I reach out to Prof. Tomozawa, as I was already involved with research in glass/water interactions. I was excited for the opportunity to work on more fundamental research than my previous slow crack growth studies.

What RPI organizations are you a part of?
I was the seminar chair for the graduate student group in the MSE department. I also helped organize study groups with my fellow students preparing for their PhD qualifying exams.

What aspect of Materials Science are you passionate about?
I'm very interested in the connections between processes and properties in materials. I work with materials such as glass ceramics, which have sensitive responses to changes in melting, subsequent heat treatment, and additional strengthening techniques such as ion exchange. The foundational thinking I developed in the MSE department's thermodynamics and kinetics courses have been invaluable in my work.

How did your experience at RPI help you choose your career?
Glass is a relatively small field. RPI and Prof. Tomozawa's lab in particular helped form connections through conference opportunities and the establishment of a shared background with several of my coworkers at Corning. I also find the experience of remote study with limited access to the lab during the pandemic helped grow my skills of prioritization, experimental design, and long term thinking in a way that has benefitted me greatly at work. My current role involves a lot of international collaboration which is often remote.

What is your favorite part of being at RPI?
I formed some of my closest friendships with folks in the department and from RPI in general. In particular I stay in close contact with my lab mate Arron Potter, who I consider one of my closest friends. I often travel to visit the people I met during my time at RPI, whether they're still near Troy or have moved on to new things in other parts of the country.

How do you want to change the world?
What a daunting question! My technical work has made some impact. Over the past four years I've filed for three patents and published over twenty internal technical reports, all of which have contributed to the advancement of several key products. The glasses I've helped develop are on store shelves all around the world, which is very gratifying. I'm a transfemme Staff Scientist at a Fortune 500 company, which gives me the opportunity to be a role model and queer community liaison. I hope the largest impact I have is being a positive force for my local community and hopefully an example to others that being yourself is worth the risk and effort that it requires. If I am able to inspire or enable even just one person to be more themselves, that's how I would like to change the world.

What was your favorite memory of your time at RPI?
My favorite memory is getting to set up my first apartment away from home and share it with my incredible fiancée, Athena. We've been a couple for 14 years, but only began living together during my time at RPI. So many of my fondest memories involve us exploring Troy together during my studies. It helps to be passionate about one's field like I am, but my ambition and motivation to grow is entirely in service to the life we are building together.

Metallurgy and Society: How Metals Shaped Human History

Professor Dan Lewis, Materials Science and Engineering

I sometimes use the phrase "stone age" when I am dealing with a malfunctioning bit of modern technology. It's almost an expletive in my vocabulary. Scoffing, I mutter, "Stupid Stone Age phone." However, if I pause and think a bit, I realize that these "ages" each seem to be tied to a different material: stone, copper, bronze, and iron. If I get a bit more creative, I can tie our modern timeline to some technology (maybe even a modern materials technology) that embodies what is currently important to human civilization.

I wanted to know how metals came to be used by the earliest humans and what the emergence of these materials meant for civilization. For example, today I know that cobalt mining is a source of conflict in the Democratic Republic of the Congo. But, has conflict always been part of metallurgy? How does power in a civilization change when resources are scarce? I found myself wondering if I could answer these questions and whether our current and future students might be interested in finding out, too.

This spring, I'm going to launch a new course: "Metallurgy and Society." I designed the course for anyone curious about the story of how metals shaped civilization. No prior engineering background is required. I want to introduce the physical science of metallurgy at the same time as I present the history, economics, and ethics behind the use of metals in society.

Metal as Power

When I look through the history of metallurgy, I see a recurring connection between control of metal and control of power. Bronze required tin and tin was rare. It was traded across enormous distances in the ancient world. A kingdom without access to tin could not easily arm its soldiers or equip its farmers. Modern semiconductors depend on rare earth metals. Electric vehicle batteries depend on lithium, cobalt, and nickel. The map of who controls these materials increasingly shapes the map of global power. Tin played that same role four thousand years ago.

The Steel That Puzzled Scientists for Centuries

One of the stories that fascinates me involves swords forged in South Asia during the medieval period. The steel, known as wootz, was later reworked into blades called Damascus steel. It carried a rippling pattern in the metal and an edge sharp enough to become legendary. For centuries, no one could explain why these particular blades outperformed every other. Modern electron microscopy eventually helped solve a mystery that blacksmiths had guarded as a trade secret for a thousand years. The answer turned out to involve trace impurities in the ore. Vanadium, in particular, encouraged the formation of carbide bands during forging.

To me, materials science does not only build the future. As a microscopist, it also gives me a way to understand the past.

Corrosion, or Why Some Metal Lasts and Some Doesn't

A solid iron pillar has stood in Delhi, India, since roughly the fourth century CE. This pillar shows almost no rust. Researchers eventually traced its resistance to a thin protective layer on the metal's surface. High phosphorus content in the ancient iron produced that layer as a byproduct of the smelting process, rather than as a deliberate invention. I find examples like this especially interesting because corrosion science connects directly to RPI's own history.

RPI alumnus James A. Parsons Jr. graduated in 1922. He went on to lead the research laboratory at the Duriron Company. His team developed Durimet 20, an early corrosion-resistant stainless steel still used across the chemical industry today. Parsons was inducted into the National Inventors Hall of Fame in 2023.

What I Cover in the Course

In "Metallurgy and Society," I move chronologically through the history of metals. I start with the first copper tools and move through the Bronze Age, the Iron Age, medieval steelmaking, and the Industrial Revolution. I then bring the story into the modern world, ending with alloys such as stainless steel, titanium, and aluminum, along with the rare earth elements inside a cell phone.

We will explore the questions of control and cost; of the techniques available; what metal means to different cultures; and the human cost that comes with metallurgical advancements.

These questions are part of what makes metallurgy so interesting to me. When I study a metal, I am not just studying its chemistry or its microstructure. I am also studying the people, technologies, economies, and societies that developed around it.



Professor Daniel Gall's Thin Films and Nanostructures Laboratory Research Group:



Emma Sponga, Ethan Hendrix, Zahra Ahmadian, Sanzida Rahman, Sadiq Nishat, Mehedi Hasan Prince, Oishy Roy, Ariful Islam, Dr. Daniel Gall

The Thin Films and Nanostructures Laboratory at Rensselaer Polytechnic Institute uses ultra-high vacuum deposition equipment to take atoms and put them on surfaces to create new materials and nanostructures. We then measure their structure as well as their mechanical, electrical and optical properties.

For example, we study metal nanowires for future integrated circuits, explore atomic bonding in nitrides to design new hard and tough coatings, create new nitride semiconductors for thermoelectric waste heat recovery, or study atomic transport through nanopores to design self-lubricating coatings for bearings in fuel-efficient jet-engines and wind-turbines.

Learn more at Gall-lab

Rensselaer Polytechnic Institute Launches New Quantum Computing Minor to Prepare Next Generation of Quantum Professionals



The IBM Quantum System One at Rensselaer Polytechnic Institute, unveiled on April 5, 2024. Credit: IBM

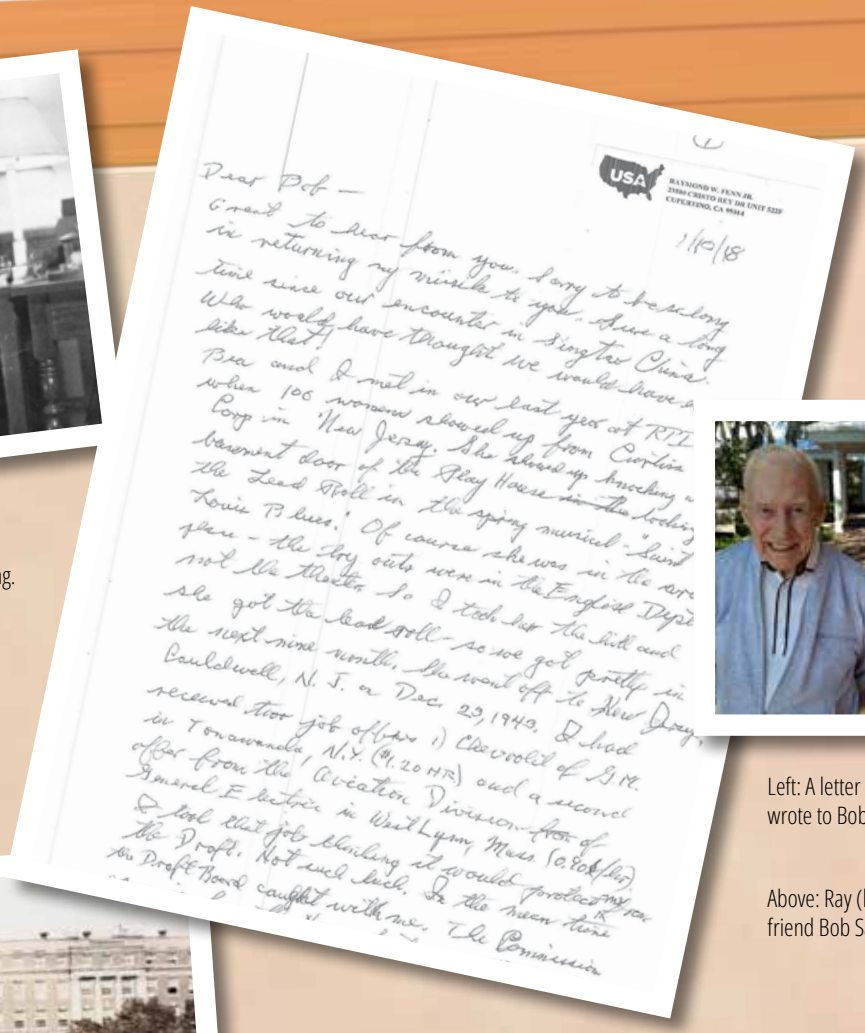
The School of Science at Rensselaer Polytechnic Institute (RPI) has launched a new minor in quantum computing, positioning students at the forefront of one of the most rapidly developing fields in technology. The minor leverages RPI's unique status as the first university in the world to house an IBM Quantum System One on campus, providing students with unprecedented access to utility-scale quantum computing technology.

The minor, which is now available to all currently enrolled students, requires four courses drawn from physics, computer science, mathematics, and engineering. The curriculum provides both theoretical foundations and practical exposure to quantum hardware and software, and gives students a leg up in a field rapidly approaching quantum advantage — the point at which quantum systems outperform classical computing approaches on meaningful tasks.

"The quantum computing minor will augment the training of RPI students with insight into an emerging technology that will reshape industries from pharmaceuticals to artificial intelligence," said Steven Tait, Ph.D., Dean of the School of Science. "With direct access to the IBM Quantum System One, our students will gain hands-on experience with cutting-edge tools that are not yet widely available. This minor equips them with the interdisciplinary foundation needed to understand and contribute to quantum-enabled innovation."



Above: Ray at his RPI desk
Below: The quad, Ray and Bea's wedding.



Dear Bob —

Great to hear from you. Sorry to be so long in returning my missile to you. Sure a long time since our encounter in Singapore China. Who would have thought we would have seen it like that?

Bea and I met in our last year at RPI when 100 women showed up from Curtiss Wright Corp in New Jersey. She showed up knocking on the basement door of the Play House in the lobby. She got the lead role in the spring musical "Saint Louis Blues." Of course she was in the English Dept. - the only outs were in the English Dept. not the theater. So I took her the script and she got the lead role - so we got pretty close the next nine months. She went off to New Jersey, Caldwell, N. J. on Dec 23, 1943. I had received two job offers 1) Chevrolet of G.M. in Tonawanda, N.Y. (81.20 HR) and a second offer from the Aviation Division of General Electric in West Lynn, Mass (0.90¢/hr) I took that job thinking it would protect me from the Draft. Not such luck. By the mean time the Draft Board caught with me. The Commission



Left: A letter that Ray wrote to Bob

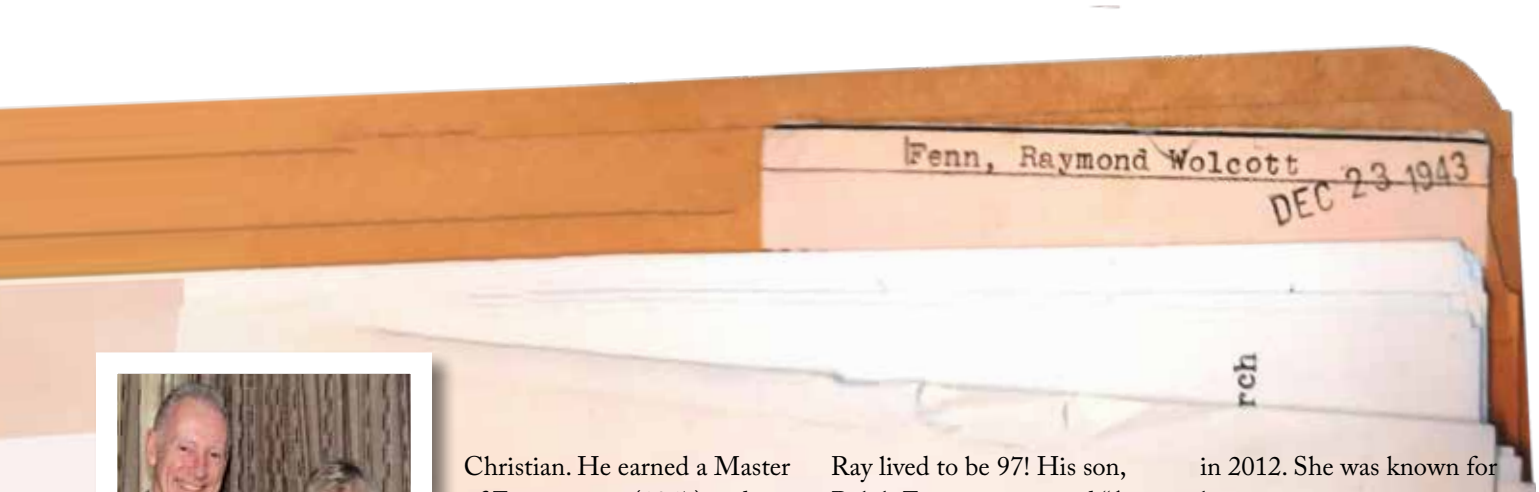
Above: Ray (l) meeting with old friend Bob Savage (r).





In 1943, Raymond Wolcott Fenn was in his last year at RPI getting a BE in Metallurgy Engineering, when he met his wife to be, Beatrice Christian. They met when 100 women showed up from the Curtiss-Wright Cadettes from New Jersey and knocked on the basement door of the Playhouse looking for auditions for the spring musical "Saint Louis Blues." The auditions were actually in the English Department, so Ray walked his future wife over there and she proceeded to get the lead role! She also was the first female cheerleader at RPI!

Ray was a communication officer on the staff of Vice Admiral Daniel Barby, 2nd ranking officer in the 7th fleet in the Pacific theater, where he met up with his roommate from Rensselaer Society of Engineers, Robert Eugene Savage, who was XO of an LST.





Raymond and Beatrice Fenn

In 1942, when the men were away, women stepped up to save the day. The Curtiss-Wright Corporation knew they needed more people to build military planes. More than 900 ladies were recruited to leave the universities they were studying at, and possibly their major, to learn aviation engineering. Curtiss-Wright partnered with seven colleges across the country, including Rensselaer Polytechnic and Cornell universities, and the women who were part of the program became known as Curtiss-Wright Cadettes. Bea was a Curtiss-Wright Cadette and later designed aircraft for the SeaBees.

Ray and Bea were married in 1946, and had 2 children, Carol Louise and Ralph Christian. He earned a Master of Engineering (1947) and a Doctorate of Engineering (1949) from Yale. His long career as a Metallurgical engineer was spent at General Electric (1943-44); Dow Chemical Company (1949-1961), and Lockheed Missiles & Space Company (1961-87).

Fenn also Served with United States Naval Reserve, 1944-1946; Fellow American Society Metals (trustee 1969-1971, chairman, member Executive Committee SantaClara Valley chapter 1966-1969); Member American Society Testing Materials (director 1966-1969, R.E. Templin award 1961). Also American Institute Mining and Metallurgical Engineers, Research Society American, American Welding Society, Society Manufacturing Engineers, Society for Advancement of Material and Process Engineering (chairman Northern California chapter 1973-1974, national director 1974-1976, 2nd vice president 1976-1977, 1st vice president 1977-1978, president 1978-1979), National Management Association, Sigma Xi.

Ray lived to be 97! His son, Ralph Fenn, commented "As he mentioned at least once, "I have had a good life." He was always the optimist. Always with a ready smile." Bea passed in 2012. She was known for her creativity as a musician, artist, and poet. She was principal bass player with the Peninsula Symphony and several other orchestras.



Raymond F. Fenn, Jr.
1400 W. Parkway Dr.
Midland, Mich.
Telephone TEmple 5-6505

(ge: 29 years: married, 2 children

EDUCATION

Doctor of Engineering (Metallurgy) Yale University, 1949
Master of Engineering (Metallurgy) Yale University, 1947
B. of Met. Engineering, Rensselaer Polytechnic Institute, 1942

EXPERIENCE (1½ years in Research and Development)

1949-1961 Dow Chemical Co., Dow Metal Products Div.
Metallurgical Laboratory, Midland, Mich.

1958-1961 Chief, Testing and Instrumentation Section

Responsibility: 15 employees
Initiate and supervise research and development on test methods, instrumentation, and effect of metallurgical variables on mechanical properties at room, elevated and cryogenic temperatures

Member, Research Policy Committee

Participate in research policy decisions

-1958 Supervisor, Testing Laboratory

Group Leader, Design Section

Supervise Testing Laboratory, working on such things as Mg, Al, steel, plastics, concrete, sandwich constructions, metal to metal adhesive bonds, honeycomb panels, wear problems, etc. Assess mechanical property data requirements of missile and aircraft industry; Initiate research programs to fill these requirements; Develop new elevated temperature test methods; advise other laboratory sections and outside departments on testing problems

1952-1956 Project Leader, Design Section

Evaluate new Mg alloys for use in missiles and conventional aircraft

1949-1952 Research and Development Engineer, Corrosion Research

Study purification of Mg and the effect of impurities and alloy additions on the corrosion characteristics of pure Mg and Mg alloys

Ray lived to be 97! His son, Ralph Fenn, commented "As he mentioned at least once, 'I have had a good life.' He was always the optimist."

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