

MAX-NUCLEAR QUARTERLY

Materials at Extremes-Nuclear at Queen's University Newsletter



A LOOK INSIDE THIS ISSUE:

1. 2024 Highlights

- UNENE R&D event winners
- Profs. Daymond, Persaud and Mabee's SMR program grant
- Welcome CERC Prof. Yanwen Zhang

2. Upcoming Events

- CNA Conference & Trade Show 2025
- 49th CNS/CNA Student Conference

3. Industry News

4. Meet the MAX-Nuclear Team: Students & Researchers

5. Job Board, Snapshots & Announcements

WELCOME FROM PROF. MARK DAYMOND

As we start 2025, I want to wish you a Happy New Year and welcome you to this inaugural issue of Materials at Extremes - Nuclear (MAX-Nuclear) Quarterly. The goal of this newsletter will be to inform you of what is happening at Queen's, covering our research into the mechanics, irradiation, modelling, analysis, and corrosion of materials used for nuclear power production. In addition, you will get to meet some of the fantastic team of graduate students and postdoctoral researchers who are carrying out projects in our laboratories.

Last year was a significant one for Queen's MAX-Nuclear, with highlights including the arrival of Prof. Yanwen Zhang, our new Canada Excellence Research Chair, and hearing that our new CFI supported project Microscopes and Ions for Small Modular Reactors (MISMR) had been funded. MISMR will bring \$20M of new facilities that will expand and build on the state-of-the-art equipment already available at the Reactor Materials Testing Laboratory (RMTL). 2024 was also a major year for nuclear power in Canada, with the announcement of the successful refurbishment of Ontario Power Generation units at Darlington ahead of schedule, continuing work on the Darlington site in preparation of installation of the new GE-Hitachi Small Modular Reactors (SMR), and news of a planned expansion of Bruce Power's medical isotope production capabilities.

We look forward to bringing you some of the groundbreaking research, innovative projects, and collaborative efforts taking place within our community. From cutting-edge developments in coatings, to insights into environmental degradation, to breakthroughs in understanding irradiation resistance in materials, we will showcase the remarkable work happening here at Queen's and beyond. Thank you for joining us as we kick off this exciting new chapter of Queen's MAX-Nuclear.

Here's to a year of discovery, innovation, and collaboration!

Mark

Mark R. Daymond, PhD, PEng, Professor



2024 HIGHLIGHTS

Queen's students bagged awards at UNENE R&D 2024

Razieh Larki (PhD student) and Richard Meng (Master's student), from the Queen's nuclear groups, won top honors at the UNENE Annual R&D Workshop 2024 Student Symposium, which took place in Toronto, Ontario, on December 9-10, 2024. Larki won Poster 1st Prize for her presentation on "Pb-induced SCC of Fe- and Ni-based alloys in high temperature caustic environments", while Meng was awarded Best 7-Minute Thesis for his presentation on "Modelling molten salts and other nuclear materials".

When asked about her winning presentation, Razieh Larki stated, *"My research investigation focuses on Pb-SCC susceptibility of Alloys 800, 690 and 600 in high temperature high pressure using static autoclave."* She added that the valuable opportunity to network with peers from different universities and engage with industry people to talk about their research and future findings was one of the highlights of the UNENE event.



Razieh Larki receiving her award



Richard Meng delivering his thesis

In particular, Richard Meng's Best 7-Minute Thesis presentation on "Modelling molten salts and other nuclear materials" explored a method that can significantly lower the costs associated with preparing such models. Speaking about his competition experience and highlights of the event, Meng emphasized, *"This year, having a presentation rather than a poster, I was able to see the research of more students and also capture some great moments in photo. One of the highlights, in my opinion, was the poster session which was far bigger than in prior years and had a greater variety of schools and attendees. Additionally, compared to previous years, the panel-based sessions allowed for more audience participation and a more engaging environment."* Meng also shared his key conclusions from the conference. *"As evidenced by the larger conference this year, nuclear is indeed growing fast. Future work is still essential though, especially when focusing on the younger generation of engineers and researchers who will need to eventually succeed the older generation. Another personal takeaway is the importance of communication and presentation in general. Perceived confidence and momentum is a huge component. In believing in one's own ability, one actively improves it—a self-fulfilling prophecy of sorts,"* he stressed.

Razieh and Richard, congratulations on your well-earned awards!

For event recap and photos of the UNENE Annual R&D Workshop 2024, visit the [UNENE website](#).

2024 HIGHLIGHTS

Grant from Natural Resources Canada's Enabling Small Modular Reactors (SMR) program

Profs. Mark Daymond and Suraj Persaud in Mechanical and Materials Engineering, and Prof. Warren Mabee in Policy Studies have received a multi-disciplinary grant from Natural Resources Canada's Enabling Small Modular Reactors (SMR) Program.

Profs. Mark Daymond and Suraj Persaud in Mechanical and Materials Engineering, and Prof. Warren Mabee in Policy Studies have received a multi-disciplinary grant from Natural Resources Canada (NRCan) to look at issues around dry storage of small modular reactors (SMR) fuel, and to conduct a techno-gap / life cycle assessment to enable effective SMR deployment. The grant is part of NRCan's \$13.6 million funding for nine research projects under the Enabling Small Modular Reactors (SMR) program, of which Queen's University is a recipient.

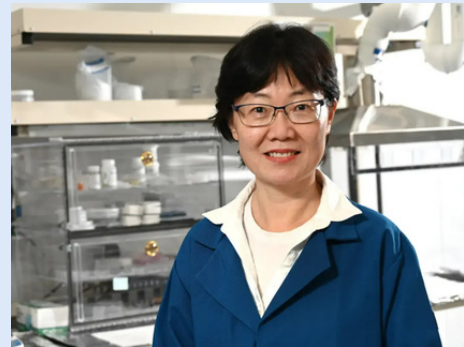
With a total of \$935, 542 in funding and leveraging the state-of-the-art Reactor Materials Testing Laboratory (RMTL) facility's irradiation capabilities, Profs. Daymond and Persaud will look at the combined effect of environment and radiation on the degradation of materials proposed for casks for short term storage of fuels. Prof. Mabee will look at the supply chains related to SMR deployment, including identifying opportunities and applications for heat and electrical production from SMRs.

Enabling Small Modular Reactors (SMR) program is part of NRCan's research and development initiatives to bringing clean energy to more Canadians.

For more information about the program, visit the [NRCan website](#).

Gazette interview with Prof. Yanwen Zhang, Canada Excellence Research Chair (CERC) in Impact of Radiation in Energy and Advanced Technologies

Shared from [The Queen's Gazette](#).



Prof. Yanwen Zhang

Amidst the global push for climate action, the spotlight intensifies on nuclear energy as a pivotal player in the low-carbon revolution. Canada and Ontario, already relying significantly on nuclear power, face an escalating demand for expansion, amplifying the urgency for innovative solutions to address the stress on existing systems and propel new developments in the nuclear energy sector.

Yanwen Zhang, a globally renowned nuclear materials scientist, has been appointed as the Canada Excellence Research Chair in Impact of Radiation in Energy and Advanced Technologies and will join the Department of Mechanical and Materials Engineering at Smith Engineering in May. Her chair, valued at \$8 million over eight years, will fuel research that has the potential to enhance the efficiency, reliability, safety, and cost-effectiveness of nuclear energy systems, making a significant impact on multiple sectors and advancing Canada's and Queen's international expertise in materials research and innovation.

[READ MORE](#)

UPCOMING INDUSTRY EVENTS

CNA Conference and Trade Show 2025 April 15-17, 2025 | Rogers Centre Ottawa



Student Program

Student Program The Canadian Nuclear Association would like to give students an all-expenses paid opportunity to attend our 2025 Conference and...

 CNA2025 / Oct 23, 2024

Student Program application deadline: January 31, 2025
For more information and to register, visit the [CNA website](#)

49th CNS/CNA Student Conference June 8-11, 2025 | Westin Harbour Castle Hotel Toronto



Registration 2025

Home Attend Accommodation Call for Papers
Program Plenary Program Technical Program Student
Conference Hamburger Toggle Menu Home Attend...

CNS Annual Conference 2025

Early bird registration deadline: April 30, 2025
For more information and to register, visit the [CNS Conference website](#)

INDUSTRY NEWS



Pickering (Image: OPG)

OPG SAYS GOODBYE TO PICKERING 4

Shared from [World Nuclear News](#).

Ontario Power Generation's Pickering Unit 4 was permanently shut down as planned at the end of 2024.

"As the year comes to a close and Pickering Unit 4 is removed from service, we extend our gratitude to the thousands of workers who have contributed to its legacy since 1973. For decades, it has played a vital role delivering safe, reliable, and low-carbon electricity for Ontario," [the company said on X](#).

[READ MORE](#)

ONTARIO EXPLORES POTENTIAL NEW GENERATION SITES

Shared from [World Nuclear News](#).

The provincial government has told Ontario Power Generation to begin discussions to determine community support for all types of new energy generation, including nuclear, at three sites in the southern part of the province.

Ontario's Independent Electricity System Operator has said the province's demand for electricity is forecast to increase by 75% by 2050 - the equivalent of adding four and a half cities the size of Toronto to the grid, the Government of Ontario said.

[READ MORE](#)



Lambton, Nanticoke, and Wesleyville are already zoned for electricity generation (Image: OPG)

SPOTLIGHT: MEET THE MAX-NUCLEAR TEAM

Kevin Daub, PhD

Senior Research Associate



I obtained my BSc in chemistry at Western University (2007), and my PhD in chemistry from Western University (2013), under the supervision of Dr. Clara Wren, studying the effects of gamma radiation on carbon steel corrosion. Following my PhD, I worked at Canadian Nuclear Laboratories for 5 years and had a great working experience, having had the chance to work on projects that spanned nuclear plant chemistry and materials issues. While living up further north, I picked up curling, eventually winning the Club Championship at the Deep River Curling Club and have continued curling in Kingston at the Royal Kingston Curling Club.

I have been working with the nuclear materials group for 6 years. Over those years, we have refurbished lab spaces and started up a number of unique corrosion experimental systems at Queen's. Working with graduate students, we have developed numerous systems that encompass aqueous, gaseous, and molten salt corrosion in a short period of time, even facing the many barriers of COVID. It is always great to start with every new student, starting with a general idea and goal of a project, and begin to plan out and design experiments following logical routes of discovery.

We are all seeing the potential for substantial growth in the nuclear industry, and I look forward to the new ideas and challenges that might be raised with that growth. It is also very exciting how integrated the nuclear materials group is, in that many of these new challenges require an interdisciplinary approach, and we have great experience of combining expertise across our corrosion group, with those studying irradiation damage, characterization, and modelling.



Fei Long, PhD

Research Associate

I finished my undergraduate and Masters' degree in China, and my PhD degree at Queen's University. I joined the nuclear materials group back in 2010 as a PhD student. Fourteen years later, I'm still with Queen's working with the research group. Through the years, I've witnessed the dramatic expansion that the nuclear materials research group has had on both faculty members and research capabilities. It is exciting to be part of a team that educates future research scientists and engineers in the nuclear industry.

At RMTL, you will find me busy working with students on different instruments to run various tests or doing cool electron microscopies. RMTL is a great place with knowledgeable professors, friendly coworkers, and is equipped with a full suite of instruments for nuclear research.

One of my favorite research areas is on the formation of hydride in zirconium alloys and its impact on structural properties. I am excited to expand my research to the mechanical side of the hydrides impact-- through applying high resolution digital image correlation to reveal deformation behavior that occurred at micron scale.

Over the years I had opportunities to work with professors in the research group and witnessed many students graduate and join the Canadian nuclear industry. I really look forward to seeing new research areas being developed in our group and making a global impact on fundamental materials research.

SPOTLIGHT: MEET THE MAX-NUCLEAR TEAM



Nathan Jones

Master of Applied Science candidate

I am originally from Kingston. Haven't made it too far yet! I did my undergraduate degree at Queen's in mechanical and materials engineering. After my third year, I worked at 3M in Brockville for a 12-month internship as a product development intern.

In my final year of undergrad at a "Nuclear info night", I learned about the nuclear group. The research interested me, and it seemed like they had good industry connections. I had a conversation with Prof. Mark Daymond, and he was very convincing, so I applied.

I started in September 2024, so I'm still quite new. I was able to attend the UNENE R&D Workshop in December 2024 which gave me a comprehensive view of nuclear engineering in Canada. I'm looking forward to making lifelong connections and contributing some new knowledge to the field!



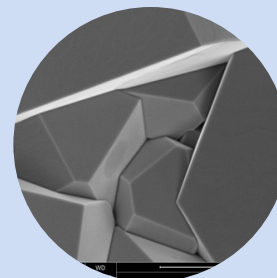
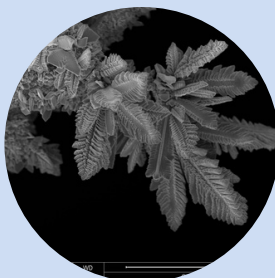
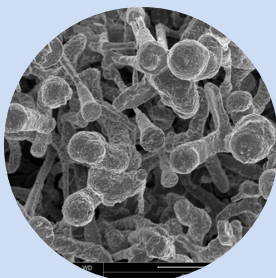
Benjamin Hackett

PhD candidate

I started my masters in 2021, after completing my undergraduate degree in mechanical engineering at Queen's. I enjoyed my thesis topic so much that I upgraded to a PhD in January of 2023. My research is focused on the corrosion of copper by hydrogen sulfide, for application the disposal of used nuclear fuel in deep geological repositories.

One of the highlights of my nuclear materials studies is presenting my research at national and international conferences, giving me the opportunity to meet and discuss with industry professionals and build connections.

I have had the opportunity to use state of the art characterization techniques, but my favourite days are when I get to use the scanning electron microscope (SEM) at the RMTL. I never know what I will see in my samples, such as these nice SEM images I'm sharing.



SPOTLIGHT: MEET THE MAX-NUCLEAR TEAM

Ebrahim Mansouri, PhD

Postdoctoral Researcher



I am originally from Iran and recently completed my PhD at the prestigious KTH Royal Institute of Technology in Sweden. My doctoral research is focused on the intricate interplay between atomic-scale processes and the macroscopic behavior of materials under extreme irradiation conditions, specifically in iron-based alloys and oxides. A significant milestone in my career was being honored with the Sigvard Eklund Prize for the best PhD thesis in Sweden in 2024. This prestigious award, bestowed by the Swedish Centre for Nuclear Technology (SKC), recognizes exceptional contributions to the field of nuclear technology. Beyond academics, I find solace in the dynamic sport of tennis and the serene pursuit of cycling. During my time in Sweden, cycling became an integral part of my lifestyle, providing a sustainable mode of transportation while promoting physical and mental well-being.

I was drawn to Queen's University by its renowned nuclear materials research program and the state-of-the-art facilities at the Reactor Materials Testing Laboratory (RMTL). The RMTL's cutting-edge equipment allows for the simulation of radiation damage and the investigation of material behavior under extreme conditions. This provides invaluable insights for the development of safe and efficient nuclear energy technologies. One of the most compelling aspects of RMTL is how closely my research background aligns with the work being conducted there. This alignment strongly attracted me to the RMTL and Professor Yanwen Zhang's research.

I eagerly anticipate contributing to the research group at Queen's University and applying my expertise to advance our understanding of material behavior under irradiation. I am also excited to immerse myself in the vibrant Canadian culture, explore the beautiful landscapes, and forge lasting friendships.

JOB BOARD



MAX-Nuclear at Queen's University hiring Queen's University - Postdoctoral...

Posted 8:39:21 PM. We are looking for an enthusiastic candidate for postdoctoral position(s) ...

 LinkedIn

[View job posting HERE](#)

SNAPSHOTS AND ANNOUNCEMENTS

UNENE R&D
Workshop
2024



Corrosion Group's
annual Frontenacs
game outing

CONGRATULATIONS
to our
recent graduates!

Adil Shaikh
Yubin Zhao
Amir Ghorbani
Mayank Arora
Zachary Stenstrom
Lucas Ravkov



follow us on



[LinkedIn](#)