



Hawai'i Natural Energy Institute Research Highlights

Advanced Materials

UH and UW Materials Research and Education Consortium (MRE-C)

OBJECTIVE AND SIGNIFICANCE: The objective of the University of Hawai'i (UH) and University of Washington (UW) Partnership for Research and Education in Materials (PREM) program is to develop foundational knowledge about advanced nano-to-microscale defect-bearing and doped materials and the properties controlling their unique behaviors, and investigate their use for future energy technologies. If successful, the project would develop the foundation necessary for increasing participation in materials science and STEM at undergraduate and later graduate level by underrepresented groups (URGs), enabling diverse student participants to perform research at the frontiers of the world's greatest materials research challenges.

BACKGROUND: This project is focused on increasing Materials Science and STEM participation by unique URGs – in particular, Native Hawaiians and Pacific Islanders (NHPI), women, and Veterans to equity – by creating a pathway that recruits and retains participants and keeps them on track towards degree attainment. The Seed PREM is configured to capitalize on synergistic expertise and exceptional resources in materials syntheses and characterization available at UH and UW to create close interdisciplinary research collaborations emphasizing the education and training of a diversified next generation of scientists and engineers.

The project research on defect-bearing and doped materials is organized into four thrusts aligned with UW's Materials Research Science and Engineering Center Interdisciplinary Research Groups (MRSEC IRGs): 1) dopant control in boron compounds for tailored gas sorption; 2) defect modeling, characterization, and engineering in ordered vacancy compound chalcopyrites for photovoltaic applications; 3) the role of hydrogen in the chemistry of proton-irradiated solids; and 4) strain control of electronic and magnetic properties of solid materials. The results of this research will lead to new materials and the understanding of new phenomena critical for solving emerging needs in energy storage and durable space technologies.

PROJECT STATUS/RESULTS: The research and education initiatives are targeted to encompass: strong student dual-mentoring by both UH and UW senior participants, annual in-person faculty/student

summer research exchanges complimented by regular virtual exchanges, UH-UW co-development of teaching materials, and an annual student symposium.



Figure 1. Student presentation during 2022 summer research experience at UW.

The main focus of the last year was the retainment of students in the four research thrusts through the full realization of M.O.R.E. strategy, encompassing mentoring (M), outreach (O), materials research (R), and materials science education (E). The student research activities were focused on design and syntheses of materials and/or characterization of the materials using general lab equipment and specialized instruments. A total of 24 UH-UW exchanges have assisted with students' retainment on the partnership to date, including 8 student exchanges during this period.

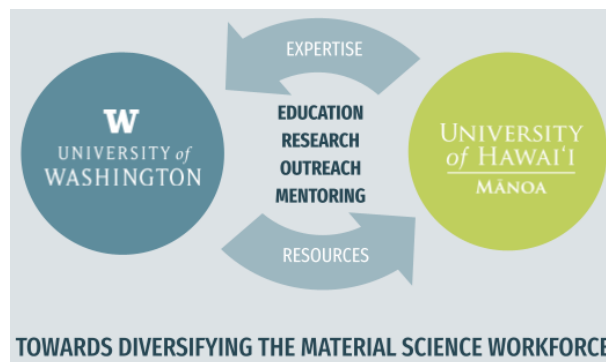


Figure 2. Strategy and goals of the PREM program.

In March 2023, a two-day MRSEC faculty exchange visit to UH occurred. The visit focused on accelerating and expanding research and education activities in the PREM thrusts. Student research presentations, informational sessions for students, and UH campus laboratory and facility tours also took

place over these two days. Fifteen faculty members from UW and UH spanning seven various disciplines, along with UH's Provost, attended these meetings. During this visit, the need for location-based research and education in the PREM to solve Hawai'i's materials challenges was seen as an important area to consider moving forward.



Figure 3. MRSEC faculty exchange visit in March 2023.

The PREM outreach efforts for building and sustaining the URG pipeline into materials science and STEM at UH continue to be based on a bottom-up strategy centered on active engagement of Hawai'i schools to spark early interest in STEM and materials science. Hence, we expanded our outreach activities to five public schools ('Ilima Intermediate, Kaiser High, Radford High, UH Laboratory School, and Waipahu High) to complement our continued outreach efforts to Kamehameha Schools.



Figure 4. PREM research student outreach efforts during a K-12 student visit.



Figure 5. PREM faculty and students participating at the 2023 Kamehameha Schools' science fair.

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