PURDUE UNIVERSITY | School of Nuclear Engineering

Nuclear Engineering Seminar

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Wednesday, February 8, 2023

3:30pm | WALC 1018

Overview on Betavoltaics and Improvements on Tritium Storage for Betavoltaic Films

Abstract

Betavoltaics are used in applications that were previously not deemed feasible due to limitations of chemical batteries in temperature and chemical instability. Betavoltaics are a maturing technology due to interest in commercial, as well as military applications. A recent resurgence in interest in betavoltaics is due to the recent advance and widespread use of ultra-low power electronics.

This seminar will highlight betavoltaic operations and their current applications, as well as projected applications that can be realized through our research, such as burst power. Betavoltaics were demonstrated at Purdue University to not suffer power loss from temperature cycling, an issue that persists in chemical batteries. In addition, we focus on improving the performance on betavoltaics, particularly in the source. Commercial betavoltaics currently utilize titanium as a tritium storage substrate. The Multiphase Fuel Cell Research Laboratory explores the viability of other storage substrates, such as lithium and aluminum. These substrates are evaluated in our state-of-the-art hydrogen loading system that simulates tritium loading to observe their ability to absorb hydrogen/tritium. These substrates are then simulated in MCNP to project betavoltaic performance in the future.

Darrell Cheu is a PhD candidate at Purdue University. He received his B.S. in Nuclear Engineering from Purdue University in 2016 and his M.S. in 2018. He is currently seeking his Ph.D. while performing research at the Multi-Phase Fuel Cell Research Laboratory (MFCRL). His research interests include Direct Energy Conversion in Radioisotope Power Systems and interactions within Hydrogen-Metal systems. He seeks to improve the performance of betavoltaic cells and implement their use in a wider variety of applications such as powering cardiac pacemakers and sensors in hard to reach places such as spent fuel casks and deepwater applications.