PURDUE UNIVERSITY | School of Nuclear Engineering

Nuclear Engineering Seminar

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Refractory Metals: Hard, High-Z, Hip? Some High-resolution Highlights

Abstract

Refractory metals (Zr, Nb, Hf, Mo, Ta, W, Re, V, etc.) are elements with high melting points and hardness, making them attractive for extreme environment applications. Refractory metals are receiving renewed interest for high temperature radiation environments, such as those in future advanced nuclear reactors and nuclear fusion reactors. Tungsten (W), for example, is likely to be used as a plasma-facing component in future nuclear fusion reactors for its high melting point and good thermal conductivity. However, issues persist regarding its brittle nature, fabricability of complex geometries, and fundamental questions of radiation damage in novel refractory alloys. This talk will discuss recent work in the CHARISMA Lab at UNM deciphering structure-processing relations regarding alloying and advanced manufacturing techniques to enhance properties and ion irradiation effects in complex refractory alloys and composites. We will highlight irradiation-induced damage in additively-manufactured tungsten-based composites and refractory compositionally complex alloys (CCAs), with a focus on the insights gleaned from electron microscopy and in situ materials characterization. We will also highlight the impacts of in situ ion irradiation compared to ex situ irradiation and the importance of understanding the holistic environments of both experimental conditions.

Dr. Eric Lang is an Assistant Professor in the Nuclear Engineering Department at the University of New Mexico (UNM) leading research on ion-materials interactions, advanced characterization, and micromechanical testing, with a focus on materials for future nuclear reactors in the CHARISMA Research Group. The current research interests of the group include refractory metal design and synthesis, low energy ion-materials interactions, designing lightweight fusion neutron shields, modelling of Z-pinch plasma instabilities, coupled stress+irradiation performance of steels, radiation tolerance of 2D materials, and irradiation response of metal hydrides. He reignited the NE 485/515 Fusion Engineering course in the department at UNM and advises senior design groups on fusion projects related to a dense plasma focus and MCNP modelling of shielding and activation considerations in tokamak geometries. He joined the Nuclear Engineering Department at UNM in August 2022, following a post-doctoral position at Sandia National Laboratories. He earned his doctorate and master's degrees in Nuclear, Plasma, and Radiological Engineering from the University of Illinois – Urbana Champaign, and a bachelor's degree in Engineering Physics from the same institution. He holds memberships in the American Nuclear Society, Materials Research Society, The Minerals, Metals, and Materials Society, and the American Physical Society.