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TMS 2025
154th Annual Meeting & Exhibition

March 23–27, 2025
MGM Grand Las Vegas
Hotel & Casino
Las Vegas, Nevada, USA
#TMSAnnualMeeting

SUBMIT AN ABSTRACT FOR THE FOLLOWING TMS2025 SYMPOSIUM:

NUCLEAR MATERIALS

Elucidating Microstructural Evolution Under Extreme Environments

Extreme environments such as irradiation, high temperature, stress, corrosion, or a combination thereof, are known to produce point defects (interstitials and vacancies) in materials that can evolve into extended defects such as voids, stacking fault tetrahedra, and dislocations. The progression of defects plays a key role in microstructural and microchemical changes such as swelling, precipitation, and grain boundary segregation/depletion, which severely affect the mechanical and physical properties, functionality, and performance lifetime of the material for structural applications. To meet industry standards, testing of nuclear materials requires innovative solutions and surveillance concepts. Creative experimentation and modeling in needed to resolve technology gap through pre-normative R&D of codes and standards that suits industry. Impressive progress has recently been made in elucidating the nature and population of defects and the associated microstructural evolution through advanced characterization such as (not limited to) high resolution scanning transmission electron microscopy (HR-STEM), atom probe tomography (APT), synchrotron X-ray and neutron scattering analysis, positron annihilation spectroscopy (PAS), and sophisticated modeling (density functional theory, molecular dynamics, and phase field), as well as artificial intelligence and machine learning (AI/ML) tools. But there remains an increasing need to improve advanced data analytics coupled validation approach for understanding fundamentals of defect evolution and its impact on materials properties and performance in extreme environments. This call also encourages discussion on the latest technological innovations which will connect fundamental evolution to deployment of materials that serve the nuclear industry. This symposium primarily focuses on the development of new techniques/modeling tools needed to promote discussion on defects in materials, and evolution of material structure in extreme environments. It will bring experts and leaders from academia, national labs and industries.

Topics of interest include, but are not limited to:
- Role of external stimuli in generation and evolution of defects.
- Advanced techniques for characterizing structure and chemistry of defects.
- Modeling and simulation tools for understanding evolution of defects.
- Machine learning for predicting evolution of defects in simple model alloys to complex multicomponent systems such as high entropy materials.
- Linking fundamentals of microstructural evolution to industrial applications

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