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ANAHEIM CONVENTION CENTER & ANAHEIM MARRIOTT
ANAHEIM, CALIFORNIA, USA
#TMSAnnualMeeting

SUBMIT AN ABSTRACT FOR THE FOLLOWING TMS2022 SYMPOSIUM:

NUCLEAR MATERIALS

Materials Systems for the Future of Fusion Energy

The recent National Academies report on "Bringing Fusion to the U.S. Grid" has established an ambitious goal of producing net electricity in a nuclear fusion pilot plant by 2040. Scientific and technical innovations in materials for plasma facing components, structural and functional materials, high temperature superconducting magnets, and the tritium fuel cycle were recognized as essential components to achieving this critical milestone in carbon-free energy production. Exposure of materials to fusion plasmas and their ensuing property degradation has long been recognized as one of the most important challenges facing the future of fusion energy. Bulk damage in structural and blanket materials from aggressive neutron fluxes combined with surface damage on plasma facing components from the high flux, high fluence plasma conditions will ultimately limit material stability, and in turn, component, and sub-system lifetimes. A fundamental understanding of the coupling between near-surface phenomena and bulk microstructure evolution under fusion relevant conditions, and its implications for materials performance and sustainability, are thus key scientific drivers for future innovations in fusion materials.

This symposium aims to broadly discuss fusion materials research and the fundamental physics of materials degradation under separate effects testing and coupled extremes involving elevated temperature, stress, irradiation (ion and neutron), plasma exposure, and oxidizing environments. Talks are solicited that cover new structural and functional materials systems, fusion specific applications of materials, fundamentals of radiation damage, novel in situ techniques and other testing approaches, and advances in modeling and theory for fusion materials.

Topics of interest include, but are not limited to:

- Reduced activation ferritic/martensitic steels, tungsten and refractory alloys, composites and functionally graded materials, and novel radiation-resistant materials including compositionally complex alloys and interface engineered materials. Findings using novel model material analogues for fundamental mechanism exploration are also of interest
- Advanced manufacturing methods that enable scalable, cost-effective fabrication of fusion reactor components, including but not limited to novel powder metallurgy, additive manufacturing, solid state processing, simulations-informed alloy design and processing, etc.
- Irradiation effects and synergistic effects under coupled extremes using neutron sources, accelerators, multi-ion beams, environmental test cells, and other tests systems including in situ and in operando techniques and innovative algorithms for high-throughput characterization
- Consideration of off-normal events and associated safety hazards such as the aggressive thermal oxidation and decomposition of plasma facing components in case of air ingress accidents
- Multiscale modeling and simulation of radiation effects including the fundamentals of gas behavior, design of radiation-resistant materials, and integrated studies on materials performance
- Cross-cutting materials science for fusion and fission including fusion prototypic neutron experiments for probing materials degradation toward fusion conditions

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