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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

Meeting Materials Challenges for the Future of Fusion Energy

With the establishment of the Bold Decadal Vision for Commercial Fusion Energy, scientific and technical innovations materials have been thrust to the forefront of the critical needs if the community is to succeed along this ambitious timeline toward carbon-free energy production. The fusion environment inevitably exposes materials to high heat, neutron, and particle wall loading that collectively induce damage in plasma facing, structural, and blanket materials, ultimately limiting their operational lifetimes. A fundamental understanding of the synergy between plasma, neutron, and thermal loads under fusion-relevant conditions, and its implications for materials stability and performance, are key scientific drivers for future innovations in fusion materials. This is the second iteration of the symposium on Materials Systems for the Future of Fusion Energy, which was first held at the TMS 2022 Annual Meeting & Exhibition. This symposium aims to broadly discuss fusion materials research and the fundamental physics of materials degradation under elevated temperatures, transient heat loads, stresses, irradiation, plasma exposure, and oxidizing environments. Talks are solicited that cover new structural and functional materials systems, fusion specific applications of materials, fundamentals of environmental damage, novel characterization and testing approaches, and advances in modeling and theory for fusion materials.

Topics of interest include, but are not limited to:

- Plasma-facing and structural materials, but findings using novel model material analogues for fundamental mechanism exploration are also of interest.
- Functional materials, particularly the development and characterization of breeder materials, neutron multipliers, coatings and barriers, magnetic materials, and auxiliary system materials.
- The effects of irradiation and environmental damage typical of, or extrapolatable to, conditions encountered in nuclear fusion.
- The influence of transmutation products on microstructure evolution and thermo-mechanical property degradation.
- Tritium retention and interaction with materials.
- Multiscale modeling and simulation of fusion phenomena and material interactions, such as in the processes of plasma contamination and erosion.
- 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.
- 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.

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