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TMS 2026

155th Annual Meeting & Exhibition

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San Diego Convention Center
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San Diego, California, USA
#TMSAnnualMeeting

## SUBMIT AN ABSTRACT FOR THE FOLLOWING SYMPOSIUM

### MATERIALS DEGRADATION AND DEGRADATION BY DESIGN

# Environmental Degradation of Multiple Principal Component Materials

Multiple principal component materials seek to utilize configurational entropy to stabilize disordered solid solution phases. The most well-known materials in this novel class include multi-principal element alloys (MPEAs), high-entropy alloys (HEAs), and high-entropy ceramics (HECs). The numerous combinations of constituents in such materials represent a huge but under-explored chemical space and offer considerable freedom in the material design. Among a wide range of material properties observed based on the compositions selected and microstructures developed, the exceptional degradation resistance of some MPEAs and HECs suggests potential applications in severe and extreme environments, while others exhibit reduced environmental durability. This variation in behavior demonstrates that gaps in knowledge still exist regarding the effects of individual elements and their combined effects on reactivity. One can expect more complex processes to occur in the multicomponent systems, including selective oxidation and dissolution of various elements, possible nonstoichiometric oxides and nonequilibrium defect formation, and complicated synergies between materials and the environment. For these reasons, the current models lack the capabilities to fully understand and predict degradation processes in multi principal component materials.

This symposium will provide a platform to discuss and present recent experimental investigations on environmental degradation behavior, novel characterization methods development, and advanced theoretical modeling and computational simulation.

Themes of interest include, but not limited to:

1. Aqueous and high temperature corrosion, oxidation, and electrochemistry studies of multicomponent materials such as high entropy alloys, ceramics, and intermetallic compounds under various corrosive environments.
2. Thermodynamics and kinetics of formation and growth of secondary phases including oxide and phase separation in multi-principal elements alloys and high-entropy ceramics.
3. Interaction of mechanical stresses and corrosive environments, such as stress corrosion cracking, corrosion fatigue, and tribocorrosion.
4. Interaction of ion irradiation and corrosive environments, such as irradiation affected corrosion and irradiation-assisted stress corrosion cracking.
5. Hydrogen pick-up and embrittlement.
6. Degradation of HEAs in molten salts and liquid metals.
7. In situ and ex situ electrochemical analysis of oxidation and corrosion kinetics.
8. Advanced characterization on the structure and composition of oxidation and corrosion products.
9. Multiscale modeling and computational simulation, including density functional theory, molecular dynamics, kinetic Monte Carlo, CALPHAD, and phase-field methods.
10. High-throughput materials design, synthesis, tests, and characterization.
11. Database and machine learning model developments in high-entropy alloys and ceramics design.

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