Séminaire présenté par David L. Poerschke

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University of Minnesota, Minneapolis, MN - USA

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High Temperature Materials Design Challenges for More Sustainable Transportation and Energy Conversion Applications

Structural materials are pushed to their extremes in the hottest sections of jet engines, rockets, and in the turbines that produce much of our electricity. Increasing the durability and temperature capability of these materials would enable higher thermodynamic efficiency and reduced emissions. This talk will explore some of the most important factors limiting materials performance and discuss ongoing research efforts to overcome these challenges. We will focus on the challenges associated with glassy silicate deposits (CMAS) that form on hot section components when dusts, sands, ashes, and other particulates are ingested with intake air. These deposits accelerate chemical corrosion of metal alloys and ceramics, and alter the thermomechanical properties leading to increased material failure rates. Ongoing research seeks to model these degradation processes and develop materials with tunable reactivity tailored for specific environments. We will also discuss the design of ceramic thermal and environmental barrier coatings (T/EBCs) that can be used to protect structural components, and recent advances in the design of alloys, ceramic composites, and oxidation-resistant coatings with higher temperature capability. We will conclude by discussing future needs and opportunities for materials science research to advance societal goals for cleaner energy and transportation.

Biosketch: David L. Poerschke is an Associate Professor in the Department of Chemical Engineering and Materials Science at the University of Minnesota. His research seeks to understand the coupled thermodynamic and kinetic processes controlling the structural evolution and performance of multi-phase and composite systems in complex chemical, thermal, and mechanical environments. His group applies these insights to accelerate the discovery of new materials for service in extreme environments. He is a recipient of an NSF Faculty Early Career Development (CAREER) award and ONR Young Investigator Program (YIP) award. Prior to joining UMN in 2017, he earned his Ph.D. as an NDSEG Fellow in the Materials Department at the University of California Santa Barbara and holds B.S. and M.S degrees in materials science and engineering from Case Western Reserve University.

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