Phase Field Modeling of Nano and Micro Structural Evolution in Materials

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Abstract:
Predicting and controlling the structure-property-processing relations in materials play important roles in design and manufacturing of engineering parts and structures. With the recent progress in computing power, computational modeling and simulations have become commanding modules in studying these relations, which also enable design of new generation of materials in a faster pace. In this seminar, different mesoscale computational models based on phase field theory and molecular dynamics will be presented to quantitatively simulate nano and micro structures, and determine mechanical and physical properties of materials. Examples will include models for solidification and casting microstructures of pure and multi-component lightweight metals, and models for oxidation, solid state phase transformation and hydride precipitation in energy related materials. Lastly, a new phase field model connected to density functional theory and molecular dynamics for modeling crystallization and grain growth will be presented, which naturally incorporates elasticity, plasticity, and nucleation and evolution of dislocations.

Bio:
Dr. Mohsen Asle Zaeem is the Roberta and G. Robert Couch Endowed Assistant Professor of Materials Science & Engineering at Missouri University of Science & Technology (Missouri S&T). Dr. Zaeem received his B.S. and M.S. in Mechanical Engineering from Shiraz University, Iran, and his Ph.D. in Mechanical Engineering from the School of Mechanical and Materials Engineering at Washington State University. Prior to joining Missouri S&T, Dr. Zaeem was a postdoctoral fellow and an assistant research professor in the Computational Manufacturing and Design group within the Center for Advanced Vehicular Systems (CAVS) at Mississippi State University. Dr. Zaeem has published 36 peer-reviewed journal articles in prestigious journals, such as Acta Materialia, International Journal of Plasticity, Physical Review B, Materials Letters, and Journal of Computational Physics. He is currently serving as an editor of the Journal of Metals, and he is also a member of the editorial board of Mathematical Problems in Engineering and International Journal of Materials Engineering and Technology. Dr. Zaeem is a member of technical committees of different professional societies, including TMS/ASM Computational Materials Science and Engineering Committee, TMS/ASM Solidification Committee, TMS/ASM Young Professionals Committee, AIST Metallurgy-Steelmaking and Casting Technology Committee, ASME Manufacturing Engineering Division, and ASME Committee on Computing in Applied Mechanics. Dr. Zaeem is the recipient of the 2015 TMS Young Leader Professional Development Award, and the 2015 Junior Faculty Award from Mines and Metallurgy Academy. Dr. Zaeem's current research interests include developing multiscale computational models for predicting nano- and microstructures and properties resulted from different manufacturing processes. He is particularly interested in studying solidification, grain growth, and solid state phase transformation in light-weight and energy related materials. His main research goal is to develop multi-scale computational tools to predict and improve mechanical and other properties of materials for different engineering applications.

This seminar is co-sponsored by the Academy of Mechanical and Aerospace Engineers

Refreshments will be served at 3:15 p.m