MECHANICAL ENGINEERING PhD SEMINAR

Thursday, December 17 2026 at 13:30, Dan Kahn Building, Auditorium 1

Modeling Liquid Metal Embrittlement

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Liquid Metal Embrittlement (LME) is a phenomenon in which the interaction between a solid metal and a penetrating liquid metal can lead to a significant reduction in ductility and fracture resistance. Although liquid metal penetration along grain boundaries is widely recognized as a central mechanism of LME, the relationship between the morphology of the penetrating liquid, its evolution, and the resulting fracture behavior remains incompletely understood.

This seminar presents a computational investigation of LME through three complementary modeling approaches, addressing the evolution of intergranular liquid structures and their influence on fracture resistance. First, a multiphase-field model is employed to investigate the transition of a continuous intergranular liquid film into a discontinuous array of lenticular droplets. The simulations capture the capillarity driven retraction and breakup of the liquid film and examine the influence of interfacial energies, interface mobilities, and diffusion coefficients on the resulting droplet morphology and evolution kinetics. The second part focuses on the mechanical implications of these discontinuous liquid structures. Using a phase-field fracture model, the effects of lenticular droplet size and tip angle on fracture resistance are investigated under both Mode I and Mode II loading conditions. Finally, the investigation is extended to polycrystalline microstructures represented by Voronoi tessellations, with grain boundary interfaces modeled using a cohesive zone approach. Different liquid metal penetration patterns are introduced to examine their influence on crack propagation and the overall fracture resistance of the material.

Seminars Coordinator: Prof. Sefi Givli

Note: the seminar will be given in English