ME Seminar

Continuum mechanics modeling and experiments for phase transitioning materials: From metastable steels to rate stiffening gels

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ABSTRACT

Coupled mechanics phenomena, especially those leading to phase transitions in materials, are interesting and important for many applications. Modeling the mechanical response coupled with phase transitions in various essential materials is critical. I will discuss the role of continuum mechanics, experimental behavior, theoretical framework, and our finite deformation constitutive models for two distinct materials showing coupled multi-physics phase transformation phenomenon.

Stainless steels like 316L are metastable and show coupled temperature and plastic strain-driven transformation from FCC austenite to BCC martensite at cold temperatures. The mechanical properties of such metastable austenitic steels make them desirable for applications ranging from automobiles to liquefied natural gas transportation. I will present our thermo-mechanical finite deformation model for phase transitioning austenitic steels for room to cryogenic temperatures.

Shear-rate stiffening gels are materials that can mitigate impact energy and shield structures from events such as high-velocity collision, projectile impact, and shock loads from explosions. During high-rate deformations, shear-rate stiffening gels can change from viscous-fluid-like to rubbery and glassy-solid states. I will present our physically motivated theoretical framework and a constitutive model to describe the rate-dependent shear-stiffening and phase transformation response of such gels.

ABOUT THE SPEAKER

Dr. Srivastava is the Howard M. Reisman Assistant Professor of Engineering at Brown University. Dr. Srivastava received his Ph.D. in Mechanical Engineering from M.I.T. in 2010. Following his Ph.D., Dr. Srivastava worked at ExxonMobil Upstream Research and Corporate Strategic Research organizations in various roles, including Senior Technical Professional Advisor – Mechanics of Materials, Mechanics Team Lead, Marine Team Lead, Fitness for Service Research Area Lead, and Worldwide Deepwater Drilling Coordinator. Dr. Srivastava joined Brown University in the fall of 2018. Professor Srivastava's research focuses on developing and applying continuum-scale solid mechanics theories, models, and experiments for engineering materials, structures, and biomedical systems.

Follow the lab on https://sites.brown.edu/srivastavalab/ and @Srivastava_Lab

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