

Mechanical Engineering Seminar Series

December 3, 2024, 10:00AM

Dean's Conference Room, E-203E

Title: Multiscale Investigation of Time-Dependent Deformation Mechanisms in Shock-Tolerant Polymers

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Abstract: Polymers are ubiquitous in modern engineering, often subjected to extreme loading conditions. Understanding the underlying mechanisms of deformation, particularly in shock-tolerant materials, is crucial for optimizing their performance. However, traditional experimental techniques often lack the temporal and spatial resolution to capture the rapid, multiscale processes involved. This research aims to address this challenge by employing a multiscale, spectro-mechanical approach. By combining full-field digital image correlation, light scattering, and terahertz time-domain spectroscopy, we investigate the dynamic optomechanical response of polyurea, a highly cross-linked elastomer with superior shock and impact tolerance properties. This integrated approach allows us to probe deformation mechanisms from the macro- to the molecular scale. Additionally, we explore the influence of strain rate on the time-dependent behavior of polyurea. By subjecting samples to both slow creep and rapid shock loading, we aim to elucidate the interplay between molecular dynamics and macroscopic deformation. This presentation will discuss the latest findings from our collaborative research and outline future directions in this exciting field of experimental solid mechanics.

Brief Bio: George Youssef is a Professor of Mechanical Engineering at San Diego State University and the Principal Investigator of the Experimental Mechanics Laboratory (EML). His research focuses on the mechanics of innovative materials, including polymers, composites, and additive manufacturing materials. Through a multidisciplinary approach, EML investigates the behavior of these materials under extreme conditions, enabling the development of advanced technologies. The research at EML is generally supported by extramural grants from the National Science Foundation, Office of Naval Research, Army Research Office, and private industry. Dr. Youssef is a dedicated educator and mentor, committed to fostering the next generation of engineers. He has received numerous awards for his research, teaching, and service, including recognition from the Society of Automotive Engineers and the Engineer's Councils of San Diego and Los Angeles.