Connecting Mechanical Properties of Oxide and Hybrid Glasses with Structure at Varying Length Scales

Invited Talk

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Non-metallic glass families, including oxide, chalcogenide, and hybrid glasses, suffer from low fracture toughness, which limits their potential applications. In this talk, I will discuss our recent progress in understanding structure-mechanical property relations of oxide glasses as well as a recent family of organic-inorganic hybrid glasses, namely zeolitic imidazolate frameworks (ZIFs). Our aim is to design new glass compositions and microstructures with improved mechanical properties from the bottom-up. Such design is building on knowledge of the structural deformation mechanisms of the glasses under high local stress through a combination of experimental and simulation studies. We show that glass materials with improved resistance to both crack initiation and growth can be prepared by appropriately tailoring their structure at varying length scales, from coordination numbers and ring units to microstructures.