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Failure Resistance of Fiber-Reinforced Ultra-High Performance Concrete (FRUHPC) Subjected to Blast Loading BRETT ELLIS, MIN ZHOU, DAVID MCDOWELL, Georgia Institute of Technology — As part of a hierarchy-based computational materials design program, a fully dynamic 3D mesoscale model is developed to quantify the effects of energy storage and dissipation mechanisms in Fiber-Reinforced Ultra-High Performance Concretes (FRUHPCs) subjected to blast loading. This model accounts for three constituent components: reinforcement fibers, cementitious matrix, and fiber-matrix interfaces. Microstructure instantiations encompass a range of fiber volume fraction (0-2%), fiber length (10-15 mm), and interfacial bonding strength (1-100 MPa). Blast loading with scaled distances between 5 and 10 m/kg1/3 are considered. Calculations have allowed the delineation and characterization of the evolutions of kinetic energy, strain energy, work expended on interfacial damage and failure, frictional dissipation along interfaces, and bulk dissipation through granular flow as functions of microstructure, loading and constituent attributes. The relations obtained point out avenues for designing FRUHPCs with properties tailored for specific load environments and reveal trade-offs between various design scenarios.

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