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Spall Fracture Morphologies and Mechanisms of Zr-based Bulk Amorphous Alloys Y.M. GUPTA, J.P. ESCOBEDO, Wash. State Univ. — Plate impact experiments were conducted to examine the dynamic tensile response of Zr-based bulk amorphous alloys (BAAs). Tensile loading was preceded by elastic compressive loading (3.6 to 6.0 GPa). Microscopy results revealed that the BAA samples exhibit brittle behavior (glass like) macroscopically and ductile behavior (metal like) microscopically; corrugations and bumps are observed at the nanoscale. The observed fracture morphologies are related to three key features of our spall experiments and the free volume content of the BAAs. With increasing compressive stress, the available free volume decreases causing a suppression of shear stresses during tension, resulting in brittle cleavage at higher stresses. The high tensile loading rate likely causes cracking by multiple shear band propagation and interception, rendering a serrated surface morphology. Finally, the corrugations are likely created due to a succession of arrest and propagation of mode I cracks. A subsequent dilatation, an effect of the tensile mean stress, caused the corrugations to evolve to bump-type features (10-100 nm). Work supported by DOE/NNSA.

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