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Mechanical Response of Aluminum Foam Under Biaxial Combined Quasi-Static Compression-Torsional Loads

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Abstract : Metal foams have been developed intensively as a new class of materials for the last two decades due to their unique structural and multifunctional properties. The aim of this experimental work was to characterize the effect of biaxial loading complexity (combined compression-torsion) on the plastic response of highly uniform architecture open-cell aluminum foams of spherical porous with a density of 80%. For foam manufacturing, the Kelvin cells model was used to generate the generally spherical shape with a cell diameter of 11 mm. A patented rig called ACTP (Absorption par Compression-Torsion Plastique), was used to investigate the foam response under quasi-static complex loading paths having different torsional components (i.e. 0°, 45° and 60°). The key mechanical responses to be examined are yield stress, stress plateau, and energy absorption capacity. The collapse mode was also investigated. It was concluded that the higher the loading complexity, the greater the yield strength and the greater energy absorption capacity of the foam. Experimentally, it was also noticed that there were large softening effects that occurred after the first pick stress for both biaxial-45° and biaxial-60° loading.

Keywords : aluminum foam, loading complexity, characterization, biaxial loading
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