Multi-scale mechanical behavior of metallic foams: From struts to foams

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Abstract

This paper reports the results of studies on mechanical behavior of open cell aluminum foams. The multiscale nature of compressive deformation is examined from individual struts to overall foam deformation. Stress-strain curves of individual struts were investigated using micro-tensile testing. The localization (slip bands) in individual struts is discussed along with evidence of deformation bands at the macro-scale. The onset and propagation of deformation localization bands are elucidated via in-situ imaging and digital image correlation (DIC) techniques that provide continuous mapping of strain fields across sample section. A simple unit cell model is then used to estimate the dependence of foam strength and stiffness on relative density and strut properties.