A mechanism of failure under shear-dominated loading

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ABSTRACT

The phenomenology of failure under shear dominated loadings begins to be understood on the basis of cell model calculations and *in situ* experiments. The process involves void nucleation at, say second-phase particles, followed by significant void distortion, including rotation and partial closure, as well as void-induced strain concentration in intervoid ligaments. Nucleation aside, attempts at modeling failure in shear have employed isotropic models, e.g. [1], which do not account for the induced anisotropy inherent to the process. More recently, Morin et al. [2] used a void-shape dependent porous metal plasticity model to capture details in void distortion preceding failure. However, they modeled failure using an ad hoc coalescence criterion. Here, a micromechanics based two-surface porous material plasticity model is employed which accounts for void shape changes, void rotation and void coalescence under combined tension and shear [3-5]. A mechanism of failure is uncovered in simple shear, which is found to prevail over a range of tension to shear stress ratios in the shear-dominated regime. Furthermore, the capabilities of the model at capturing transitions to tension-dominated loading are highlighted.

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