Size-effects on growth and collapse of voids

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Abstract

Deformation of voids in metals is highly affected by size-effects on the micron scale. Plastic size-effects have been observed in a plethora of experiments including indentation, bending, torsion and thin film deformation. Observed size-effects suggest that void growth is suppressed on small scales relative to the behavior of macroscopic voids. The suppression of void growth on small scales affect void coalescence and thereby material ductility. In the present study, a recent strain gradient plasticity theory with dissipative gradient effects is employed to quantify size-scale effects on void growth under different loading conditions. Furthermore, investigations of void collapse on the micron scale under compressive loading is carried out, and implications for material ductility are discussed.