CAVITATION INSTABILITIES IN ELASTIC-PLASTIC SOLIDS

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ABSTRACT :

In an infinite elastic-plastic solid containing a single void a state may be reached, where the void keeps growing while the stresses at infinity stay constant. In such cases the void growth is driven by stored elastic energy. This typically occurs in cases where the mean tensile stress is much larger than the initial yield stress, i.e. under high stress triaxiality. At the tip of a blunting crack in a homogeneous metal the hydrostatic tension is not sufficiently high to drive such unstable void growth, but the mechanism is important when plastic flow takes place under highly constrained conditions, as often occurs in metal-ceramic systems. As examples will be shown analyses for a thin metallic layer between ceramics, and for a ductile particle in a ceramic. The discussion will include effects of strain gradient plasticity in the metal surrounding the cavity, and the effect of neighbouring voids. A recent study has considered a small void in the matrix of a metal matrix composite.