Multiscale experiments on ductile failure in polycrystalline materials

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ABSTRACT

In recent years, significant effort has been devoted to different ways of modeling and representing ductile failure in structural materials: one approach simply specifies a strain-to-failure as in the Johnson-Cook model, with some dependence on the stress triaxiality; the second approach combines the micromechanical void nucleation and growth models of the Gurson-Tvergaard-Needleman type with a critical porosity based failure criterion. The inability of the latter models to capture failure under shear-dominant loading has resulted in ad hoc modifications; in particular, void growth models have been modified through the introduction of the Lode angle parameter in order to capture effects of shear. We focus on these aspects of ductile failure through multi-scale experiments that provide measurements of strain and damage evolution at the micro as well as macroscales.