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NUMERICAL SIMULATION OF DAMAGE AND FAILURE BEHAVIOR OF BIAXIALLY LOADED SPECIMEN

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ABSTRACT The presentation deals with the effect of stress state on damage and failure behavior of isotropic ductile metals. Within the general framework of continuum thermodynamics of irreversible processes a thermodynamically consistent anisotropic damage and failure model as well as its numerical implementation are discussed [2].
The model takes into account damaged and fictitious undamaged configurations and is based on kinematic definition of damage tensors. Free energy functions are formulated in both configurations leading to respective elastic material laws. Onset of plastic flow, damage and fracture are characterized by criteria depending on stress intensity, stress triaxiality and Lode parameter [1,3]. In this context, a generalized hydrostatic-stress-dependent yield condition and a non-associated flow rule are used to adequately describe the plastic behavior of ductile metals. Furthermore, a damage criterion formulated in stress space is proposed. This criterion is based on series of experiments and corresponding numerical simulations [3] as well as different numerical calculations on the micro-scale [4]. Different branches of the damage criterion depending on stress triaxiality and Lode parameter are considered. To be able to take into account a wide range of different stress states new experiments with two-dimensionally loaded specimens have been developed. Numerical simulations of these tension-shear and compression-shear tests permit validation of stress-state-dependent functions for the damage criterion and damage evolution laws. In addition, experimental and numerical results are used to identify corresponding constitutive parameters.

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