Incorporating strain localization into porous plasticity modelling of ductile failure in aluminium alloys: a combined experimental and numerical study

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Abstract

In this study we investigated, both experimentally and numerically, the ductile tearing of aluminium plates made of the 6016 alloy in three different tempers (T4, T6 and T7). The three alloys were characterized by means of notched tension specimens as well as single edge notched specimens under quasi-static loading conditions. Those experiments were simulated with an enriched Gurson-Tvergaard-Needleman model to describe the plastic flow and ductile failure of the investigated alloys. To incorporate strain localization into the constitutive model, two approaches were employed to trigger accelerated void growth: in-situ bifurcation analysis and a material softening criterion. Both methods demonstrated good agreement with experimental observations, effectively capturing failure initiation and crack propagation.

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