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Characterizing Fracture forming limit and Shear fracture forming limit for sheet metals

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Abstract

This article investigates, experimentally, the failure loci in transition region between failure by crack-opening by mode I and by mode II of fracture mechanics. This investigation determines the fracture forming limit (FFL) and the shear fracture forming limit (SFFL) for copper with 0.8 mm and brass with 1 mm of thickness, by means of conventional sheet metal tests. Special focus is given to the use of staggered C-slit shear tests in order to obtain fracture strain pairs in the transition zone between FFL and SFFL, and the obtained results are presented. The procedure makes use of circle-grid analysis, thickness measurements and digital image correlation system (DIC).

The fracture loci for the copper sheet were validated by simple and complex geometries deformed by single point incremental forming (SPIF). These different geometries allowed to obtain different strain paths (plane strain, shear and bi-axial deformation) with and without fracture, and revealed a good agreement between the results.

Keywords: fracture forming limit, shear fracture forming limit, brass, copper, single point incremental forming, application.

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