

# Effect of friction stir processing on the damage resistance of 6xxx series aluminium alloys

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Damage evolution in ductile metals is characterized by the nucleation, growth and coalescence of small internal voids. In aluminium alloys, the void population generally nucleates by the fracture of the iron rich intermetallic particles. Previous studies have shown that the nucleation stress increases when the size of the intermetallic particles decreases retarding the final fracture of the material in tension. Hence, friction stir processing has been applied to a 6xxx series aluminium alloy in order to assess the ability of the process to fragment the intermetallic particles, suppress initial porosities and distribute them more homogeneously to aiming at improving the fracture strain of the material.

Detailed microstructural analysis of the intermetallics distribution has been carried out by including 3D X-ray tomography and in-situ tensile testing in the SEM. The mechanical properties have been investigated by tensile testing under various heat treatment conditions.

A cellular automaton model predicts the impact of the intermetallic particle fragmentation and their distribution on the fracture strain. The impact of the reduced porosity can also be better quantified by the model thanks to its ability to decouple the various microstructure features playing a role in the damage evolution.