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Study of Iron-rich Intermetallic Particles Effect on Ductile Damage nucleation in Recycled 6xxx Aluminium Alloy by In-situ Nano-tomography

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Extended Abstract

Abstract

Using Al alloys with a higher recycled content is a significant lever to reduce the carbon footprint of vehicles' fabrication. However, increasing the amount of recycled material can result in increased impurity content in Al alloys, especially iron content, and may lead to a decrease of material's formability. This study focuses on the effect of Fe-rich intermetallic particles on damage mechanisms in plane strain tension in 6xxx recycled aluminium alloys in T4 condition. In-situ synchrotron nano-tomographic experiments were performed on several aluminium alloys to capture damage evolution inside the material at different nanoscale resolutions. DVC (Digital Volume Correlation) methods were used to implement the tracking of particles and voids during the tensile test and identify damage mechanisms at particles which lead to void nucleation and ductile rupture of material. The size of particles appears to be the most influential parameter to control damage nucleation by cracking of particles and resulting

void nucleation. Particle nature, shape and neighbouring voids also play a strong role on when cracking happens by promoting stress concentration in the particle. Clusters of particles promote coalescence of nucleated voids which lead to final fracture of the material.

Keywords:

Ductile damage Nano-tomography Intermetallic particles Particles tracking Digital Volume Correlation Recycled Aluminium alloy