

Ductilization of 7475 aluminium alloy by Friction Stir Processing: homogenization of microstructural constituents

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7XXX aluminium alloys present high yield strength (>500MPa). However, the age-hardening η precipitates are not homogeneously distributed throughout the rolled bulk material. Some coarse precipitates are usually found at grain boundaries. Furthermore, a soft precipitate free zone develops around these coarse η leading to dramatic inter-granular crack propagation. According to Rometsch et al. [1], these heterogeneities persist after homogenization by heat treatments. Friction Stir Processing (FSP) could bypass this weakness. FSP has a proven potential of homogenization and ductility improvement. Hannard et al. [2] gained 100% additional ductility at same yield strength in 6XXX series Al alloys. After FSP, fine equiaxed grains replace the typical elongated grains of rolled material.

Investigations on 10mm thick Al 7475 plate are performed with one to four FSP passes.

Additional heat treatments allow modifying the η precipitation. Various microstructures at the same tensile strength reveal the competition between inter-granular and trans-granular modes of failure in the alloy. In the best cases, 150% in ductility increase is obtained after FSP, opening a promising way of improvement of the 7XXX aluminium series.

[1] P. Rometsch, Y. Zhang, S. Knight, Trans. Nonferrous Metals Soc. China, 24 (2014) 2003-2017

[2] F. Hannard, S. Castin, E. Maire, R. Mokso, T. Pardoen, A. Simar, Acta Mater., 130 (2017) 121–136