ICSMA19 Metz, France, June 26 - July 1, 2022
International Conference on Strength of Materials

Effect of high pressure torsion on microstructure evolution and mechanical behavior of Al-Mg-Sc-Zr alloy

Swetha Singam[a,*], Rohit T. Mathew[a,1], Pradipta Ghosh[b,c], Suresh Kumar Masa[d], M.J.N.V. Prasad[a]

[a]*Microstructural Engineering and Mechanical Performance (MEMP) Lab, Department of Metallurgical Engineering and Materials Science, Indian Institute of Technology Bombay, Powai, Mumbai, 400076, India*

[b]*Erich Schmid Institute of Materials Science, Austrian Academy of Sciences, Leoben 8700, Austria*

[c]*Materials Science and Engineering, Indian Institute of Technology Gandhinagar, Palaj, Gandhinagar 382 355, India*

[d]*Materials Science Division, CSIR-National Aerospace Laboratories, Bengaluru 560 017, India.*

[1]*Currently at: School of Engineering, Brown University, Providence, RI 02912, USA.*

**swetha.singam799@gmail.com*

The influence of both initial microstructure and high pressure torsion (HPT) processing temperature on microstructure and mechanical behavior of a commercially available Al-Mg-Sc-Zr (AA5024) alloy was investigated. The alloy was deformed by HPT up to 10 turns at three different temperatures (300 K, 473 K and 623 K) with two different initial microstructures: one is deformed plus tempered (as-received) and the other one is a fully recrystallized grain structure. Results show that as anticipated, HPT led to significant grain refinement down to ~130 nm and texture weakening in the alloy but with no noticeable effect of prior microstructure. In addition, HPT at elevated temperatures resulted in a more homogenous microstructure. The alloy processed at room temperature exhibited higher hardness (~2 GPa) and remarkable tensile strength (~800 MPa) but at the expense of its ductility. However, the ductility was restored with reduction in strength in high temperature processed alloy. Furthermore, in-plane tensile anisotropy and specimen orientation-dependent mode of dynamic strain aging were observed in the as-received and heat-treated alloy specimens with respect to the initial rolling direction [1]. The effects of the HPT induced strain, the prior processing history, the presence of second phase particles on grain refinement and texture evolution, and subsequently on mechanical response of the AA5024 alloy will be discussed.

Keywords: Al-Mg-Sc-Zr alloy; High pressure torsion; Microstructure; Texture; Strength.

References:

[1] Rohit T. Mathew, Swetha Singam, Pradipta Ghosh, Suresh Kumar Masa, M.J.N.V. Prasad, The defining role of initial microstructure and processing temperature on microstructural evolution, hardness and tensile response of Al-Mg-Sc-Zr (AA5024) alloy processed by high pressure torsion, Journal of Alloys and Compounds, Vol. 901, 2022, 163548 (1-13).