Fine-grained magnesium alloy designed for aviation applications

Stanislav Šašek[a], Jitka Stráská[a], Peter Minárik[a, b], Robert Král[a], Jozef Veselý[a], Jiří Kubásek[c]

[a] *Charles University, Faculty of Mathematics and Physics, Department of Physics of Materials, Ke Karlovu 5, 121 16 Prague, Czech Republic*
[b] *University of Žilina, Univerzitná 1, Žilina 01026, Slovakia*
[c] *University of Chemistry and Technology, Faculty of Chemical Technology, Department of Metals and Corrosion Engineering, Technická 5, 166 28, Praha 6, Dejvice, Czech Republic*

Magnesium alloy (Mg-2Y-2Gd-1Ca) designed with an emphasis on high flammability resistance was successfully processed by extrusion and additionally, by Equal channel angular pressing (ECAP) to achieve ultrafine-grained microstructure. Studied alloy achieved exceptional high ignition temperature, which is a critical safety measure.
The investigation of microstructure by EBSD revealed, that the fraction of recrystallized grains, grain size, and texture was affected by processing parameters. SEM and TEM analysis proved the presence of Mg_2Ca, REH_2 and Mg_5RE secondary phases particles. Microstructural condition including distribution and morphology of secondary phase particles directly affected the mechanical properties. Bimodal microstructure of extruded conditions contained large non-recrystallized grains with strong $\{10\bar{1}0\}$ texture resulting in a significant anisotropy in mechanical properties. Condition processed by ECAP was characterized by a homogeneous microstructure with a mean grain size below 1 μm. ECAP condition showed a higher yield strength with a low anisotropy. The developed and analysed microstructural condition resulted in favourable mechanical properties. The studied alloys have therefore great potential for the utilization in aerospace industry.

Keywords: magnesium alloys, equal channel angular pressing, microstructure, mechanical properties.