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Orientation imaging microscopy and microhardness in a ZK60 magnesium alloy processed by high-pressure torsion

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Abstract

An extruded ZK60 magnesium alloy was processed by high-pressure torsion (HPT) at room temperature for up to 5 turns under a constant compressive pressure of 2.0 GPa with a rotation speed of 1 rpm. This processing produced an average grain size of ~700 nm. The grain size distributions and textures were examined by electron backscatter diffraction (EBSD) and this revealed some multi-modality in the microstructure at different stages of straining with fractions of both coarse grains and ultrafine grains. EBSD analysis at the mid-radius positions of unprocessed and HPT-processed materials revealed a gradual evolution from a prismatic $\{10\bar{1}0\}$ fiber to an ultimate basal $\{0001\}$ fiber texture with the *c*-axis parallel to the normal direction. The majority of grain boundaries had misorientations larger than 15^{o} throughout the processing. The strain hardening tended towards a reasonable hardness homogeneity with a hardenability exponent, η, of 0.07 up to strains of ~20 and with a subsequent hardness saturation at Hv ≈ 125.

Keywords: high-pressure torsion, hardenability, magnesium alloy, texture, ultrafine-grained materials.