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Microstructure and mechanical properties of 7005 aluminum alloy processed by room temperature ECAP and subsequent annealing

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Abstract: A coarse-grained microstructure of the extruded 7005 aluminum alloy was processed by equal channel angular pressing (ECAP) via route B_C at room temperature. Microstructural evolution of the alloy processed by ECAP with different passes and subsequent annealing treatment were analyzed by using optical microscope, transmission electron microscope and electron backscatter diffraction. The results revealed that grains were refined gradually, and the low angle boundaries were progressively transformed to high angle boundaries by an increasing ECAP passes. After 7 ECAP passes, the average grain size decreased to ~0.87 μm, and the fraction of high angle boundaries increased to ~65.5 %. Furthermore, the results of tensile testing indicated that the yield strength was remarkably increased from ~170 MPa before ECAP to ~389 MPa after 7 ECAP passes, and the corresponding tensile strength increased to ~400 MPa after 7 ECAP passes, maintaining an appropriate elongation of ~13 %. After annealing treatment at 150 °C for 1 h, the samples processed by 7 ECAP passes obtained large elongation of ~16 %, and still maintained a high yield strength of ~337 MPa and tensile strength of ~350 MPa, which may be attributed to the recovery effects.

Keywords: 7005 aluminum alloy; Equal channel angular pressing; Microstructural evolution; Mechanical properties

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