بيانات عن بحث (8) مقدم للترقية

The Effect of ECAP Processing Conditions on Microstructural Evolution and Mechanical Properties of Pure Magnesium- Experimental, mathematical empirical and response surface approach

In this study, a quantitative evaluation approach was used to investigate how certain ECAP processing parameters affect the microstructural evolution, Vicker's microhardness values and tensile properties of pure Mg. The ECAP processing parameters were number of passes, ECAP die channel angle and processing route type. Response Surface Methodology (RSM) technique was used to design 16 runs of the experiment using Stat-Ease design expert software. Billets of pure Mg were processed up to 4 passes of routes Bc, A and C at 225 °C. Two ECAP dies were used with internal channel angles of 90° and 120°. Experimental findings were used to establish empirical models to assess the influence of the ECAP processing parameters on grain size and mechanical properties of ECAPed billets. The established relationships were examined and validated for their adequacy and significance using ANOVA as well as several statistical criteria. Response surface plots and contour graphs were established to offer better understanding of the intended relationships. In addition, the optimum processing parameters for grain size, hardness values and tensile properties were defined. Both experimental results and the theoretical model revealed that route Bc is the most effective route in grain refining. The experimental findings showed that 4 passes of route Bc through the die channel angle 90° revealed a significant reduction in the grain size by 86% compared to the as-annealed counterparts. Similar to the grain size refining, 4-passes processing through ECAP die with internal channel angle of 90° leads to improved Vicker's microhardness values. Additionally, 4-passes of route Bc using the 90° die angle recorded a significant HV increase at the edge and central areas by 112% and 78%, respectively, compared to the as-annealed counterpart. On the other hand, according to the optimization findings, 2 passes of route Bc using die angle of 120° resulted in the best ultimate tensile strength for pure Mg whereas 4-passes of route Bc revealed the optimum ductility at fracture.