Using X-ray Diffraction Peak Profile Analysis to Characterize the Dislocation Density and Stacking Fault Probability within Mg Alloys

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The current work aims at investigating the stacking faults (SF) density in Mg alloys after different annealing and deformation paths by high resolution X-ray diffraction peak profile analysis. Recently published transmission electron microscopy (TEM) results and atomistic simulations of Mg alloys, which contain rare earth elements, have suggested that the addition of rare earth elements promotes formation of the so-called $I_1$ growth stacking fault within the hexagonal close packed solid solution alloys. Furthermore, a connection between $I_1$ stacking faults and $(c + a)$ dislocations has been proposed. The operation of the latter defect is expected to promote homogeneous deformation in polycrystals and therefore enhanced ductility. In this work, line profile analysis of traditional Mg alloy, AZ31, is compared with that of experimental Mg-Gd binary alloys. TEM analysis of the dislocations present within the samples is used to confirm the results obtained by XRD.