Effect of degassing temperature on the microstructure of a nanocrystalline Al-Mg alloy

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The microstructural evolution of a nanocrystalline Al-Mg alloy was investigated to determine the effects of degassing temperature. Al 5083 powder was ball-milled in liquid nitrogen to obtain a nanocrystalline structure, then vacuum degassed to remove contaminants. The degassed powder was consolidated by cold isostatic pressing (CIP) and then forged to produce bulk, low-porosity material. The material microstructure was analyzed at different stages using optical microscopy, transmission electron microscopy (TEM), and density measurements. The impurity concentration of the final product was also measured. The forged material exhibited a bimodal grain size distribution, consisting of both ultra fine and coarse grains. The bimodal distribution was attributed to the presence of residual coarse grains in the as-milled powder. Higher degassing temperatures resulted in higher density values and lower hydrogen content in the consolidated materials, although these materials also exhibited more extensive grain growth.