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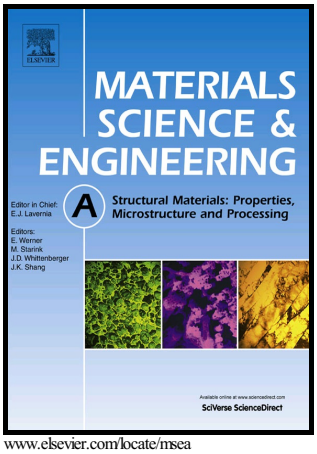

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Microstructure and mechanical properties of the carbon nanotubes reinforced AZ91D magnesium matrix composites processed by cyclic extrusion and compression

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Abstract:

Cyclic extrusion and compression (CEC) was taken to process the carbon nanotubes (CNTs) reinforced AZ91D composites. Effects of CEC passes and CNTs on the microstructure evolution, hardness and tensile properties of the post-processed composites were investigated. Results show that the matrix grain of the 0.5wt.% CNTs/AZ91D composites is greatly refined from ~112μm to ~126.6nm after 8 passes of CEC, with $Mg_{17}Al_{12}$ uniformly distributed along grain boundaries. The addition of CNTs leads to a reduced matrix grain, but exerts a limited effect on the $Mg_{17}Al_{12}$ precipitates. The initial highly-agglomerated CNTs are gradually dispersed with the progress of CEC, though degrading of CNTs occurs. The implement of CEC markedly enhances the hardness, YS, UTS and elongation to fracture of both the monolithic AZ91D alloy and the CNTs/AZ91D composites, all of which are mainly attributed to the greatly refined matrix grain and the uniformly distributed $Mg_{17}Al_{12}$ precipitates. Incorporation of CNTs increases the hardness, YS and UTS of the base alloy, but decreases the elongation to fracture, which is closely related with the gradually dispersed but degraded CNTs.

Key words: Composites, Bulk deformation, Grain refinement, Mechanical characterization

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