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Fabrications of aluminium matrix composites with nano-sized reinforcements via friction stir processing

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Metal matrix composites with nano-sized reinforcements exhibit better mechanical properties than those with micro-sized particles. However, it is a serious challenge to fabricate the nanocomposites because of the difficult in incorporating the nanoparticles into the metal matrixes. In this study, ex situ carbon nanotubes (CNTs) reinforced 2009Al (CNT/2009Al) and *in situ* Al_2O_3 and Al_3Ti particles reinforced pure Al (Al_2O_3+Al_3Ti)/Al) composites were fabricated by means of friction stir processing (FSP), a development based on friction stir welding. It was indicated that FSP could break up the CNT clusters and achieve uniform individual distribution of CNTs and induce *in situ* reaction between TiO_2 and Al, forming Al_2O_3 and Al_3Ti nanoparticles. The mechanisms responsible for the dispersion and damage of CNTs and the accelerated reaction between Ti and Al were analyzed in detail. It was indicated that although CNTs were cut short during FSP, the layer structure of CNTs was well retained. The formation mechanisms of Al_2O_3 and Al_3Ti during FSP were determined to be a deformation-assisted interfacial reaction and deformation-assisted solution-precipitation, respectively. The CNT/2009Al and (Al_2O_3+Al_3Ti)/Al composites exhibited a good combination of strength and ductility. This investigation provides a new route to fabricate high-property nanocomposites.

Biography

Z Y Ma has completed his PhD from City University of Hong Kong and Post-doctoral studies from Missouri University of Science and Technology. He is a Professor and Group Leader in Metal Institute of Research, Chinese Academy of Sciences. He has published 285 peer-reviewed journal papers, with a total of over 7000 citations. He has written several highly-cited review papers, including "Friction Stir Welding and Processing" in *Materials Science and Engineering–Reports* (2005, 50:1-78). He has been serving as Editorial Board Member of several international journals such as *Materials Science and Engineering A*.

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