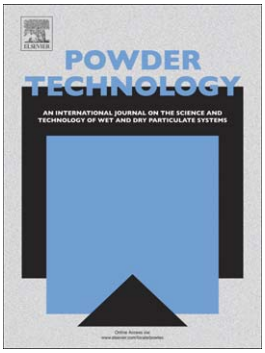

Effect of high energy ball milling on the morphology, microstructure and properties of nano-sized TiC particle-reinforced 6005A aluminium alloy matrix composite

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Effect of high energy ball milling on the morphology, microstructure and properties of nano-sized TiC particle-reinforced 6005A aluminium alloy matrix composite.

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Abstract

Micron-sized aluminium powder alloy AA 6005A was reinforced with different volume fractions, from 1.5, 3 and 6 vol. %, of 20-30 nm diameter nano-sized TiC particles (n-TiC). The nanocomposite powders were synthesized by applying high energy ball milling for different milling times, in the range from 1 to 10 hours. It was evident that the presence of n-TiC particles had a marked influence on the powder morphology, average particle size and microstructure of the matrix during the milling process. Also, a fine homogeneous dispersion of the reinforcement phase into the Al alloy powder was obtained after ball milling. No intermetallic compounds were observed during high energy ball milling nor was iron contamination present due to ball and vial media after 10 h milling. The correlations between the morphological and microstructural evolution of the matrix powder particles and the milling time were investigated for each n-TiC volume fraction. The results of work suggest that the higher reinforcement content produces finer and narrower size distribution of matrix particles at shorter milling times and could be associated with the presence of n-TiC particles, which can favour the refining of matrix particles. The evolution of the crystallite size of the matrix powder particles with the milling time of the three nanocomposite powders is similar to the unreinforced alloy powder, and an increase in the amount of n-TiC particles in the soft matrix didn´t resulted