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Dispersion of CNTs in aluminum 2024 alloy by milling process

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The dispersion of carbon nanotubes (CNTs) as reinforcement material into an aluminum alloy using mechanical alloying technique, makes possible the production of novel composites with light weight and high strength for automotive and aerospace applications. In this work, elemental powders and CNTs were mixed and milled in a high energy shaker mill (SPEX-8000), to produce 2024 aluminum (Al_{2024}) matrix composites reinforced with CNTs. Milled products were consolidated by uniaxial load pressing followed by pressure-less sintering under argon atmosphere for 3h at 823 K. Consolidated samples were solution treated at 766 K for 90 min and finally quenched in cold water. The effect of CNTs concentration (0.0, 0.5, 1.0, 2.0, 3.0, 4.0 and 5.0 wt. %) and milling time (5, 10, 20 and 30 h) on the density, morphology evolution, precipitation kinetic, Vickers microhardness (HV) and yield strength (σ_y), obtained from compressive test, on the synthesized composites, were studied. As reference material, an unreinforced and not milled Al_{2024} sample was prepared by the same route. The microstructural characterizations of the composites were carried out by X-ray diffraction (XRD), differential scanning calorimetry (DSC), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). TEM micrographs show that milling conditions previously mentioned, allow to obtain an homogeneous dispersion of CNTs into the aluminum matrix. As consequent result of the CNTs dispersion process, the mechanical properties of the composites show an important improvement with respect to reference sample. The possible strengthening mechanisms are discussed in the present work.

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