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The role of CNTs on the characteristics of mechanically alloyed and spark plasma sintered CNT-Fe nanocomposites

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Metal composites reinforced by carbon nanotube (CNT) often show improved mechanical properties along with various interesting properties associated with the interfaces between CNTs and metal matrix. For example; ion irradiation experiments on CNT-aluminum composite demonstrate that the CNT-metal interfaces can act as efficient defect recombination sites and as a result reduce void generation and radiation hardening. Most of the metal matrices studied so far are non-ferrous metals, e.g., Al, Cu, Ni etc., and there are only few studies on CNT-ferrous alloy. A recent research paper concerning the fabrication of 304LSS–CNT composites using mechanical alloying combined with hot pressing and melting has also been found. Recently, we fabricated and investigated a 304 stainless steel and carbon nanotube (304SS-CNT) composite with an aim to study its microstructures and high-temperature tensile properties. 304SS powders were mixed with carbon nanotubes using ball milling and consolidated using the spark plasma sintering technique. Tensile specimens made from the consolidated samples of 304SS-CNT were tested in a temperature range from 299 K to 773 K. The yield strength and the work hardening of the 304SS-CNT samples were found to be higher than those of a sample fabricated from 304SS without carbon nanotubes for all tested temperatures. 304SS-CNT samples have a microstructure significantly different from the 304SS sample, e.g., reduced grain size and many small cuboidal particles. Composition analysis using energy-dispersive spectroscopy revealed that the cuboidal particles are chromium carbides and the chromium content is reduced in the 304SS-CNT matrix. In this study, we extended our previous work to CNT-Fe matrix composites. We will present the role of CNTs on the formation of micro structures and mechanical properties of pure Fe and ferrous alloys.

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