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 microstructures and mechanical properties of pure Fe and ferrous alloys.