



## Carbon Nanotube Reinforced Aluminum-Based Nanocomposites Processed by Mechanical Alloying

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### ABSTRACT

Carbon nanotubes (CNTs) are relatively new materials with excellent combination of properties. They are one of the advanced reinforcement materials for engineering composites. Besides the polymer and ceramic matrices, interests are growing recently on the metallic matrices such as aluminum alloys for potential structural applications. Mechanical alloying (MA) is one of the best processing methods for synthesizing Al/CNTs nanocomposites, which results in the uniform dispersion of the reinforcement, inhibits the formation of undesired phases, and produces a nanostructured microstructure. It is of great importance to understand the mechanical alloying of Al/CNTs powder mixture for preparing nanocomposites. As a result, the current short review deals with the basics of the MA process, preparation of nanocomposites by MA, and summarizing the current knowledge on Al/CNTs nanocomposites processed by MA.

**Keywords:** Nanocomposites, Carbon nanotubes, Mechanical alloying

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### 1. INTRODUCTION

Carbon nanotubes (CNTs) are relatively new materials discovered only about twenty-five years ago by Iijima [1] and have been shown to have excellent combination of properties. Based on their excellent mechanical properties, they have been regarded as ideal reinforcements for advanced structural composite materials [2,3]. While the polymer and ceramic matrix nanocomposites reinforced with CNTs have gained more attention of the research community, interests are growing recently on the metallic matrix materials for potential structural use where ultra-high-strength materials having good resistance to wear and thermal stability are required [4]. In this new wave, the Al matrix seems to be a preferred material in many cases due to its relatively low density, reasonable mechanical properties, and good workability. The uniform dispersion of the CNT reinforcements is of great importance; hence, special processing techniques such as mechanical alloying (MA) have recently utilized. In fact, the chemical reaction between Al and CNTs results in the formation of  $Al_4C_3$  at process temperatures higher than about 527 °C, below the melting point of Al (660 °C). This reaction limits the choice of fabrication process [5] and MA followed by consolidation at relatively low temperatures is a solution in this respect [6]. Therefore, it is of great importance to understand the mechanical alloying of Al/CNTs powder mixture for preparing nanocomposites. As a result, the current short review deals with the basics of the MA process, preparation of nanocomposites by MA, and summarizing the current knowledge on Al/CNTs nanocomposites processed by MA.

### 2. NANOSTRUCTURE BY MECHANICAL ALLOYING