# Fabrication and Characterization of Carbon Nanotube/Ceramic Nanocomposite Powders

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## 1. Introduction

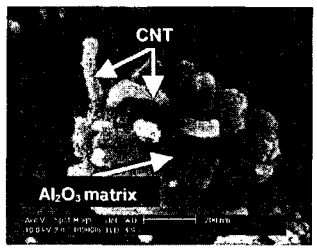
Carbon nanotubes (CNTs) are considered as the most promising material in various fields of applications [1]. Moreover, due to their extraordinary mechanical and functional properties, CNTs are the ideal reinforcements in composite materials and are expected to overcome the limits of conventional materials such as polymers, metals and ceramics [2]. The development of CNT reinforced metal and ceramic matrix nanocomposites have been limited mainly due to the difficulty in homogeneous distribution of CNTs within the inorganic matrix [3]. To overcome the current limitations, here we suggest a novel fabrication process named as "Molecular Level Mixing" for CNT reinforced ceramic nanocomposite powders. The final microstructure reveals homogeneous distribution of CNTs within the matrix powder.

## 2. Experimental Procedure

CNT powders are dispersed in a solution such as ethanol to make a stable suspension by attaching functional groups on the CNT surface. Then, a salt containing metal ion is dissolved in the CNT suspension. Additional sonication treatment assists the dispersal of metal ions among the suspended CNTs and promotes reaction between metal ions and the functional groups on the CNT surface. The next step is drying the solution in air at 100~250°C during which the solvent and ligands are removed and the metal ions on CNTs are oxidized to form oxide powder. The final step is the calcination process to obtain a chemically stable crystalline powder.

## 3. Results and Discussion

The most important feature of this process is that CNTs and metal ions are mixed at molecular level which gives homogeneously dispersed CNTs in the ceramic matrix powder as shown in the Figure. The fabricated CNT reinforced oxide ceramic nanocomposite powders can be consolidated by various kinds of consolidation processes such as vacuum sintering, hot pressing and spark plasma sintering process. The consolidated CNT reinforced alumina by spark plasma sintering process gives superior mechanical properties such as hardness and fracture toughness.

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