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분자수준 혼합법에 의한 탄소나노튜브/알루미나 나노복합재료 제조공정

(Fabrication Process of Carbon Nanotube/Alumina Nanocomposite by Molecular Level Mixing Process)

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Carbon nanotubes(CNTs), since their first discovery, have been considered as new promising materials in various fields of applications including field emission displays, memory devices, electrodes, NEMS constituents, hydrogen storages and reinforcements in composites due to their extra-ordinary properties. The carbon nanotube reinforced nanocomposites have attracted attention owing to their outstanding mechanical and electrical properties and are expected toovercome the limit of conventional materials. Various application areas are possible for carbon nanotube reinforced nanocomposites through the functionalization of carbon nanotubes. Carbon nanotube reinforced polymer matrix nanocomposites have been fabricated by liquid phase process including surface functionalization and dispersion of CNTs within organic solvent. In case of carbon nanotube reinforced polymer matrix nanocomposites, the mechanical strength and electrical conducting can be improved by more than an order of magnitude. The carbon nanotube reinforced polymer matrix nanocomposites can be applied to high strength polymers, conductive polymers, optical limiters and EMI materials. In spite of successful development of carbon nanotube reinforced polymer matrix nanocomposites, the researches on carbon nanotube reinforced inorganic matrix nanocomposites show limitations due to a difficulty in homogeneous distribution of carbon nanotubes within inorganic matrix. Therefore, the enhancement of carbon nanotube reinforced inorganic nanocomposites is under investigation to maximize the excellent properties of carbon nanotubes. To overcome the current limitations, novel processes, including intensive milling process, sol-gel process, in-situ process and spark plasma sintering of nanocomposite powders are being investigated. In this study, the carbon nanotube reinforced alumina matrix nanocomposite was fabricated by novel process, molecular level mixing process, and followed by spark plasma sintering process. The carbon nanotubes can be homogeneously dispersed within alumina matrix. Both hardness and fracture toughness of carbon nanotube reinforced alumina nanocomposite increases with increasing the volume fraction of carbon nanotubes. The hardness of carbon nanotube reinforced alumina nanocomposite was improved by load transfer from matrix to carbon nanotubes and the fracture toughness was improved by bridging and pull-out of carbon nanotubes.