

Control of carbon nanofibers growth based on different densities of Ni particles

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Abstract

Nearly ten years after their discovery, carbon nanotubes (CNTs) and carbon nanofibers (CNFs) still attract much interest for their potential applications. Due to their unusual structural and electronic properties, the carbon nanostructures can be extensively applied in future fields, including field emission display, battery, transistor, nanoscale interconnects, and so on. Although the ways to prepare CNFs have been enhanced recently, how to control of carbon nanofibers growth is still a challenge. This study pointed out a simple procedure to control the morphologies of CNFs. At firstly, nickel-based thin films were uniformly deposited on stainless substrate via a voltage input (electric field: 2 V/cm) in 0.05 M $\text{Ni}(\text{NO}_3)_2$. According to different deposited time, two types of Ni films were obtained in ranges of 0.040 mg/cm^2 and 0.44 mg/cm^2 , respectively. Using toluene as carbon precursor, a thermal chemical vapor deposition (CVD) was conducted in a home-made furnace at 900°C . Field-emission scanning electron microscope (FE-SEM) showed that two types of nanofibers, straight- (Fig. 1) and coil-type (Fig. 2), are obtained from the low and high density of Ni film, respectively. This indicates that the densities of catalyst would be an important factor in affecting the fiber distribution and growth orientation.

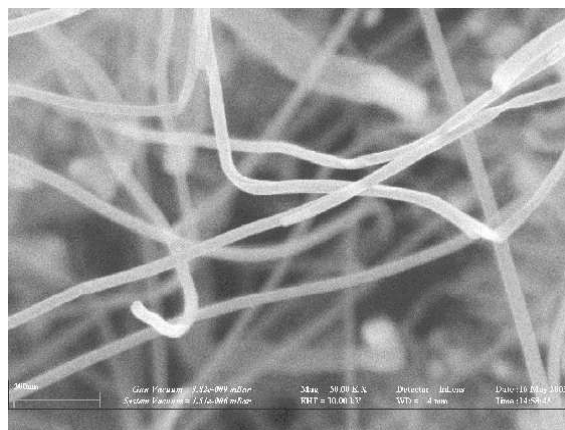


FIG 1 Carbon nanofibers grown on low Ni density (0.040 mg/cm^2).

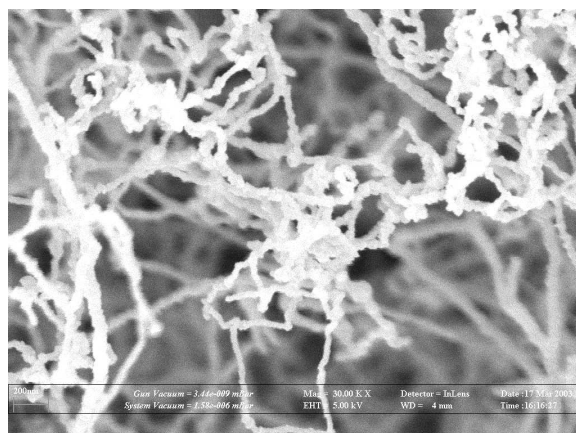


FIG 2 Carbon nanofibers grown on high Ni density (0.44 mg/cm^2).