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Synthesis of Carbon Nanofibers by Spray Pyrolysis

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Due to its special properties, carbon-related nanomaterials have attracted increasing interest among scientists around the world in both synthesis and applications. Nowadays, these nanomaterials represent one of the major research topics of science and technology of materials, as well as condensed matter physics [1-4]. Carbon nano-fibers (CNFs) are composed of stacked and curved graphene layers from a quasi-one-dimensional (1D) filament. CNFs have cylindrical or conical nanostructures. Their diameters vary from a few to hundred nanometers, while lengths vary from less than a micrometer to millimeters. As shown in Figure 1, according to the angle between graphene layers and fiber axis, the morphological structure is often divided into plate CNFs, ribbon-like CNFs, herringbone CNFs [5-7].

Carbon Nano fibers (CNFs) were synthesized by spray-pyrolysis in an ultrasonic nebulizer (Nebucor E-505, 5 W) connected to a quartz tube using hexane as a precursor. Silicon monocrystal substrates were placed at the center of the quartz tube. A flow of N_2 gas was introduced into a quartz tube at constant rate of 15 ml/min. Once a suitable reaction temperature of 800 ^{0}C was reached, the ultrasonic nebulizer was switched on, and the hexane nebulized was deposited into a thin film for 30 minutes. After deposition, the furnace was switched off and allowed to cool at room temperature. Finally, the deposited samples were analyzed by scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS) techniques. Figure 2a show (SEM) image of the CNFs cluster nano-fibers formed during the synthesis by spray-pyrolysis and figure 2c shows the chemical composition of the nano-fibres showing that all fibers are composed by carbon as main element, Fe and Si signals came from the reactor walls and organic precursor used. Figure 2b shows a tubular filament solid CNF with a diameter ranking from 0.085 μm to 0.114 μm. These results show that the Carbon Nanofibers (CNFs) can be synthesized by nebulized spray-pyrolysis in a single step process. CNFs can be formed from hexane at lower temperature and the repetition of the experiment resulted in a similar growth pattern of the deposits, demonstrating that conditions are suitable for CNFs growth.

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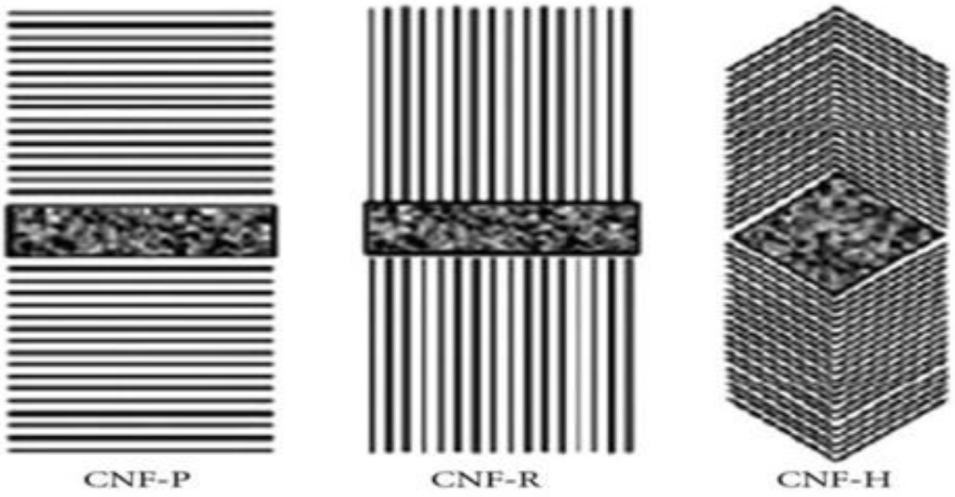
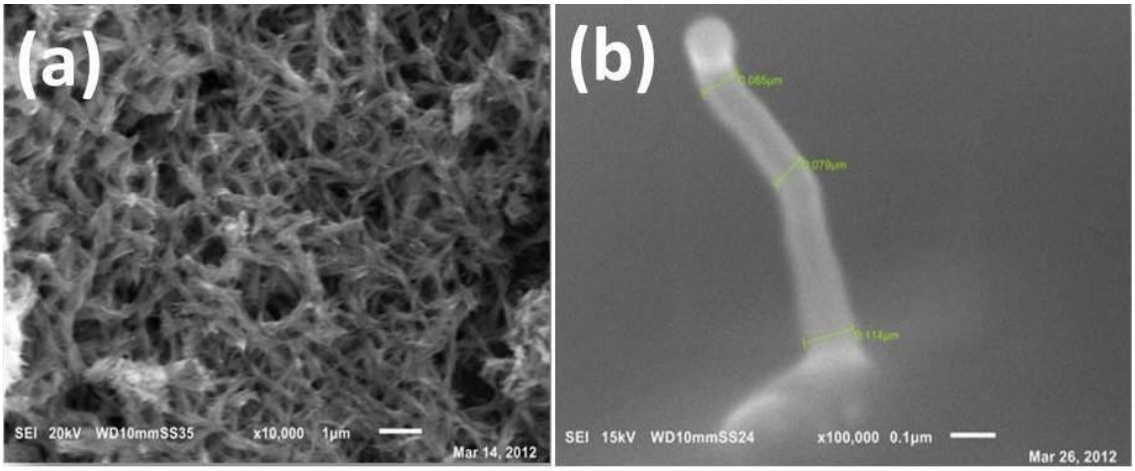


Figure 1. Schematic Diagram of different CNFs: Platet, Ribbon and Herringbon [5-10].



(c)

Element	at [%]
C	90.28
Si	8.66
Fe	1.06

Figure 2. (a) SEM Image of CNF Cluster, (b) SEM Image of a Single CNF and (c) chemical composition of a Single CNF.

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