11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

Mass Production, Applications and Safety Issue of Multi-Walled Carbon Nanotubes

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Abstract – Highly crystalline and pure carbon nanotubes have been industrially produced in a semi-continuous system through the right combination of the catalytic chemical vapor deposition method and the subsequent high-temperature thermal treatment in argon. Their versatile applications including multi-functional filler in nanocomposite and electrochemical system will be described with a strong emphasis on the critical issue of "biological responses of carbon nanotubes". It should be noted that lots of carbon nanotube-derived products are already in use and also their viability strongly depend on their commercialization.

Carbon nanotubes have attracted lots of attention from various fields of scientists because they exhibited extraordinary physical and chemical properties due to their intrinsic nano-sized one-dimensional nature. Thus, their intrinsic characteristics will change everything from computer, bio- and medical-device, batteries, nanocomposite-based vehicles to electronic nano-device etc in the near future. A large quantity of carbon nanotubes is currently available because of the development of the cost-effective synthetic techniques for producing carbon nanotubes in a large scale [1, 2]. Therefore, a synergistic effect of an industrially produced carbon nanotubes and the newly created end-uses will cut down their price by at least 10 percent of the current value in the near future. At present, the biggest hurdles in nanotube business are considered to be the limited use and safety issue of carbon nanotubes. Thus, it is now urgently needed to speed up their current applications as well as find out their new end uses.

In this talk, I, first, describe the bulk synthesis of high-purity carbon nanotubes, and then their current usages as multi-functional filler for lithium ion secondary batteries in electric vehicles as well as lead acid batteries with a special emphasis on the effect of nanotubes texture and morphology. Then, we report a super rubber sealant that is able to withstand temperatures up to 260^{o}C and pressures as high as 239MPa by incorporating surface-modified nanotubes into fluorine rubber (Fig. 1). Thus our rubber sealant will contribute to a revolutionary enhancement in the oil recovery efficiency from the current 35% to more than 70% by excavating previously inaccessible deposits [3]. Finally, we have to clarify the potential toxic of carbon nanotubes through the systemic study of various carbon nanotubes because the controlled safety of carbon nanotubes is critical for successful business. In present, we have proceeded beyond the first mountain of science, the second mountain of technology and the third mountain of economy by successful large-scale production of carbon nanotubes at a reasonable cost (Fig. 2). Now we are striving to climb the mountain of society.

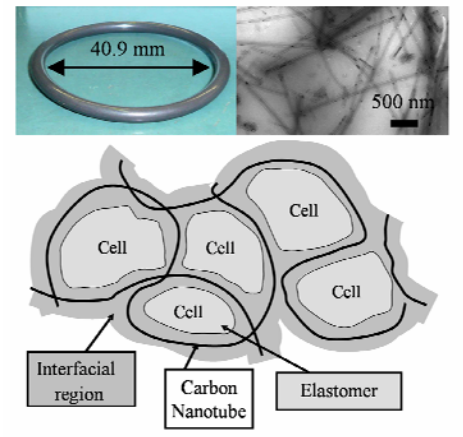

Figure 1: Homogeneously and randomly dispersed, surface-controlled, multi-walled carbon nanotubes within fluorine rubber, exhibiting a cellulation structure, make the sealant durable at extreme high temperatures and pressures.

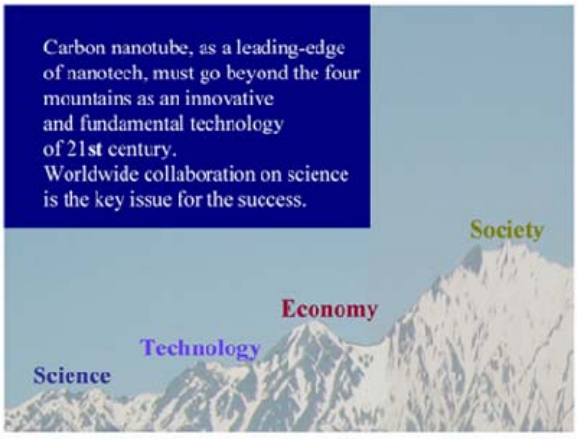

Figure 2: Four mountains in carbon nanotube business

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