**Enhanced tensile strength of thick dielectrophoretic carbon nanotube fibers by $TiO_2$ infiltration**

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Carbon nanotube fibers (CNT-fibers) have recently attracted attention because of their potential in developing strong lightweight materials. Research on both neat and those of polymer matrix composite fibers have been increasingly promising. However, there are certain physical restrictions in reinforcing neat CNT-fibers, whereas in the case of composite fibers the lightweight phenomenon and other important mechanical characteristics inherent to these of neat fibers are lost. In this work we demonstrate an alternative method – an atomic layer deposition (ALD) of thin $TiO_2$ film to the porous framework of neat CNT-fibers produced by dielectrophoresis. The performance of treated fibers is outstanding, as the $TiO_2$ coating of 10 nm thickness provides up to fivefold increase in their tensile strength and Young's modulus, while the electrical conductivity, density and inner texture of the fibers remains virtually intact. High-resolution electron microscopy and elemental analysis reveal that the ALD parameters can be adjusted so that the $TiO_2$ coating thoroughly infiltrates the CNT-fiber, yielding thin layer of $TiO_2$ on the CNT framework that constitutes the fiber. Thus, the structure and porosity of the initial fiber is largely maintained. We propose the ALD-coating infiltration method being effective and perspective alternative in developing novel lightweight and mechanically strong CNT based materials.

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**Figures**

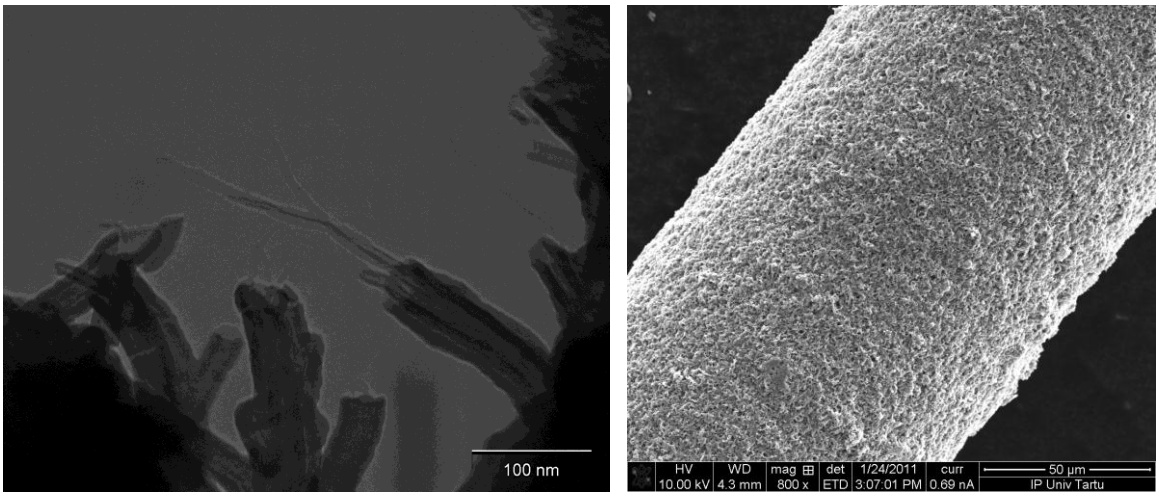


**Figure 1.** TEM image of a broken $TiO_2$ infiltrated CNT-fiber (left) and SEM image of a $TiO_2$ infiltrated CNT-fiber (right).