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Controlling Dimensions and Shape of Carbon Nanotubes Using Nanoporous Anodic Alumina under Different Conditions

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Abstract : In situ synthesis of carbon nanotubes featuring different diameters (10-200 nm), lengths (1 to 100 µm) and periodically nanostructured shape was performed in a custom designed chemical vapor deposition (CVD) system using nanoporous anodic alumina (NAA) under different conditions. The morphology of the resulting CNTs/NAA composites and free-standing CNTs were analyzed by transmission electron microscopy (TEM) and scanning electron microscopy (SEM). The results confirm that highly ordered arrays of CNTs with precise control of nanotube dimensions in the range 20-200 nm with tube length in the range < 1 µm to > 100 µm and with periodically shaped morphology can be fabricated using nanostructured NAA templates prepared by anodization. This technique allows us to obtain tubes open at one / both ends with a uniform diameter along the pore length without using any metal catalyst. Our finding suggests that this fabrication strategy for designing new CNTs membranes and structures can be significant for emerging applications as molecular separation/transport, optical biosensing, and drug delivery.

Keywords : carbon nanotubes, CVD approach, composites membrane, nanoporous anodic alumina
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