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Synthesis of diameter-controlled carbon nanotubes via structural modification of Al2O3 supporting layer

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The lack of homogeneously sized single-walled carbon nanotubes (SWNTs) hinders their many applications because properties of SWNTs, in particular electrical conduction, are highly dependent on the diameter and chirality. Therefore, the preferential growth of SWNTs with predetermined diameters is an ultimate objective for applications of SWNTs-based nanoelectronics. It has been previously emphasized that a catalyst size is the one crucial factor to determine the CNTs diameter in chemical vapor deposition (CVD) process, giving rise to several attempts to obtain size-controllable catalyst by diverse methods, such as solid supported catalyst, metal-containing molecular nanoclusters, and nanostructured catalytic layer.

In this work, diameter-controlled CNTs were synthesized using a nanostructured catalytic layer consisting of Fe/Al2O3/Si substrate. The CNTs diameter was controlled by structural modification of Al2O3 supporting layer, because Al2O3 supporting layer can affect agglomeration phenomenon induced by heat-driven surface diffusion of Fe catalytic nanoparticles at growth temperature.