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Vertically aligned growth of SWNTs "mat" on a quartz surface

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Single-walled carbon nanotubes (SWNTs) are the focus of intense interdisciplinary studies because of their unique physical properties. To best utilize their fascinating properties, controlled positioning of SWNTs on appropriate substrates is being sought. However, whereas the vertical growth of multi-walled carbon nanotubes (MWNTs) by chemical vapor deposition (CVD) is well known, the alignment of SWNTs has been limited to in parallel to the substrate surface. Here we demonstrate that even flexible SWNTs can grow vertically through a simple thermal CVD process. Specifically, a dense, uniform "mat" of vertically aligned SWNTs with a thickness of a few μm is grown on a quartz substrate on which densely mono-dispersed Co-Mo catalyst around 1.5-2 nm is supported by our dip-coat process. Thereby prepared vertically aligned SWNTs exhibit unique optical anisotropy and could accelerate a variety of SWNT-based applications that have been proposed thus far using randomly oriented SWNTs deposited on a substrate.

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