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Growing suspended carbon nanotubes: Uncovering the importance of thermal vibrations. MATTHEW MARCUS, J.M. SIMMONS, S.E. BAKER, O.M. CASTELLINI, R.J. HAMERS, M.A. ERIKSSON, University of Wisconsin - Madison — Nanotubes are grown by chemical vapor deposition into suspended structures over etched trenches. When the length of the nanotube is short (L<500nm) the entire length of the nanotube remains suspended. In contrast, for long tubes with length L> 2 microns the ends of the nanotubes remain pinned to the ridge tops, but for many nanotubes the central body of the tube drops ∼80nm and sticks to the substrate. For nanotubes with lengths between (500nm-2 microns) the probability that the nanotube is stuck to the substrate increases with tube length. We propose that thermally driven oscillations of the nanotube during the CVD growth cause the nanotube to oscillate with amplitudes large enough (∼80nm) to touch the substrate, then stick. Using the length of the nanotubes, and the diameter distribution from the CVD growth we are able to non-invasively place limits on the range of Young's modulus (Y = 200 GPa – 2 TPa). This work is supported by the National Science Foundation under Grant No. DMR-0079983, DMR-0094063, and the Research Corporation.

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