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Self-Assembly of Multiwall Carbon Nanotubes from Quench-Condensed CNi_3 Films[1] PHILIP ADAMS, DAVID YOUNG, AMAR KARKI, JAYNE GARNO, JOHNPETER NGUNJIRI — Freestanding, vertical, multiwall carbon nanotubes (MWCNT) are formed during the vacuum deposition of thin films of the metastable carbides CT_3 (T = Ni, Co) onto fire-polished glass substrates. In contrast to widely used chemical and laser vapor deposition techniques, we utilize direct e-beam evaporation of arc-melted CT_3 targets to produce MWCN's that are self-assembled out of the CT_3-film matrix. The depositions are made in an ambient vapor pressure that is at least six orders of magnitude lower than the 1-100 Torr typically used in chemical vapor techniques. Furthermore the substrates need not be heated, and, in fact, we observe robust nanotube growth on liquid nitrogen cooled glass and sapphire substrates. High-resolution atomic force microscopy reveals that MWCNT's of heights 1-40 nm are formed in films with nominal thicknesses in the range of 5-60 nm. We show that the growth parameters of the nanotubes are very sensitive to the grain structure of the films. This is consistent with a precipitation mediated root-growth mechanism.

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Philip Adams
LSU

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