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## Direct production of carbon nanofibers decorated with $\text{Cu}_2\text{O}$ by thermal chemical vapor deposition on Ni catalyst electroplated on a copper substrate

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### Abstract

Carbon nanofibers (CNFs) decorated with  $\text{Cu}_2\text{O}$  particles were grown on a Ni catalyst layer deposited on a Cu substrate by thermal chemical vapor deposition from liquid petroleum gas. Ni catalyst nanoparticles with different sizes were produced in an electroplating system at  $35^\circ\text{C}$ . These nanoparticles provide the nucleation sites for CNF growth, removing the need for a buffer layer. High temperature surface segregation of the Cu substrate into the Ni catalyst layer and its exposition to  $\text{O}_2$  at atmospheric environment, during the CNFs growth, lead to the production of CNFs decorated with  $\text{Cu}_2\text{O}$  particles. The surface morphology of the Ni catalyst films and grown CNFs over it was studied by scanning electron microscopy. Transmission electron microscopy and Raman spectroscopy revealed the formation of CNFs. The selected area electron diffraction pattern and electron diffraction studies show that these CNFs were decorated with  $\text{Cu}_2\text{O}$  nanoparticles.

**Keywords:** carbon nanofibers, nickel nanoparticles, thermal chemical vapor deposition, nickel electroplating, surface segregation

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