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Fluidized bed chemical vapor deposition of copper nanoparticles on multi-walled carbon nanotubes

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Abstract

Multi-walled carbon nanotubes tangled in easy-to-fluidize porous balls have been decorated by pure copper nanoparticles using a pre-industrial fluidized bed chemical vapor deposition process. Copper (II) acetylacetonate $Cu(acac)_2$ was used as precursor. The low precursor volatility led to low deposition rates, responsible for a non-uniformity of the deposit both on the MWCNT balls and from the outer part to the center of the balls. An oxidative pre-treatment of the MWCNTs allowed to increase slightly the deposit weight and uniformity, by creating new nucleation sites on the nanotube surface. It also allowed decreasing the size of Cu nanoparticles by a factor of ten. A decrease of the deposition temperature increased more markedly the deposit weight, by probably favoring the formation of gaseous reactive intermediate species more reactive on the oxidized nanotube surface. A more efficient precursor delivery system would allow reaching higher deposition rates and much more uniform deposits, making possible an industrial production of metallized carbon nanotubes.

Keywords: CVD – Fluidized bed – Multi-walled carbon nanotubes - Copper – Nanoparticles - Copper acetylacetonate