CONFINEMENT of OXIDES and SEMI- METALS in CARBON NANOTUBES

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The search of new materials leads to the creation of nanocomposite structures, such as oxides or semi-metals-filled MWNTs, offering the possibility to enhance, on a nanometric scale, the physical properties of both the encapsulated and encapsulating materials. In the present study, MWNTs synthesized by catalytic decomposition of acetylene and SWNTs from Rice University were filled with transition metal oxides (V, Mn, Fe, Mo, Bi) and semi-metals (Se, Bi) to study on one hand the restricted crystallization behaviour of the encapsulates and on the other hand the electronic properties modifications due to filling.

For transition metal oxides, a one-step filling chemical method was used, where nanotubes are treated with refluxing nitric acid containing a soluble metal nitrate. The corresponding metal oxide is obtained by calcination of the dried insoluble material. For open nanotubes, this method was compared with a filling via capillary action using molten media. Filling rates from 10 to 20% were observed with all the oxides. The results of filling consist either in aggregates (Fe2O3) or continuous crystals (V2O5, MoO2).

For Se, filling was realized in vapor phase using the two-bulb method, allowing the filling of a least 80% of the tubes. For Bi, filling is done under pressure.he electronic properties of such nanocomposite structures is in process.