Structural Characterization of Hybrid Carbon Nanomaterials

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Reflection High Energy Electron Diffraction (RHEED) has been used to investigate the structural features of a new class of nanostructured carbon materials, coupling nanosized diamond with single-walled carbon nanotubes. This innovative material is being produced in our laboratories in a modified CVD reactor by means of reactions between carbon nanopowders and atomic H.

We investigated samples grown at increasing deposition time, combining the structural RHEED data with the information achieved by complementary analysis techniques (Field-Emission Scanning Electron Microscopy (FE-SEM), transmission electron microscopy (TEM), Raman spectroscopy) and by a suitable theoretical approach using *ab initio* modelling [1].

We have been able to determine the growth sequence of the carbon nanophases and the architecture of the observed hybrid nanostructures. Their inner structures are found to be single-walled Carbon nanotubes (SWNT) or bundles of them, and the outermost deposit consist of faceted diamond nanocrystallites.

The experimental conclusions confirm the theoretical prediction [1] about the role of atomic hydrogen in creating localized sp3 hybridized defects on the outer wall of carbon nanotubes, able to promote the formation of suitable sites for nanodiamond nucleation.

[1] Barnard A.S., Terranova M.L., Rossi M., *Chem.Mater.*2005, 17, 527.

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