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SEMINAR

DEFECT NANO-ENGINEERING IN GRAPHITIC MATERIALS: FROM BASIC RESEARCH TO APPLICATIONS AND BIOCOMPATIBILITY

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In this talk, defects within graphite and carbon nanotubes will be categorized in 4 different groups: 1) *Structural defects*, related to imperfections that significantly distort the curvature of the hexagonal carbon honeycomb structure; these defects are usually caused by the presence of non-hexagonal rings (e.g. pentagons, heptagons, or octagons; 2) *Topological defects*, occurring on the nanotube surface, which do not result in large curvature distortions of the tubule. In particular, these defects could be 5-7 pairs embedded in the hexagonal network or Stone-Wales (SW-type) defects that could be created by rotating a carbon bond within 4 neighboring hexagons, thus resulting in the transformation of 2 pentagons and 2 heptagons; 3) *Doping-induced defects*, arising from substitutional non-carbon atoms embedded (or incorporated) into the tubular lattice, 4) *Non-sp^2 carbon defects or edge-sites* caused the presence of highly reactive carbons such as dangling bonds, carbon chains, interstitials (free atoms trapped between SWNTs or between graphene sheets), edges (open nanotubes), add-atoms and vacancies, and 5) Folded (or highly strained) graphene, caused by the severe deformation of the sheets, which induces reactivity by the deformations of the sp^2 hybridized atoms.

This presentation will review recent work related to different techniques used to identify defects using HRTEM, scanning tunneling microscopy (STM), scanning tunneling spectroscopy (STS), Raman spectroscopy (RS), atomic force microscopy (AFM), thermogravimetric analyses (TGA), electron and thermal transport measurements, etc. It is important to mention that most of the time the presence of defects and their identification has been overlooked by numerous scientists. However these play a key role in the nanotubes' physico-chemical properties and biocompatibility. There are numerous challenges that will be discussed in this presentation: How do we identify defects efficiently? Could we distinguish among various defects? Would it be possible to establish a protocol able to quantify and control the amount of these defects? How many defects are necessary to fabricate robust polymer composites or 3D architectures? Could I introduce specific defects in order to make materials biocompatible? Could we promote ferromagnetism by introducing specific defects in nanostructures?, etc.

REMEMBER

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Specific Seminar: Defect Nano-Engineering in Graphitic Materials: from basic research to applications and biocompatibility.
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PLACE: IFAE

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