THE Alan G. MacDiarmid NanoTech Institute

PRESENTS

Monica de Andrade

Ph.D. Student, Department of Material Science
Universidade Federal do Rio Grande do Sul, Escola de Engenharia,

Thursday, July 22nd at 11 a.m.
ECS South 3.503

Mônica is a doctoral student in materials engineering at Universidade Federal do Rio Grande do Sul (Porto Alegre, Brasil) and at Université Paul Sabatier (Toulouse, France). Her thesis focuses on the electrical conductivity of carbon nanotube networks (CNTNs) as pure thin films and as nanocomposites (silica matrix) prepared by spark plasma sintering (SPS) or dynamic suspensions (in chloroform).

In 2006 she spent a year and a half at Siegmar Roth's group in Max-Planck Institute of Solid State Research (Stuttgart, Germany) studying transparent and electrically conductive CNTNs pure thin films through the called doctoral sandwich program sponsored by Brazilian government.

In 2008 she joined Alain Peigney's group as a doctoral student in Université Paul Sabatier through a CAPES-COFECUB cooperation project to prepare CNT-silica nanocomposites obtained by SPS.

University of Texas at Dallas
2601 N. Floyd Rd. BE26
Richardson, TX 75081

Phone: 972-883-6530
Fax: 972-883-6529
Email: exr063000@utdallas.edu

ELECTRICAL CONDUCTIVITY OF CARBON NANOTUBE NETWORKS

The high aspect ratio of carbon nanotubes (CNTs) associated with the high electrical conductivity of their networks make them interesting for many applications. CNTs pure networks can be used in antielectrostatic coatings, electrochromic or electrically heated windshields, energy applications, electromagnetic screening and touch panels, sensors, optoelectronics. The combined properties of percolating CNTs networks (CNTNs) in an electrical insulator medium like silica (SiO_2) matrix enables the composites to be stable in harsh environments (such as high temperatures and strong acids/bases), no degradation under high optical flux and easy to fabricate. For all these applications, CNTs should form 2- or 3-dimensional (2D or 3D, respectively) percolating networks.

In this work it was studied the electrical surface conductance/conductivity: (i) *versus* transparency of films of pure CNTs obtained by dip-coating, spray-coating, filtration method and eletrophoretic deposition; (ii) of dynamic (assured by probe sonication) CNTs suspensions in chloroform; (iii) of densified CNTs-silica nanocomposites obtained by sol-gel and spark-plasma sintering.

Among the several techniques used to prepare the thin pure films of CNTs it was demonstrated that besides the promising values of the randomly oriented CNTNs obtained by eletrophoretic deposition, partially aligned CNTNs by dip-coating can achieve the highest compromise of transparency *versus* surface conductance (along the direction of alignment).

It was also found out that conductivity of the dynamic suspensions can be a good technique to easily find out the percolation threshold of a given CNT and good correlation with power law was demonstrated.

In the case of densified CNTs-silica nanocomposites, it was evidenced strong correlation between the initially state of CNTs (wet or dried) prior to its incorporation in the silica by sol-gel and the final state of dispersion of the filler in the matrix. Furthermore, the mild functionalization developed during this work showed no severe shortening of the CNTs accompanied by a decrease of maximal conductivity achieved. The conductivities achieved for the nanocomposites would be promising for heating and antieletrostatic elements.