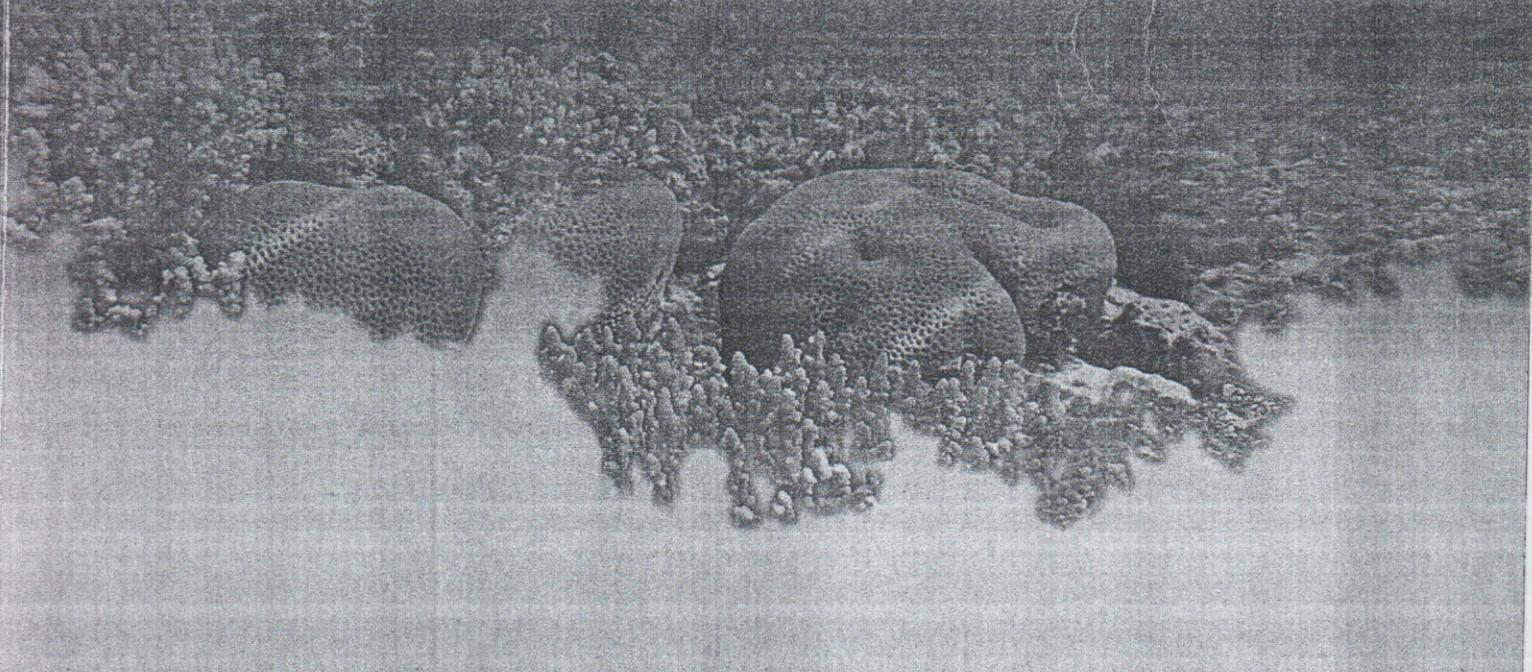


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**Book of Abstracts**

## PREPARATION OF PEDOT-AU-TIO<sub>2</sub> NANOTUBE AND PEDOT-AU COMPOSITE BY IN SITU POLYMERIZATION WITH AU<sup>3+</sup> [PTh13]

*Sze-Ming Yang (Dept. of Chemical and Materials Eng, National Central Univ. /Taiwan)*

A nanocomposite of PEDOT-Au-TiO<sub>2</sub> nanotube was synthesized. A silane containing a thiol group, (3-mercaptopropyl)trimethoxysilane was grafted on the surface of titania nanotube. AuCl<sub>4</sub><sup>-</sup> then formed a self-assembled monolayer on the grafted nanotube. 3,4-ethylenedioxythiophene was used in situ polymerized by AuCl<sub>4</sub><sup>-</sup>. FTIR, UV-VIS, XRD and TGA were used to characterize these nanocomposites. TEM photographs confirm the formation of Au-PEDOT of sphere structure; the PEDOT-Au-TiO<sub>2</sub> nanotube shows nanotube structure. Au-PEDOT shows conductivity was higher when HAuCl<sub>4</sub> concentration increases. The XPS and EDS results showed the nanocomposite contains gold.

## FUNDAMENTAL PROPERTIES AND APPLICABILITY OF CARBON BASED NANOSTRUCTURES: IMPLICATION FOR BIOMOLECULAR SENSORS [BWKL1]

Fundamental properties and applicability of carbon based nanostructures such as polymer nanofibers, carbon nanotubes and the polymer encapsulated carbon nanotubes are investigated. The results of magnetoresistance (MR) for polyacetylene nanofibers show zero MR upto 30 tesla at high electric fields which is consistent with the predicted spinless charged soliton tunneling conduction in polyacetylene. On the other hand, our measurements on polyaniline nanofibers reveal a large MR that shows no decrease in similar electric fields, which is consistent with the polaronic conduction with spin and charge in polyaniline nanofibers. An electric field modulated high magnetic field switching device can be developed as a potential application of polyacetylene nanofibers. The applicability of carbon based nanostructures (conducting polymer nanofibers, carbon nanotubes and their composites) such as the polymer nanofiber Field Effect Transistors (FET), anisotropic FET mobility of pentacene single crystal, PEAPOD single electron transistor (SET), CNT gated CNT cross junction, three terminal CNT nanorelay, single molecule conduction, and polymer nanofiber encapsulated CNT, are envisaged. In particular, the CNT and functionalized CNTs are deposited on top of a CMOS chip to apply for biomolecular sensors.



*Yung Woo Park (Seoul National University/ Korea)*

## INVESTIGATION OF INTERFACE STRUCTURE AND PHASE MORPHOLOGY IN CONDUCTIVE ELASTOMERIC FILMS OF POLYANILINE-CSA/TRIBLOCK COPOLYMERS BLENDS BY SOLID-STATE NMR SPIN-DIFFUSION AND SMALL-ANGLE X-RAY SCATTERING [PTh14]

*Gerson L. Mantovani (Universidade Federal do ABC, Santo André, SP, Brazil), Fábio Aurélio Bonk (Universidade Estadual de Campinas, Campinas, SP, Brazil), Eduardo R. deAzevedo (Universidade de São Paulo, São Carlos, SP, Brazil), Tomas S. Plivelic (Laboratório Nacional de Luz Síncrotron, Campinas, SP, Brazil), Iris L. Torriani (Laboratório Nacional de Luz Síncrotron, Campinas, SP, Brazil), Elias Hage Jr (Universidade Federal de São Carlos, São Carlos, Brazil), Tito J. Bonagamba (Universidade de São Paulo, São Carlos, SP, Brazil), Luiz H. C. Mattoso (CNPq/EMBRAPA, São Carlos, SP, Brazil)*

The spin diffusion technique in solid-state NMR spectroscopy has been widely used to simultaneously study phase domains size and interface thickness of multiphase polymer systems [1]. Information derived from spin diffusion data is often similar to information obtained from SAXS or from coherent neutron scattering. However, SAXS and spin diffusion data possess very different contrast factors; of special note in this regard is the lack of sensitivity to the presence of voids in spin diffusion data and the strong sensitivity to voids in X-ray scattering data. Hence, SAXS and spin diffusion techniques should be regarded as strongly complementary to one another. NMR does not require the formation of periodical domains and is sensitive to domain sizes ranging from nanometers to hundred of nanometers. On the other hand, NMR is not able to give the morphological information directly. SAXS, in contrast, can provide morphological information but, in more complex cases, this technique does not yield details on the domain sizes of the dispersed phases and on the interphases. In the following, we used the precise structural information obtained by SAXS into a 1H-NMR spin diffusion analysis so that two techniques can be combined to successfully determine the nanostructure of the triblock copolymers investigated here. In this work, solid-state NMR spin-diffusion and small-angle X-ray scattering (SAXS) with synchrotron radiation experiments were used to characterize the morphology of the conductive elastomeric films of polyaniline doped with camphorsulfonic acid (PANI-CSA) in polymer blends with matrix of poly(styrene-ethylene/buthylene-styrene) (SEBS) triblock copolymers. Polyaniline (PANI) was synthesized as described elsewhere (Mw ≈ 50000 g/mol) [2]. The polymer in the emeraldine form was dissolved in m-cresol (1% wt/vol) and then protonated with camphor sulfonic acid (CSA) to a doping degree of 50% PANI(CSA)0.5; triblock copolymer - SEBS (Kraton® G-1651) was dissolved in xylene (5% wt/vol) and added to the conducting polymer solution in order to obtain the desired composition. Flexible, free-standing films were obtained by casting polyblends of PANI-CSA and the thermoplastic rubber SEBS, after drying at 50 °C for 96h. The conductivity was measured by the four

probe technique. A remarkable low percolation conductivity of  $\approx 10^{-2} \text{ S}\cdot\text{cm}^{-1}$  for 2.5% of the doped conducting polymer in the blend. SAXS measurements were performed at the small-angle scattering workstation of the Synchrotron Light National Laboratory (LNLS), Campinas, Brazil. Spectra were taken for all samples for 1 hour using a wavelength of  $\lambda = 1.7433 \text{ \AA}$ , at a sample-detector distance of 885.5 mm. The SAXS curves were obtained using a dimensional position-sensitive gas detector. NMR experiments were performed using a VARIAN INOVA spectrometer at 1H frequency of 400.0 MHz at  $20 \pm 2 \text{ }^\circ\text{C}$ . A VARIAN 7-mm variable temperature probe head was used.  $\pi/2$  pulse length of 4.0 ms, recycle delays of 10 s, and spin-diffusion mixing times from 0.1 to 4000 ms were used. It was observed from SAXS results that the incorporation of the PANI-CSA in matrix of the SEBS, decrease its lamellar thickness morphology and broadens the interface. In addition, it was concluded directly from the 1H-NMR spin-diffusion curves that the parameters not only broadens the interface between rigid and mobile components but also decreases the mobile phase fraction.

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### INFLUENCE OF THE SUPPORTING ELECTROLYTE CONCENTRATION ON THE FORMATION OF NANOWIRES OF POLY(3-METHYLTHIOPHENE) SYNTHESIZED BY AN ELECTROCHEMICAL TEMPLATE-FREE METHOD [PTu15]

*Alessandra Alves Correa (Embrapa/Brazil), Ernesto Chaves Pereira (UFSCar/Brazil), Luiz Henrique Capparelli Mattoso (Embrapa/Brazil)*

Nanostructures fabricated from conducting polymers have attracted an increase in the interest in research due their physical, chemical and electronic properties, together with the wide range of potential applications in nanoscience. Templating techniques, such as those employing organic templates, ionic surfactants, silicates, polyelectrolytes, are commonly employed in the synthesis of nanostructured polymers, but such techniques can have the disadvantage of having to remove the template to obtain the nanostructured polymer. The electrochemical synthesis of conducting polymer is a technique that avoid the use of a template. In the literature it have been reported that polypyrrole microtubule [1] and polyaniline nanowires [2] could be synthesized by electrochemical polymerization. Compared to the template-synthesis method, the template-free method is simple and cheap because no micro or nano porous membranes are used as templates. The electrochemical synthesis provides easy control of the film thickness and allows an in situ characterization of the growing film and the films properties depends on of the electrochemical conditions used. In this work, the synthesis of nanowires of poly(3-methylthiophene) by an electrochemical template-free method is reported. The influence of the polymerization condition, such concentration of  $\text{LiClO}_4$ , on the nanowires morphology was investigated. The monomer 3-methylthiophene was obtained from Aldrich. The electrolyte used was lithium perchlorate (Aldrich) in acetonitrile in two different concentrations: 0.1 and 0.3  $\text{mol}\cdot\text{L}^{-1}$ . Electrochemical experiments were carried out with a cell glass with an Ag wire used as quasi-reference electrode. Platinum foils were used as working electrode and counter electrode. The electropolymerization of poly(3-methylthiophene) was carried in solution containing 0.1  $\text{mol}\cdot\text{L}^{-1}$  monomer. The polymerization potential was 1.5 V. The morphology of poly(3-methylthiophene) depended strongly on the concentration of dopant used. As Figure 1 shows, an increase in the concentration of  $\text{LiClO}_4$  favours the formation of fibrillar morphology. The SEM clearly shows that using  $\text{LiClO}_4$  at the concentration of 0.1 M no poly(3-methylthiophene) nanowires were observed and a cauliflower morphology was obtained. However, using  $\text{LiClO}_4$  at the concentration of 0.3 M the poly(3-methylthiophene) nanowires were formed. The highest concentration of the supporting electrolyte implies in higher conductivity [3]. The increase of the conductivity must provoke an increase in the occurrence of nanowires and this is in agreement with the behavior observed in the literature for polyaniline nanowires [2]. Acknowledgements: CNPq, CAPES, FAPESP

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### FERROELECTRICITY IN SYNTHETIC METALS: REALITY AND HYPOTHESES. [GMA3]

*Serguei Brazovskii (LPTMS-CNRS, Université Paris-Sud, Orsay, France), Natasha Kirova (LPS-CNRS, Université Paris-Sud, Orsay, France)*

The ferroelectricity is one of demanded effects in fundamental and applied solid state physics. The most recent rise of R&D includes active gate materials and electric RAM in microelectronics, super-capacitors in portable communicators, sensors in medical imaging, etc. Till now, the ferroelectrics were available in the inorganic world, sometimes in more complex strongly insulating materials. The recent breakthrough [1], see reviews [2], was an unexpected discovery of the ferroelectricity, related to the charge ordering, in typical quasi-1D organic conductors (TMTTF) $_2$ X, as well as and in some layered compounds like d-(EDT-TTFCONMe) $_2$ Br [3]. The dielectric susceptibility, reaching the values  $\sim 106$ , coexists with an unusually high conductivity, which gives rise to the material classified as the "ferroelectric narrow gap semiconductor". The