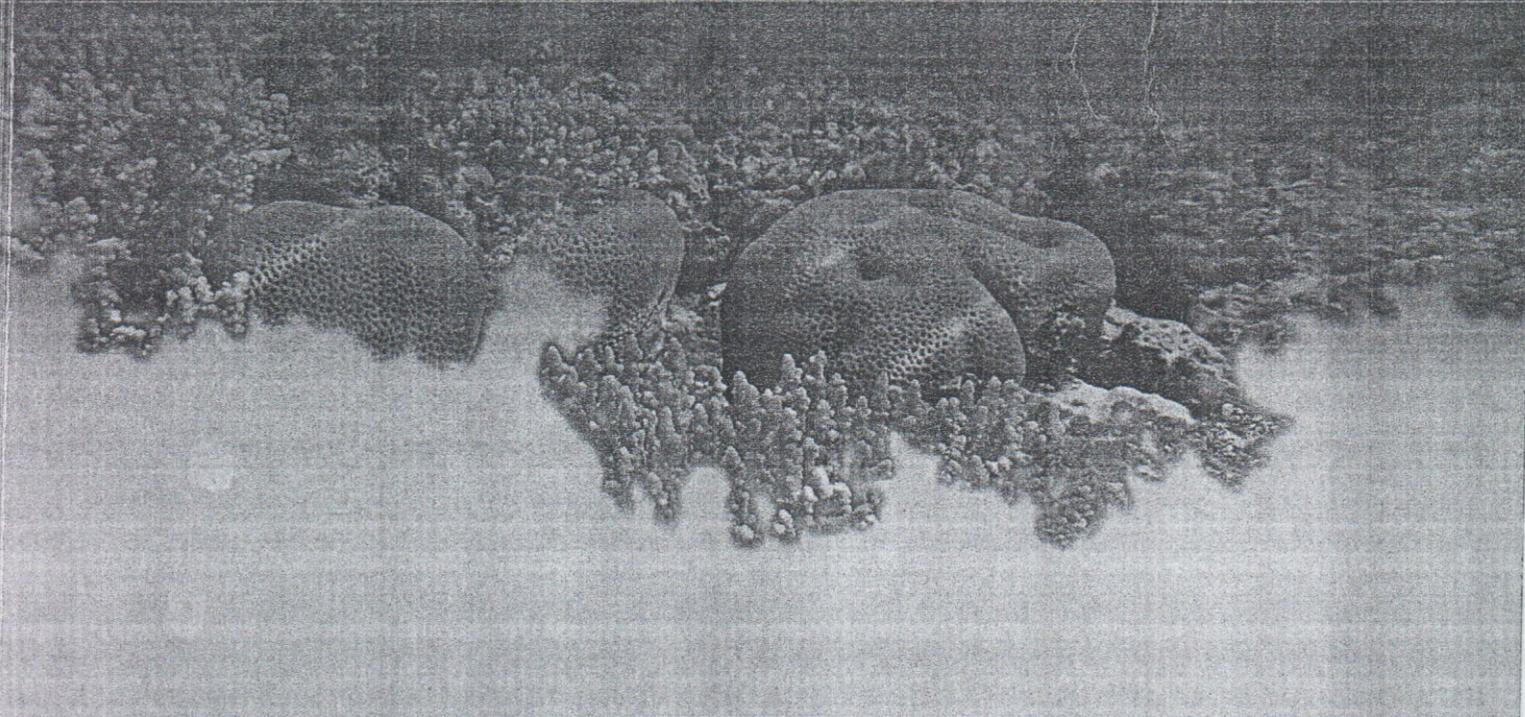# ICSM 2008

International Conference on Science and Technology of Synthetic Metals

Porto de Galinhas   Brazil   July 6-11, 2008

Book of Abstracts

CONDUCTIVITY STUDY OF GRAPHITE + PVDF COMPOSITE ELECTRODES [RThM4]

In the last years, many composites containing dispersed conducting particles in an insulating polymeric matrix have been studied for applications such as thermistors, chemical sensors, new materials for electronic industry, etc. The resistivity of such a composite is well explained by percolation theory. For a small volume fraction of conducting filler, the resistivity of the composite is basically that of the polymer matrix. As the volume fraction of the filler increased, the filler particles come into contact with one another to form the conduction paths through the composite. As a result the resistivity drops by many orders of magnitude at a critical threshold. Once a saturation region is reached, there are a large number of conduction paths, resulting in a low resistivity. Therefore, the understanding of the percolation curve is very important in order to design applications (1). In the present work, the electrical properties of graphite + poly(vinylidene fluoride) - PVDF composites were investigated using the electrochemical measurements. The graphite + PDVF composite electrodes were carried out in an aqueous containing 1.0×10^{-2} mol/L $[Fe(CN)_6]^{3-}$ in 0.5 mol/L KCl medium for different electrode compositions. The results are shown in Fig. 1, where the voltammograms were recorded at 25 mV s^{-1} for all graphite proportions. It can be seen that the voltammetric waves show evidence of a deformation when compared with those obtained by using an Pt electrode. The distortion is caused by two effects: the ohmic drop and the double layer (or non-Faradaic) charging current. The ohmic drop results in a decrease of the peak current and its widening, these phenomena are well observed for the materials with low graphite proportion (around 45% w/w). Therefore, the electrode with a 60% graphite proportion corresponds to the maximum relation between the faradaic current and the charge current. The electrical conductivity measurements were performed in ambient atmosphere using the ASTM method for bulk and surface conductivity determinations. The percolation theory was used in order to analyze the electrical resistance (R) values. It was found that the R values depended on the graphite volume fraction (V) with a power law $R1 = (V-Vc)^{-S}$ with a critical exponent, S of 1.3 and a critical volume fraction, Vc of 0.19. These results fit reasonable well the percolation equation proposed by Zallen(2) for a point percolation model and tridimendional binary mixtures.

Author block

Celso Xavier Cardoso (UNESP - FCT / Brazil) Alex Silva (UNESP - FCT / Brazil), Marcos Fernando de Souza Teixeira (UNESP - FCT / Brazil)

(1)M. B. Heaney, Phys. Rev. B, 52 (1995) 12477. (2)F. Lux, J. Mater. Sci. 28 (1993) 285. FAPESP (2005/01296-4), CNPq

EFFECT OF THICKNESS IN NANOFIBERS AND NANOPARTICLES OF POLYANILINE SYNTHESIZED BY DIFFERENT ELECTROCHEMICAL TECHNIQUES [PM64]

Nanofibers and nanoparticles of polyaniline (Pani) were synthesized by potenciodynamic and potenciostatic electrochemical techniques of cyclic voltammetry (CV) and amperometry, respectively, on gold electrodes. The Pani films were synthesized in three aniline concentrations and three thicknesses in hydrochloric acid. Then the oxidation state of the films were characterized by open circuit potential measurements (OCP) in the presence and absence of electrochemical characterization. The films were characterized by means of UV-Vis spectroscopy, field emission gun scanning electron microscopy (FEG-SEM) and atomic force microscopy (AFM). The initial stages of Pani film growth were observed in lowest aniline concentration in agreement with our previous studie (1) that Pani nanofibers are composed by nanoparticles agglomerate into interconnected networks until they form branched network-like nanofibers, confirming the proposition of Mandic (2) that such structures growth in two different steps (nucleation onto bare electrode and PANI growth on the modified surface). The type, amount and dimensions of the nanostructures produced depend strongly on the electropolymerization conditions such as monomer concentration and the electrical potential used.

Miguel Gustavo Xavier (Universidade Federal de São Carlos/Brazil), Everaldo Carlos Venancio (Universidade Federal do ABC/ Brazil), Edson Roberto Leite (Universidade Federal de São Carlos/Brazil), Luiz Henrique Capparelli Mattoso (Embrapa Instrumentação Agropecuária/Brazil)

(1) M.G. Xavier, E.C. Venâncio, E.C.Pereira, F.L. Leite, E.R. Leite, A.G. MacDiarmid, L.H.C. Mattoso, J. Nanosci and Nanotech 2008 (no prelo). (2) Z. Mandic, L. Duic, F. Kovacicek, Electrochim. Acta 42, 1389. (1997).

WRITING (WEIGHTING AND DEVELOPMENT) FOR NETWORK DEVICE OF COMPOSITE CONDUCTING POLYMER [PM60]

Neuron-type conducting polymer has been polymerized electrochemically and their conducting polymer can be connected. Thus the network of neuron-type conducting polymer can be polymerized. If the conductivity of the path of the network can be controlled by the signal that flows the path, a network memory device or a neural network device can be fabricated. It was found that the conductivity of composite film of conducting polymer (polypyrrole/poly(3-alkylthiophene(PPy/PAT) was changed by uni-polar alternate voltage signal, i.e. composite conducting polymer works as memory. Writing process consists of two processes; weighting and development. At first composite conducting polymer set in solvent with dopant(liquid phase dope) and uni-polar signal voltage is applied to it. This process is called weighting. At this time, the conductivity does not change. Next the composite conducting polymer added the signal is immersed in ethanol. It is hard for dopant to move out from the

Masaharu Fujii (Ehime University/Japan), Shinn-ichi Mukai (Ehime University/Japan), Haruo Ihori (Ehime University/Japan)