ELECTROSYNTHESIS ON CARBON FIBER FELTS FOR APPLICATION IN ELECTROMAGNETIC FILTER - RELATIONSHIP BETWEEN ELECTROCHEMICAL AND ELECTROMAGNETIC PROPERTIES

A.K. S. Poli[1], G. M. D. Caetano[2], A. M. Gama[2], S. F. Quirino[3], M. Baldan[1,3], E. S. Gonçalves [1,2]

[1]Instituto Tecnológico da Aeronáutica, São José dos Campos, SP, Brasil.

[2]Instituto de Aeronáutica e Espaço, Laboratório de Caracterização Físico-Química, Divisão de Materiais, São José dos Campos, SP, Brasil.

[3]Instituto Nacional de Pesquisas Espaciais, Laboratório Associado de Sensores, São José dos Campos, SP, Brasil.

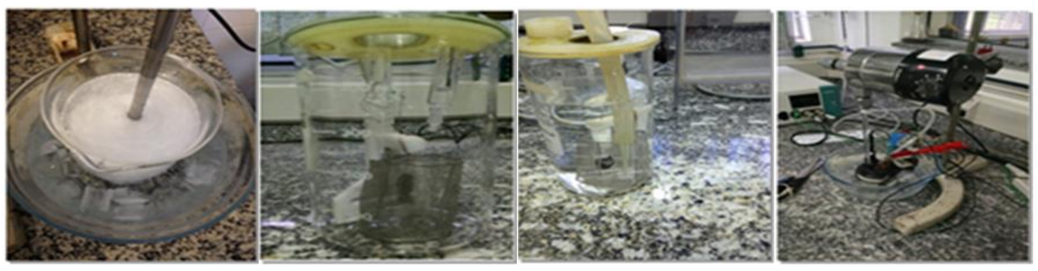
karoline-poli@hotmail.com

ABSTRACT

Conductive polymers such as polyaniline (PANI) are materials useful as a filter for electromagnetic interference (EMI). This work consists of the study of the composite polyaniline@carbon fiber felt, annealed previously to 1600K under action of electromagnetic field in the range of microwaves, in order to better understand the relationship between its electrosynthesis parameters and their behavior as an EMI filter. The characterization of composite was realized by Electrochemical Impedance Spectroscopy and Electromagnetic Response. Electrochemical Impedance Spectroscopy showed that the felt shows typical behavior of amorphous carbon, which underwent gradual changes with the cycles, increasing the capacitance and decreasing the electrical resistivity.

MATERIALS AND METHODS

The composite were obtained in 3, 6 and 9 voltammetric cycles, in a 0,1mol/L aniline and H_2SO_4 0,5 mol/L solution. Carbon fiber felt was work electrode, against platinum electrode, using cyclic voltammetry in the region of -0.50 V to +1.05 V *vs.* Ag/AgClat sweep rate 25 mV/s



aniline and H_2SO_4 solution | Cell assembly | gas bubbling in the system | onset of electrosynthesis

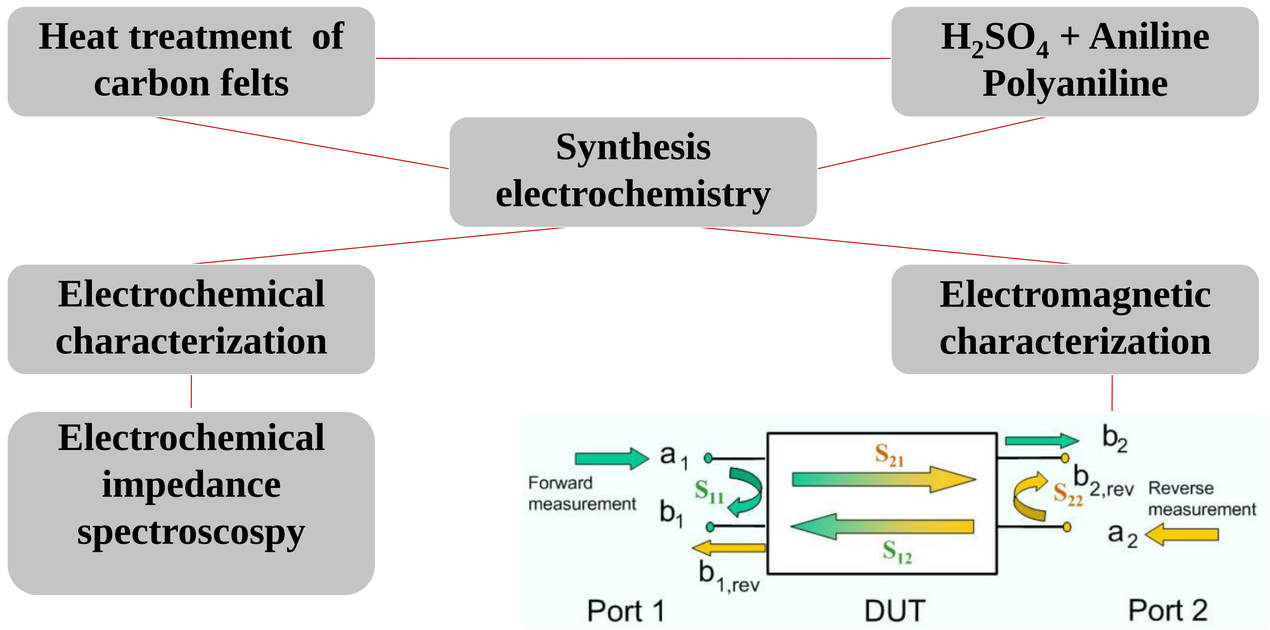


Figure 2. Schematic of the incidence and response of the wave between two ports

RESULTS

Cyclic Voltammetric Electrosynthesis

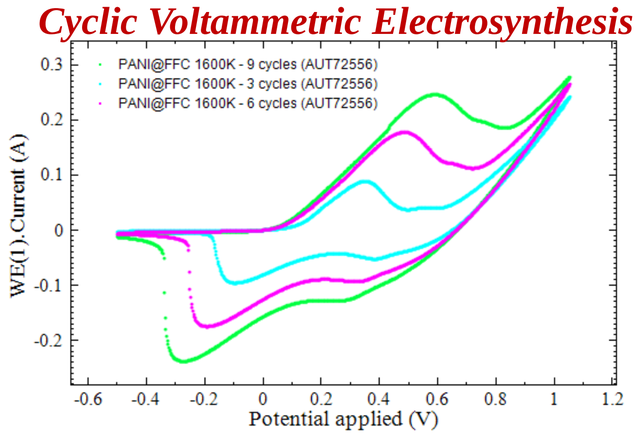


Figura 3. Polarographic data

Electrochemical Impedance Spectroscopy

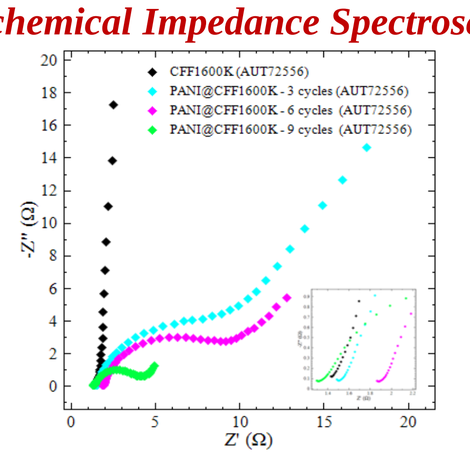


Figure 4. Electrochemical Impedance Spectroscopy of carbon fiber felt and PANI@CFF composite

Electromagnetic Properties

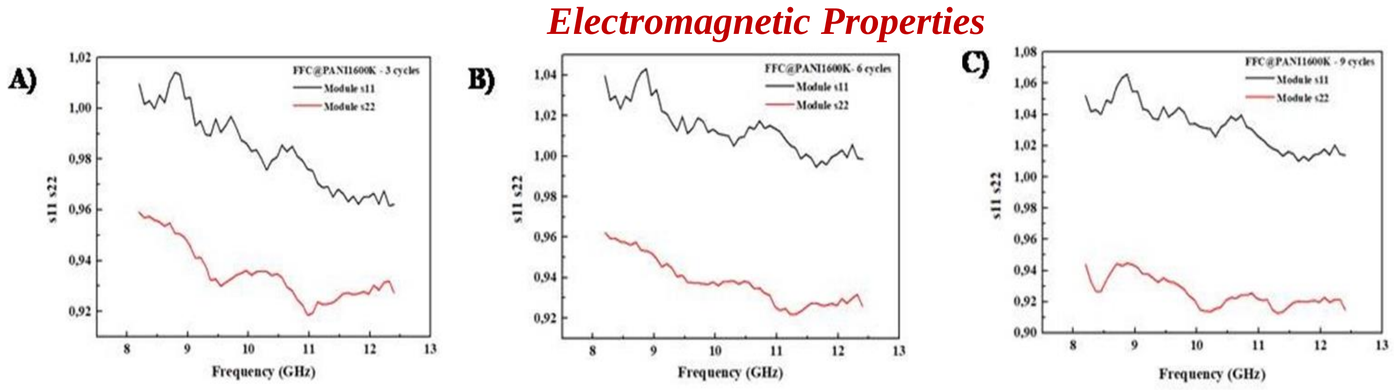


Figure 5. S-Parameters - modules of s_{11} and s_{22} for: a) 3 cycles; b) 6 cycles; c) 9 cycles

The parameters s11 and s22 are related to the wave reflection aspects in the two faces of the material. The higher the reflectivity index, the higher the conductivity of the medium.

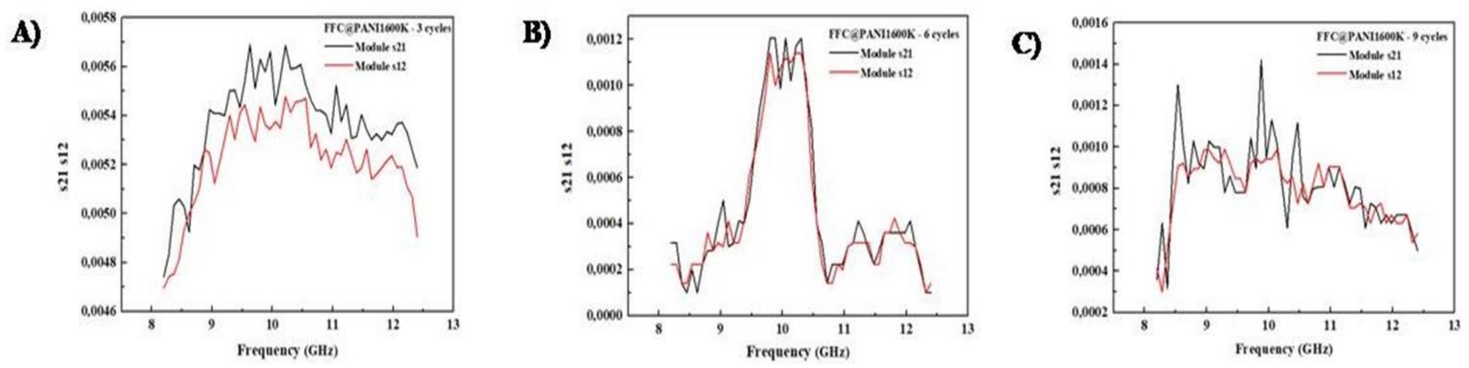


Figure 6. S-Parameters S - modules s_{21} and s_{12} for: a) 3 cycles; b) 6 cycles; c) 9 cycles

These datas present the pattern of wave transmission within the material, from one surface to another, in both directions.

CONCLUSIONS

✓ PANI@CFF composites from nine cycles showed more electroactive interfaces, increasing both the accumulation and the release of electrical charge from the material to the electrolyte environment;

✓For the S parameters s11 and s22 compounds obtained with 3, 6 and 9 cycles, there is variation of as the frequency increases, which indicates that the surfaces of the samples are anisotropic and heterogeneous ie the surfaces are different from the distribution;

✓By analyzing the S parameter curves (s21 and s12), the series of three and six cycles have a homogeneous and isotropic method, which can be explained by the similarity of the curves as a volume increases;

✓For nine cycles, a heterogeneous and anisotropic medium is shown, which may suggest whether a PANI within the carbon market or whether growth was only external.

ACKNOWLEDGEMENT

CAPES INPE FAPESP CNPq