11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

One-Step Synthesis of Polyaniline and Silver Particles Composites in Ionic Liquids

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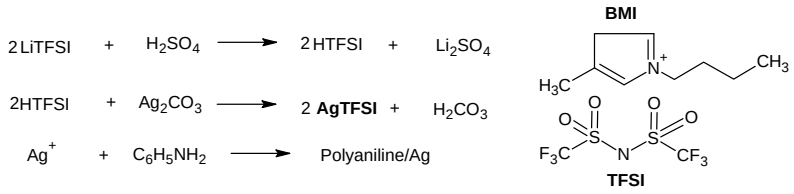
Abstract – In this work we have shown the preparation of polyaniline and Ag composite using a silver salt as oxidant agent and an ionic liquid as solvent and template for the polymer and metal particles. Due to the good solubilization of the oxidant agent, AgTFSI, silver bis(triluoromethanesulfonyl) imide, in ionic liquid the synthesis was carried out in homogeneous phase initially, leading to an uniform material. The composite was characterized by FITR, TG, XRD. A little degree of deprotonation is observed during the synthesis, fact that is suppressed during the work up with acid washings. Electrical conductivity was improved, coherent with the presence of metal in the hybrid material.

Composites formed by conducting polymer (CP) and metal have the potential to combine two materials with great academic and industrial interest. Several methods to prepare polyaniline/metal composites have been tested but often not effectively dispersed material is obtained [1]. In this work it is shown the one step preparation of a composite between polyaniline (PAni) and silver using as oxidant agent a silver salt. The use of ionic liquid was due to its good solubility capacity, structural design (template for the polymer and metal particles) and chemical and electrochemical stability.

The oxidant agent, AgTFSI, was prepared in two steps. First, the acid, HTFSI, was prepared by reacting LiTFSI with H_2SO_4. In the second one, HTFSI was treated with Ag_2CO_3 and after purification AgTFSI was obtained as white crystals. This salt was solubilized (2.5 M) in BMITFSI (1-butyl-3-methyl imidazolium bis(trifluoromethanesulfonyl) imide already with aniline and then the reaction medium was stirred during 24h (Scheme 1). After work up, a green powder was obtained and characterized by FTIR, TG, XRD and elemental analysis.



Scheme 1: Preparation of AgTFSI, Pani/Ag composite and BMITFSI ionic liquid structure

FTIR spectra (Figure 1) shows characteristic bands of PAni in its more conductive form, emeraldine salt [2]. The incorporation of Ag was checked by themogravimetric (Figure 2) (almost 35% of inorganic material) and elemental analyses. In the XRD diffractometry, in addition to the characteristic peak of PAni ($2\theta = 25^o$) others corresponding to the (111) and (200) Bragg reflections of Ag were also observed. Electrical conductivity of this composite, estimated using a four point probe, is higher than PAni prepared by conventional method.

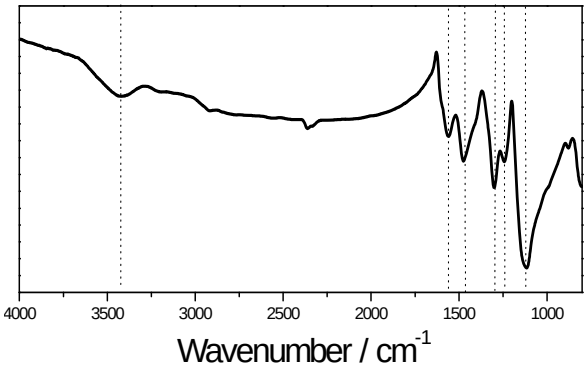


Figure 1: FTIR of the PAni/Ag composite (KBr pellets)

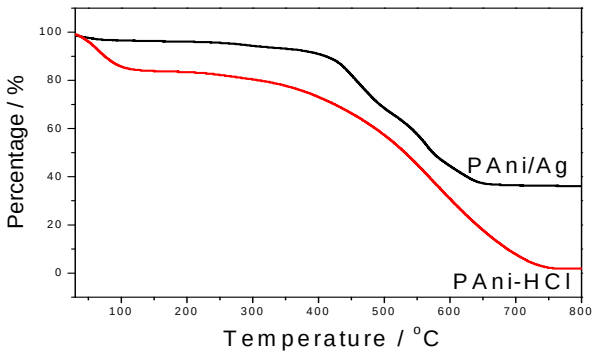


Figure 2: TG of PAni/Ag composite and Pani-HCl (in Air)

References

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[2] J. Stejskal. IUPAC Pure Appl. Chem 74 (2002), 857.