EFFECT OF WASHING ON THE RESISTIVITY OF THE POLYAMIDE TEXTILES COATED WITH DOPED POLYANILINE

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Introduction

- The interest in conductive textiles increased due to new applications as flexible optoelectronic devices [1] .
- Electronic textiles and smart devices are undergoing a rapid development and actively entering user market [2-5].
- Sensors and sensing systems detecting pressure, temperature, strain, as well as disease biomarkers and cellular metabolites, including glucose, lactate, and ascorbic acid have been successfully integrated into textile fabrics [2].
- Polyaniline (PANI) is the most commercial promising conducting polymer because of low cost of monomer, thermal and chemical stabilities, easy preparation, and eco-friendly.
- Polyaniline is an intrinsic conjugated polymer containing aromatic rings and amino groups. In polyaniline conduction is given due to delocalization of the electrons in double bonds.
- Processing and intrinsic conductivity of the polyaniline are critical established by types of doping ions used in the process.

Materials and methods

- In this work polyaniline doped with para-toluene sulfonate acid (p-TSA) were deposited on polyamide textiles by in situ polymerization. The molar ratio between aniline: p-TSA was 3:1.
- The structure and morphology of polyamide textiles before and after coating with doped polyaniline was studied using infrared spectroscopy and scanning electron microscopy (SEM).
- Attenuated Total Reflectance was carried on a Cary 630 infrared spectrometer at room temperature with 32 scans and sensitivity of 4 cm-1.
- Electrical properties were recorded on fresh obtained coated textiles and on the textiles after washing with water (neutral), HCl 10% (acid media) and detergent without phosphate (basic media), according to patent number SR EN 1149-1:2006.

Results

The morphology of the textiles covered with p-TSA doped polyaniline are shown in figure 1. A uniform thin film was deposited on the textiles.

In the figure 2 is presented the infrared spectrum between 1800 cm^{-1} and 600 cm^{-1}. Main bands are identified and assigned. Infrared spectroscopy brings valuable information on the structure of polymer obtained.

Polyaniline infrared bands highlight the following issues:
- Stretching bands of chinoid ring (Note Q) of type N = Q= N are observed at 1620 cm^{-1};
- Stretching bands of the benzenoid ring (note B) N-B-N type are observed at 1514 cm^{-1};
- Stretching bands such as CN + of the polaron structure are observed in 1232 cm^{-1};

- The surface resistivity decreased after 10 circles in the washing machine with detergent, but the value is maintained in the interval proper to applications.

Fig.1. Coated polyamide.

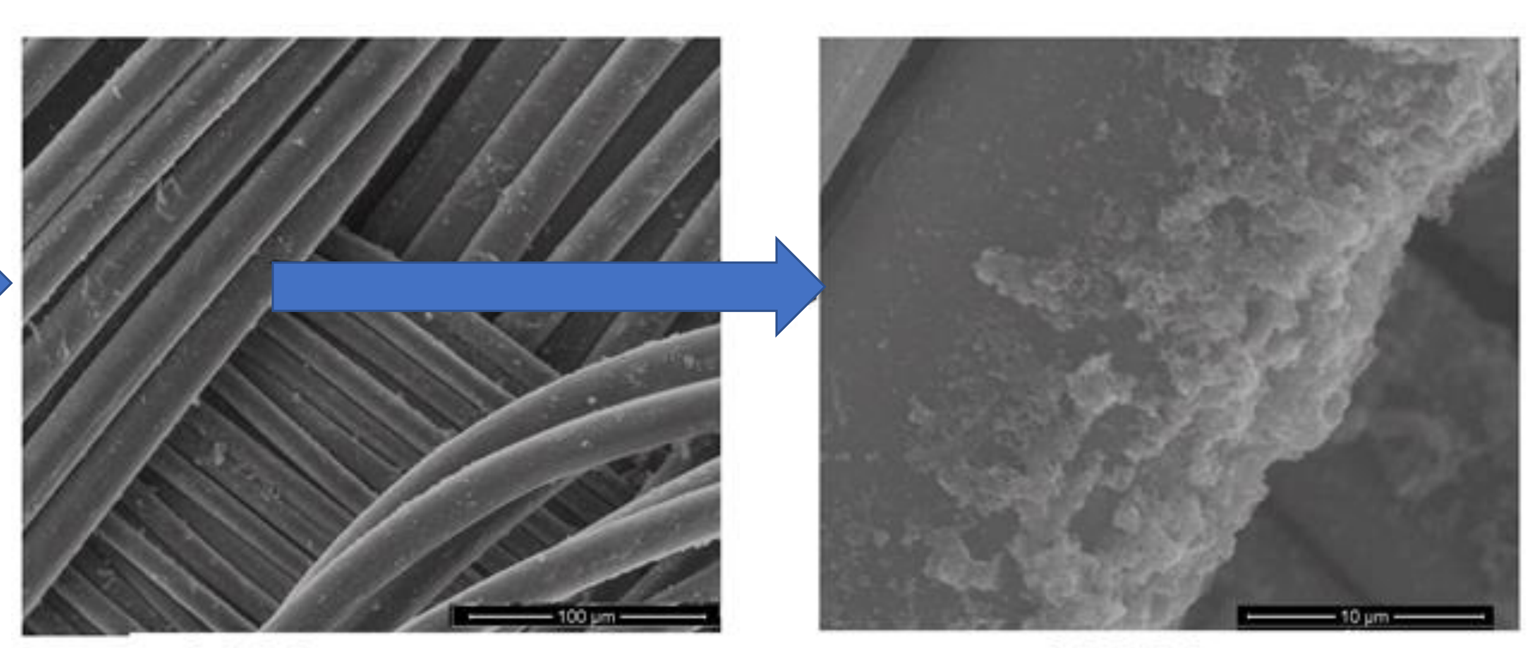

Fig.2 SEM image of coated textile at different magnifications.

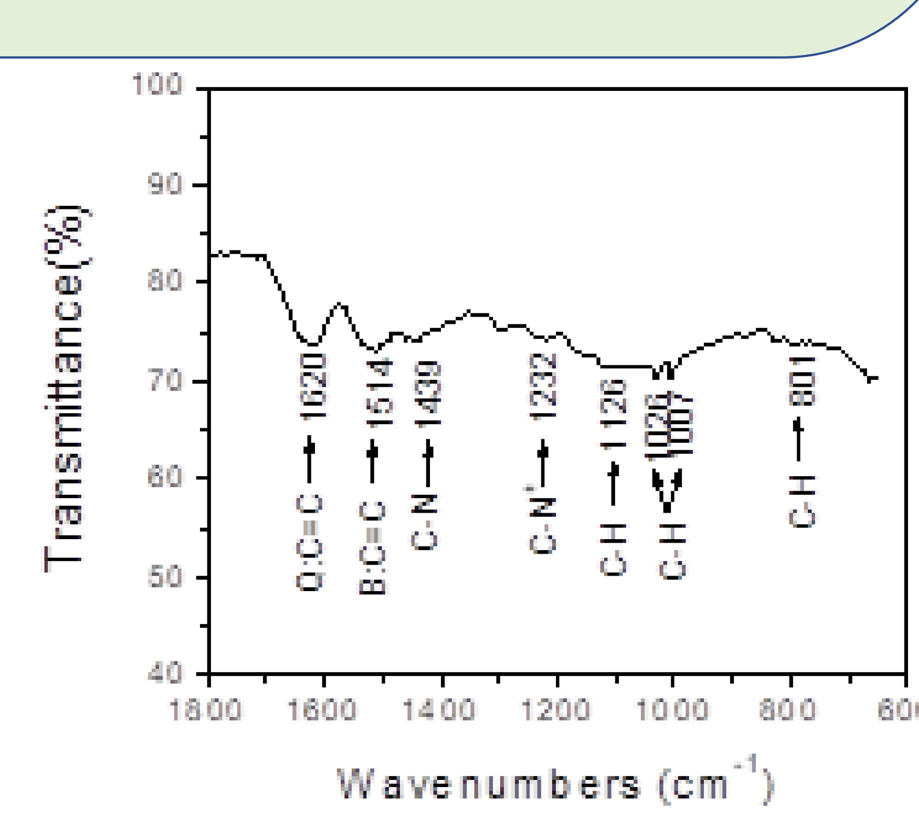

Fig.3. Infrared spectrum of coated textile

Table 1. The results of the resistivity measurements of the coated fabrics before and after washing; according SR EN 1149-1:2006

	Coated polyamide	After washing with water	After washing with HCl 10%	After washing with detergent
Surface Rezistivity (Ωcm)	$3.8*10^4$	$3.7*10^4$	$1.1*10^4$	$5.7*10^6$

Conclusions

- Conductive textiles exhibited a rough but uniform, coherent coating. The surface resistivity decreases after washing in water and in acid media and increases after washing in basic media.
- The polyamide textiles prepared by „in situ'' polymerization were coated uniformly and showed good electrical resistivity of 10^4 -10^6 Ωcm after washing with water, acid and detergent. They can be used as flexible conductive textiles.

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