EFFECT OF DOPANTS AND DBD PLASMA TREATMENT ON THE CONDUCTIVITY OF FABRICS IMPREGNATED WITH PEDOT:PSS

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INTRODUCTION

Conductive properties are paving the way to produce smart textiles with a robust framework, so the development of electroconductive textiles is an area with growing interest. Poly (3,4-ethylene dioxythiophene):polystyrene sulfonate (PEDOT:PSS), is a conductive polymer widely used to impart conductivity to textiles. An increase of the conductivities is possible through the addition of secondary dopants to the conductive polymers, such as glycerol (GLY) or dimethyl sulfoxide (DMSO). Dielectric barrier discharge (DBD) plasma treatment improves the adhesion of coatings by modifying the surface of textiles. Herein, electrically conductive textiles for heat generation were prepared and characterized. Polyester (PES, DBD plasma-treated and not treated) fabrics were impregnated in a padding system with five layers of conductive solutions: PEDOT:PSS; PEDOT:PSS + GLY 5%; and, PEDOT:PSS + DMSO 7%.

RESULTS

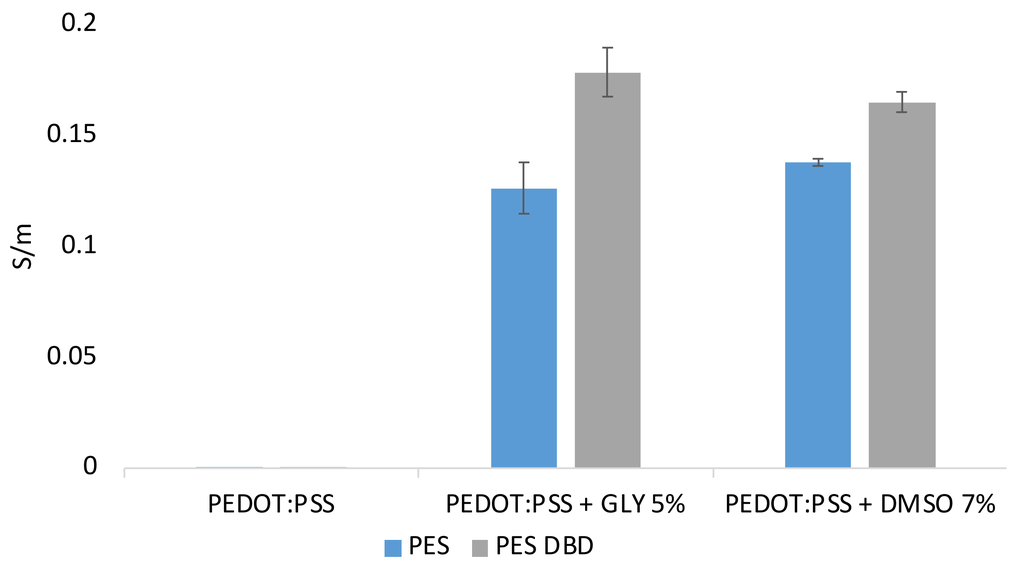

Figure 1: Conductivity measurements at 12V of the samples with PEDOT:PSS, PEDOT:PSS + GLY 5% and PEDOT:PSS + DMSO 7%.

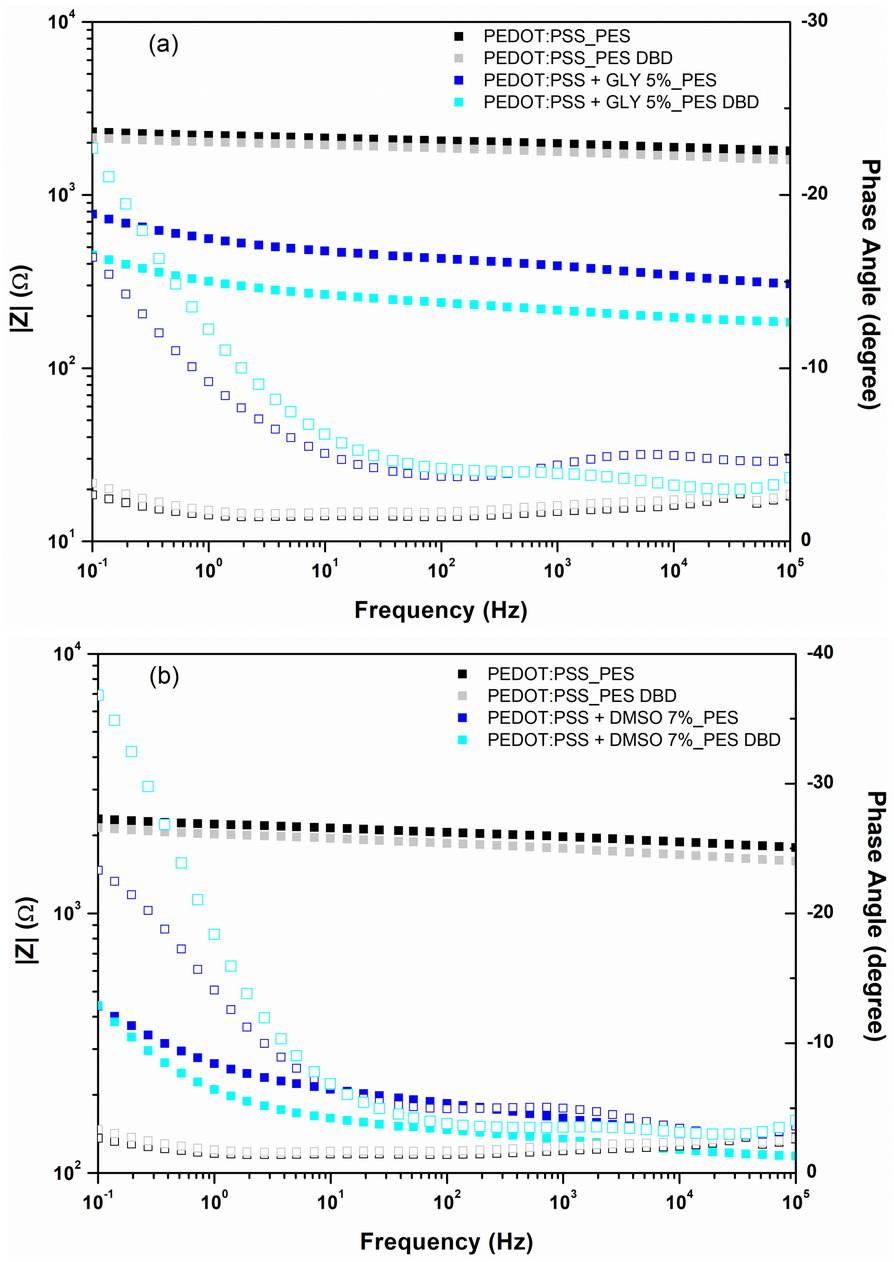

Figure 2: EIS spectra of the sample treated with PEDOT:PSS + GLY 5% (a) and PEDOT:PSS + DMSO 7% (b) in form of a Bode diagram.

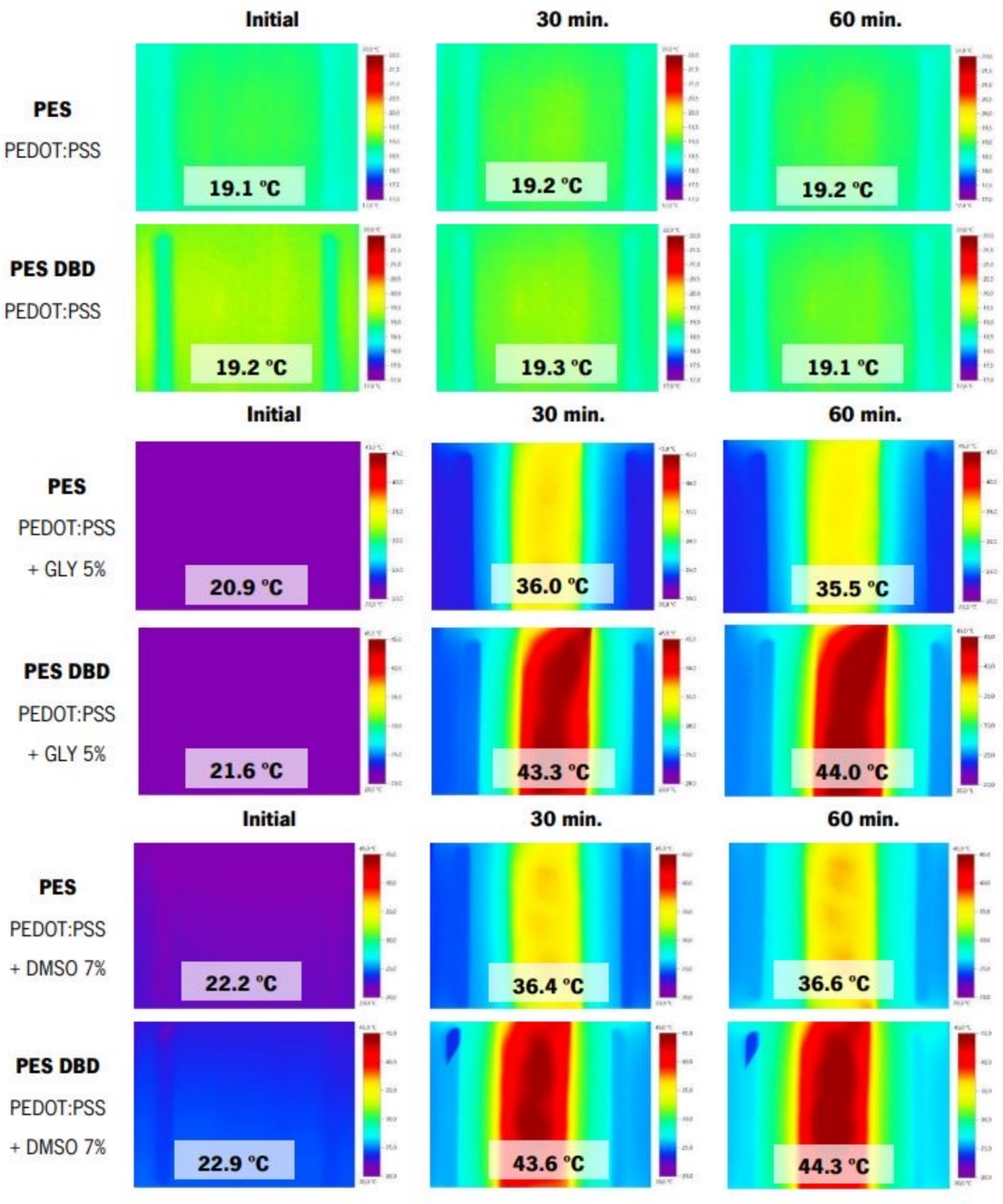

Figure 3: Joule heating effect on PES (not treated and DBD plasma-treated) fabrics impregnated with PEDOT:PSS; PEDOT:PSS + GLY 5% and PEDOT:PSS + DMSO 7%, at an applied voltage of 12V.

CONCLUSION

- The data have shown a significant increase in the conductivity of the fabrics in three orders of magnitude, after the addition of GLY and DMSO to the PEDOT:PSS dispersions.
- In this work the influence of sodium dodecyl sulphate (SDS) was also studied as a secondary dopant, although the temperatures obtained was quite lower comparing to GLY and DMSO action with a maximum temperature recorded of 36.8 °C.
- The lower values of impedance ($|Z|$) was registered to the samples treated with GLY and DMSO, which means that the electrochemical resistance of the textile samples have decreased. The phase angle results suffered an approach to -90 °, the value that is associated to the behaviour of an ideal capacitor.
- Both of the fabrics (PES and PES DBD) presented a uniform heat generation and the samples treated with GLY and DMSO attained higher heating properties in comparison to the samples only treated with PEDOT:PSS.
- PES DBD fabrics accomplished better electrical conductivities and consequent better heating behaviour than PES samples without any surface activation treatment.
- The samples get a quick temperature increment in the first seconds and a steady temperature profile was reached, which indicates two important features for smart textile applications.

ACKNOWLEDGMETS

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