Application of organic polymers for wear-resistant, electrically conductive coatings

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The way to improve the properties (resistance to washing, delamination, and rubbing off) of the PEDOT: PSS coating applied on wool fabric without reduction of its electrical conductivity by introducing a commercially available combination of low formaldehyde content melamine resins into the printing paste is presented in this work. Primarily, to improve the hydrophilicity and dyeability of wool fabric, the samples were modified using low-pressure nitrogen (N_2) gas plasma. Two commercially available PEDOT: PSS dispersions were used to treat wool fabric by the exhaust dyeing and screen-printing methods, respectively. Spectrophotometric measurements of the color difference (ΔE^*_{ab}) and visual evaluation of wool fabric dyed and printed with PEDOT: PSS in different shades of the blue color showed that the sample modified with N_2 plasma obtained a more intense color compared to the unmodified one. SEM was used to examine the surface morphology and a cross-sectional view of wool fabric that had undergone various modifications. SEM image shows that the dye penetrates deeper into the wool fabric after plasma modification using dyeing and printing methods with a PEDOT: PSS polymer. In addition, with the low melamine formaldehyde resins the coating appears more homogeneous and uniform. The chemical structure of wool fabrics coated with PEDOT: PSS was investigated using FTIR-ATR. The influence of melamine formaldehyde resins on the electrical properties, resistance to washing, and mechanical effects of PEDOT: PSS treated wool fabric was also evaluated. The resistivity measurement of the fabric containing melamine-formaldehyde resins as an additive did not show a significant decrease in electrical conductivity, while the electrical conductivity was maintained after the washing and rubbing test as well. The best results of electrical conductivity for investigated wool fabrics before and after washing and mechanical action were determined for samples subjected to the combined processing – surface modification by low-pressure N_2 plasma, dyeing by exhaust with PEDOT: PSS, and coating by the screen-printing method of PEDOT: PSS and a 3 wt. % melamine formaldehyde resins mixture.

Publication: Pupeikė, J., Sankauskaitė, A., Varnaitė-Žuravliova, S., Rubežienė, V., & Abraitienė, A. (2023). Investigation of Electrical and Wearing Properties of Wool Fabric Coated with PEDOT: PSS. Polymers, 15(11), 2539.