RESISTANCE PERFORMANCE ENHANCEMENT OF FABRICS COATED WITH COMPOSITIONS CONTAINING PEDOT:PSS

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The reduction of electromagnetic radiation (EMR) impact is extremely important for the protection of people frequently using electrical and electronic devices which are capable of emitting electromagnetic waves with frequencies that are potential hazards to health. Electrically conductive woven or knitted fabrics with particular EMR shielding properties offer an opportunity to counter these threats. For EMR shielding applications, typical shielding effectiveness - SE (dB), of at least 20 dB (indicates that 99% of the electromagnetic energy is reflected or absorbed by the material) is needed [1]. However, current coating technologies do not provide sufficiently substantial bonding between textile substrate and ICPs layer [2]. This study presents the investigation of the electromagnetic properties and resistance performance of electrically conductive fabrics coated with composition containing the conjugated polymer system – poly (3,4-ethylenedioxythiophene)-polystyrene sulfonate (PEDOT-PSS). The developed fabrics were intended for EMR shielding in microwave range and for absorbing microwaves in radar operating range to act as radar absorbing materials (RAM). The measurements of reflection and transmission of the developed fabrics were performed in a frequency range of 2 – 18 GHz, which covers the defined frequencies relevant to the application. 3 types of fabrics with different fiber composition and structure were selected and coated with conductive paste using knife-over-roll technology (Fig. 1). The obtained results revealed that the coating deposit and the amount of conductive additive – PEDOT-PSS, have a major impact to the shielding properties (Fig. 2). However, during further investigation it was observed that EMR shielding effectiveness (SE) as well as the absorption properties depend not only on the amount of conductive paste topped on the sample, but also is influenced by the construction parameters of the fabric. Such structural parameters of the fabric as – density, mass per unit area, type of weave, layer of shield (or coating) influence weather the applied conductive paste will just stick on the fabric surface or will penetrate into the fabric thus changing the thickness of the shield and SE results. Meanwhile fiber composition of the fabric influences mostly bonding between fibers and polymer coating. To improve the resistance performance of the developed samples two methods were applied: conventional textile surface modification technique – atmospheric plasma treatment and chemical modification – additional coating using a cross-linking agent. The results of the investigation revealed that both methods can be successfully used for improving resistance performance of fabrics coated with compositions containing PEDOT:PSS.

Fig. 1. Rotolabo Multi 600 ("Matex"), pilot continuous coating and laminating machine.

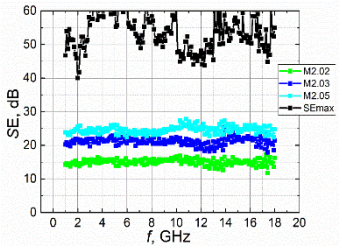

Fig. 2. SE of coated PA/ cotton fabrics with different coating deposit: M2.02 – 13 g/m^2, M2.03 – 17 g/m^2 and M2.05 – 4 g/m^2.

References

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2. Hegemann, D., Brunner, H., Oehr, C.,2003. Plasma treatment of polymers for surface and adhesion improvement. Nuclear Instruments and Methods in Physics Research B 208 (2003) 281-286.