ELECTROMAGNETIC SHIELDING PROPERTIES OF TEXTILE MATERIALS

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Electrically conductive woven or knitted fabrics with particular electromagnetic radiation (EMR) shielding properties may act as a shield against the penetration of electromagnetic waves with frequencies identified as a potential hazard to human health. Such materials can also be applicable in the development of radar-absorbing materials (RAM). Electrically conductive fabrics used in stealth technology can help to disguise a vehicle or soldier from radar detection.

This work aimed to develop and investigate fabrics coated with different conductive formulations. The research was focused on the electromagnetic properties of such materials – shielding effectiveness and absorption ability in the microwave frequency range of 2-18 GHz.

More than 40 different samples of electrically conductive textile materials were developed and investigated to achieve relevant shielding effectiveness and reduction of the reflection, leading to the decrease of a radar signature. Samples of different fabrics were coated with compositions containing inherently conducting polymer PEDOT:PSS and carbon-based compositions (carbon nanotubes – CNT, graphite). Reflection and transmission measurements were performed at FTMC Microwave laboratory and FOI Department of Electrooptical Systems, Sweden (Figure 1).

Figure 1. Microwave reflection measurements at FOI: photo of the NRL arch setup

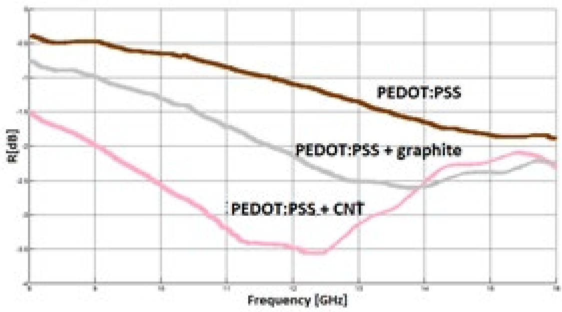

Figure 2. Reflection, dB (compared to the total reflection), metal backing, V-pol. of fabrics coated with different compositions

The measurements have revealed that for the tested samples the combined effect of reflection and absorption determined the shielding properties, but the role of these two parameters over the tested frequency range was different. Shielding properties (SE, dB) of the investigated samples were steady in all tested frequency ranges and sufficiently good for shielding/radar absorbing materials. Meanwhile, reflection and consequently absorption ability were frequency dependent. The better absorption ability of all tested samples was obtained in the range of 12–18 GHz. By controlling the coating deposit, it is possible to tune the electrical properties to a certain extent and hereby influence the reflection and transmission parameters. It was identified that for the fabrics coated on the backside better reflection reduction was obtained when the transmission (T) was below |20| dB.

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