Nanostructured coatings for electromagnetic shielding in the GHz frequency band

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The last few years, a strong need of innovative materials for efficient electromagnetic shielding appeared, since the applications of wireless communication systems have increased vastly. These new materials should combine excellent shielding effect (SE) in particular GHz frequency bands, ease of production, low weight and minimal cost. It is well established in literature that allotropic forms of carbon exhibit all of the above criteria and have been considered as a very promising group of materials for electromagnetic shielding.

Towards this direction, we investigated the potential use in electromagnetic shielding applications of carbon allotropes and especially of graphene in polymer matrices. Coatings of various concentrations and thicknesses were prepared on foam board, consisting primarily of grahene platelets, PEDOT:PSS and polyaniline (PANI). Transmission measurements were performed in free space, using a Hewlett-Packard 8722 ES vector network analyzer and four sets of microwave standard-gain horn antennas covering the range 3-24GHz. Both the total transmission (S_{21}) and reflection (S_{11}) were measured in decibels (dB) and the results were used to determine the mechanisms behind the samples' SE. The results were compared with those of commercial products, which in general are required to have a SE of at least 20 dB. Prior to every measurement, an absorbing chamber was created using typical microwave absorbers (ECCOSORB AN-77) over all surfaces except the top, and each sample was placed in the middle of each set of horn antennas.

The results up to now are very promising, since in most of the cases, a SE of about 30 dB was obtained. The measurements indicated a strong dependence of the shielding effect on the relative concentration of the materials, the thickness of the coating as well as its conductivity.

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