Determination of EMI Shielding Efficiency of Graphene Composites with Silver Nanoparticles Prepared Under Low-dose Gamma Irradiation

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Graphene and its derivatives (graphene oxide - GO and reduced graphene oxide - rGO) have high surface area and therefore are great materials to anchor metallic nanoparticles [1]. The oxygen-containing groups in the GO structure serve as locations where metal nanoparticles can be anchored [2]. Amongst various potential applications, silver nanostructures are widely studied for electromagnetic interference (EMI)shielding applications due to their high electrical conductivity and high aspect ratio [3]. Here, we prepared silver nanoparticles (Ag NPs) by low-dose (1-20 kGy) gamma irradiation of silver nitrate in the presence of graphene-based material (GO or electrochemically exfoliated graphene - EEG). By selecting this experimental procedure we opted for the pathway that does not require harsh chemicals and excessive purification steps, making it cost-efficient and environmentally friendly, and by using graphene sheets for the nucleation and growth of silver nanoparticles we made the use of a capping agent superfluous. The obtained Ag NPs were spherical with a predominant size distribution of 10-50 nm for GO and 10-100 nm for EEG and uniformly distributed over graphene sheets. EMI shielding efficiency measurements showed poor EMI shielding for the composites prepared with GO. On the other hand, all composites prepared with EEG showed EMI shielding to some extent, and the best performance was measured for the samples prepared at 5 and 20 kGy doses.

References

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Figures

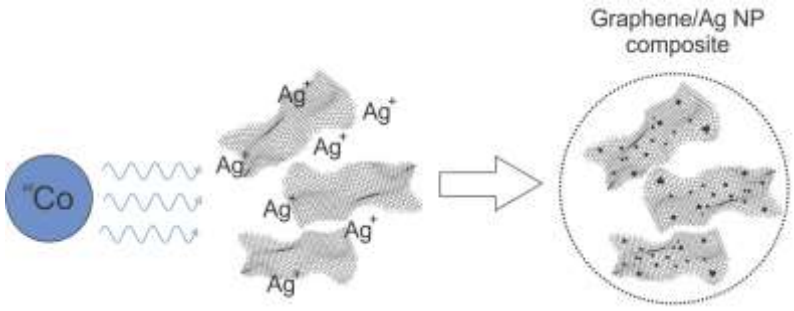

Figure 1: Schematic illustration of the graphene/Ag NP composite preparation.