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Fluence enhanced optical response of ion implanted stripper foil carbon thin films

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Silver nanoparticles (NPs) are known to exhibit a strong interaction with light because the conduction electrons on the metal surface undergo a collective oscillation once excited by light at specific wavelengths; the so-called surface plasmon resonance (SPR). However, their incorporation into amorphous carbon is shown to greatly influence the overall optical response of the nanomaterial due to aggregation of the NPs in the host amorphous carbon. In this paper, we studied the optical response of silver irradiated amorphous carbon films due to varying fluence of the NPs. Stripper foil amorphous carbon films were irradiated by 25kV Ag ions at different fluences ranging from 2.5 to 3.4×10^{16} ions/cm². Optical absorption studies revealed that the SPR of Ag NPs on quartz substrate occurs at wavelength λ_{410} nm but shows a blue shift (λ_{60} nm) in the irradiated film with increasing ion fluence up to 3.4×10^{16} ions/cm². Transmission electron microscopy (TEM) was used to investigate the particle size and aggregation. The blue shift response in plasmonic wavelength is explained with respect to the increase in particulate density due to increasing fluence of irradiation as confirmed by TEM.

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