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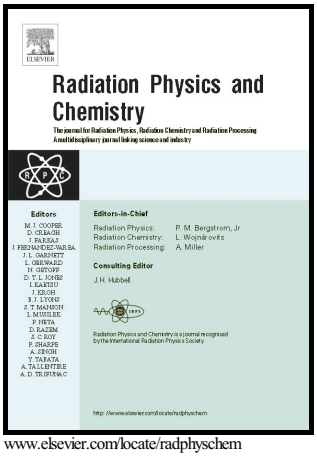

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Influence of thermal annealing and radiation enhanced diffusion processes on surface plasmon resonance of gold implanted dielectric matrices

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Abstract

Gold nanoparticles (AuNPs) embedded in fused silica and sapphire dielectric matrices were synthesized by Au ion implantation. Systematic investigations were carried out to study the influence of implantation dose, post annealing temperature, swift heavy ion (SHI) irradiation and radiation enhanced diffusion (RED). Rutherford Backscattering Spectrometry (RBS) measurements were carried out to quantify concentration and depth profile of Au present in the host matrices. X-ray diffraction (XRD) was employed to characterize AuNPs formation. As-implanted and post-annealed films were irradiated using 100 MeV Ag ions to investigate the effect of electronic energy deposition on size and shape of NPs, which is estimated indirectly by the peak shape analysis of surface plasmon resonance (SPR). The effect of volume fraction of Au and their redistribution is also reported. A strong absorption in near infra red region is also noticed and understood by the formation of percolated NPs in dielectric matrices. It is quite clear from these results that the effect of RED assisted Oswald ripening is much more pronounced than the conventional Oswald ripening for the growth of NPs in the case of silica host matrices. However for sapphire matrices, it seems that growth of NPs already completed during implantation and it may be attributed to the high diffusivity of Au in sapphire matrices in implantation process.

Key Words: Surface Plasmon Resonance (SPR); Oswald ripening; radiation enhanced diffusion (RED); ion implantation; swift heavy ions (SHIs).

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