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Metal Nanoparticle Doped Polymer Materials for Biological Applications

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Nanoparticle based materials are increasingly important in material science due to their expanding applications in photo optics, analytical and polymer chemistry, catalysis/photocatalysis and medical applications^{1,2}. Silver and gold nanoparticles have been shown to have unique physical and chemical properties which are size and material dependent, either in solutions or when embedded in a polymer matrix³. We are working towards synthesis of silver and gold nanoparticles with sizes of 2-25 nm and various morphologies – spherical, nano-rods and star-shaped. Investigation of the optical properties of the nanoparticles in solvents was performed with UV/Vis spectroscopy; the size and particle distribution by SEM and TEM. The chemical composition of nanoparticles was determined by XPS. Nanoparticles were embedded into SU-8 polymer; a gold nanoparticle/SU-8 composite was subsequently structured by UV photolithography. The composite showed polarization dependency to incident light, indicating that the particles were self-organized chemically and/or physically during fabrication. The material is speculated to be useful in various fields, such as biomedical applications and photonics. The transparent hard coating composite material with embedded silver nanoparticles will enable exiting new applications in, silver coated medical devices or silver based dressings, such as nanogels⁴. We also would like to test antibacterial properties of silver nanoparticles embedded in polymers. Also due to the simplicity of this technique for synthesising nanoparticles, it may be a break-through for cost-effective and scalable development for plasmonic sensing devices for example, SPR spectroscopy/SERS substrate and ultra-thin photonic crystals which sometimes rely on time consuming top-down approach for the fabrication.

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