MS44-P01 | SYNTHESIS AND STUDY OF HIGHLY SENSITIVE SERS SUBSTRATE BY FERROMAGNETIC HOLLOW MICRO-SPHERES

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In this study, a composite with the integration of magnetic, plasmonic and buoyant properties was designed and synthesized for facilitating sensitive detection of surface-enhanced Raman scattering (SERS). At first, iron oxide hollow spheres were synthesized by spray pyrolysis method at first, which is a simple and mass-produced process. Various reducing treatment were performed to maximize ferromagnetic strength and then Ag nanoparticles were deposited on the surface of the magnetic hollow spheres to provide the hotspots in the SERS measurements. Electron microscopy and electron energy loss spectroscopy were utilized to study the microstructure and identify the phase of the samples obtained in each stage. The experimental results show that the as-prepared iron oxide hollow spheres are a-Fe_2O_3. The spheres have a size of 0.5 μm to 3 μm and an average shell thickness of about 20 nm. After annealing in a reducing atmosphere, a-Fe_2O_3 transformed to Fe_3O_4 successfully. The maximum saturation magnetization up to 120 emu/g at 300 K was observed of samples annealing in Ar/H_2 at 400°C for 3 hours, which was 50% higher than that of the reported Fe_3O_4 nanoparticle. With the optimized synthesis protocol of Ag deposition, the size as well as the inter particle spacing between Ag nanoparticles reached 5 nm and 10 nm, respectively. At last, with applying magnetic field, the intensity of the SERS signal from the composite was strong enough to provide single particle-level detection.