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Magnetic-core/Gold-shell Nanoparticles for the Detection of Trace Chemical Contaminants in Food Products[1] ANNA MILLS, QINCHUN RAO, Florida State University, YAN XIN, National High Magnetic Field Laboratory, JOSEPH STRZALKA, Argonne National Laboratory, DANIEL HALLINAN, Florida State University — Magnetic-core/gold-shell nanoparticles (MAuNPs) are of interest for enabling portable detection of trace analytes in complex media, such as food. Gold coating provides biocompatibility and facile functionalization, and a magnetic core affords analyte concentration and controlled deposition onto substrates for surface-enhanced Raman spectroscopy. Iron oxide cores were synthesized and coated with gold by reduction of $HAuCl_4$ by NH_2OH. MAuNPs were grafted with polyethylene glycol (PEG) and/or functionalized with 4-mercaptobenzoic acid (4-MBA) and examined using a variety of microscopic, spectroscopic, magnetometric, and scattering techniques. The results showed 4-MBA displaced a significant amount of PEG. PEG displaced less 4-MBA, evidencing denser packing on the MAuNP surface. (4-MBA)-MAuNPs significantly enhanced the Raman signal, thus demonstrating functionality in direct detection of trace analytes. Magnetic deposition rate of MAuNPs and (4-MBA)-MAuNPs was explored. Deposition rate was slowed by 4-MBA. We postulate this originated from NP-substrate interactions. These findings emphasize the importance of ligand choice in reference to the medium, analyte, and substrate, as well as functionalization procedure in the design of similar sensing platforms.

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