A Novel Approach to Fabricating SERS Substrate: Deposition of Au Nanoparticles on a Glass Surface via Vacuum-assisted Solvent Evaporation

Abstract

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A novel, facile method for the fabrication of cost-effective, on-demand Surface-Enhanced Raman Spectroscopy (SERS) substrates from gold nanoparticle colloids on functionalized glass surfaced will be discussed. The method combines a variety of measures to eliminate interference from stabilizing capping ligands and capillary flow “coffee-ring” effects, and introduces a method of accelerated evaporation via vacuum-initiated vapor pressure reduction. Detection ranges demonstrated in previous SERS studies identify the usefulness of the method in single-molecule spectroscopy as well as sensitive biologically-active molecular survey. The method devised and investigated shows promise as an avenue for access to such sensitive and cutting edge spectroscopic methods in the undergraduate setting as well as the professional analytical laboratory, with evidence of detection limits approaching those described in the available literature, reporting results in the micro- to nanomolar ranges. Discussion of SERS science to date as well as methods currently being used and areas of needed improvement of the field will be reviewed. UV-Visible spectroscopic analysis of a variety of produced substrates as well as Raman analysis and micrographs will be presented, with a focus on comparing established methods with the subject process, and avenues for further honing precision and detection characterization.