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Molecular sensitivity and selectivity of metal nanoparticles decorated graphene as 'smart' surface-enhanced Raman scattering (SERS) platforms. SANJU GUPTA, A. BANASZAK, T. SMITH, Western Kentucky University, Bowling Green, KY 42101 — Graphene-mediated surface-enhanced Raman scattering (G-SERS) is a recent phenomenon that produces clean and reproducible Raman signals of chemical molecules with significantly enhanced intensity. Since G-SERS relies on a chemical mechanism and therefore it shows molecular sensitivity and selectivity. We developed graphene-family nanomaterials, GFNs, decorated with coinage silver and gold nanoparticles for detection of methylene blue (MB) and rhodamine 6G (Rh6G) probes in view of optical and biological importance. The results illustrate that silver and gold nanoparticles immobilized on GFNs enhanced the Raman signal, in general, and as cascaded amplification of on multilayer architecture, larger than those on the metal nanoparticles without graphene. Additionally, the sensitivity can be tuned by controlling the size of nanoparticles. Moreover, highly-sensitive graphene-nanoparticle sensors are capable of molecular detection over 10 pM to 100 microM concentration. The G-SERS enhancement is discussed in terms of graphene-metal nanoparticle interactions leading to local interfacial hybridization and polarization, 2. molecular conformation of analyte on nanoparticle-graphene functionalities, and 3. charge transfer and exchange or sharing of charges between analyte and nanoparticles decorated graphene supports, experiencing chemical enhancement. Optimized metal nanoparticle-graphene electronic properties are determined from density functional theory (DFT) calculations.

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