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Molecular sensitivity on graphene decorated with noble metal nanoparticles: Graphene-mediated surface-enhanced Raman scattering (G-SERS) substrates[1] SANJU GUPTA, ALEXANDER BANASZAK, TYLER SMITH, Western Kentucky University — Raman scattering signal enhancement that uses graphene as support, graphene-enhanced Raman scattering (G-SERS), is a recent phenomenon. While SERS enhancement arises due to electromagnetic mechanism, G-SERS also relies on chemical mechanism and therefore it shows unique molecular sensitivity. In this work, we developed graphene materials decorated with silver and gold nanoparticles for detecting methylene blue (MB) and rhodamine 6G (Rh6G) in view of optical and biological importance. The results illustrate that silver and gold nanoparticles immobilized on multilayer graphene graphene oxide and reduced graphene oxide significantly enhance the signal, and as cascaded amplification of SERS signal on multilayer architecture, larger than those only on metal nanoparticles. The sensitivity can be tuned by controlling the size of nanoparticles and the highest SERS enhancement factor (four orders) is achieved at optimal 30 nm silver and 40 nm gold nanoparticles on reduced graphene oxide and multilayer graphene. They serve as 'smart' SERS platforms capable of detecting MB and Rh6G below 10 pM concentration. The enhancement is discussed in 1. molecular structures (molecular symmetry; face-down and edge-on) 2. charge-transfer interaction between molecules and graphene and 3. graphene-metal nanoparticle interfacial hybridization. The signal enhancement is supported by change in UV–vis absorption spectra of molecules in contact with graphene guiding molecular detection and biotechnology.

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