

Graphene oxide/gold nanorod nanocomposite for stable surface enhanced Raman spectroscopy

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By confining light to nanometer length scales using plasmonic nanostructures, the scattering cross section of a molecule can be enhanced a billion-fold, providing a platform to enable efficient chemical and biological detection through surface enhanced Raman spectroscopy (SERS). However, thermal fluctuations and molecular dynamics can lead to strong temporal fluctuation in the SERS spectrum, which may be an obstacle for precise molecular recognition [1]. In this work, we introduce a graphene oxide/gold nanorod nanocomposite as a SERS substrate that suppresses the usual temporal intensity fluctuations, commonly referred to as blinking. The temporal stability of the SERS signal is statistically quantified using the coefficient of variation of the integrated spectra. We demonstrate that by introducing graphene oxide the coefficient of variation from the nanocomposite is five times smaller when compared with gold nanorods only, which is attributed to the removal of the nanorod's surfactant from plasmonic hot spots due to the graphene oxide-surfactant interaction (Figure 1). The resulting nanocomposite can, then, be used as a reliable substrate for precise SERS chemical analysis and is investigated as a SERS substrate for the detection of Rhodamine 640 (Figure 2), providing a four-fold stability improvement relative to gold

nanorods without graphene oxide, while the dye's Raman signal is enhanced both by SERS and by resonant excitation [2].

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References

- [1] Itoh, T. et al. J. Chem. Phys. 136, 24703 (2012).
- [2] P.G. Vianna, D. Grasseschi, G.K.B. Costa, I.C.S. Carvalho, S.H. Domingues, J. Fontana and C.J.S. de Matos, ACS Photonics, 3 (2016) 1027.

Figures

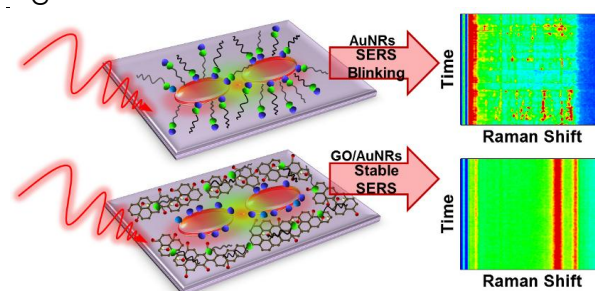


Figure 1: Scheme illustrating the molecular configurations around the AuNRs for both a AuNR-only (top) and a GO/AuNR (bottom) SERS substrate, as well as the corresponding SERS spectra time series (right).

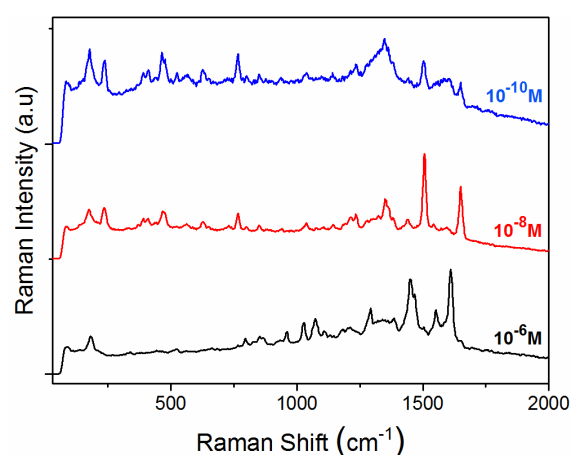


Figure 2: SERS spectra for different Rhodamine 640 concentrations on the GO/AuNR composite.