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Quantitative detection of Rhodamine 6G (R6G) by Surface-Enhanced Raman Spectroscopy (SERS) using MoS_2/graphene van der Waal (vdW) heterostructure substrate

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We have fabricated a two-dimensional MoS_2/graphene van der Waals heterostructure substrate for surface-enhanced Raman spectroscopy (SERS). A stronger SERS enhancement was observed on the MoS_2/graphene vdW heterostructure substrate compared to single-layer MoS_2 or graphene substrate due to charge transfer and dipole-dipole interaction through the MoS_2/graphene interface. Additionally, a novel substrate composed of gold nanoparticles (AuNPs) on MoS_2/graphene van der Waals heterostructure was developed to explore the SERS effect of the AuNPs. The significant observed enhancement of this substrate can be attributed to the combination of the electromagnetic mechanism of plasmonic AuNPs and the much-enhanced chemical mechanism of the MoS_2/graphene heterostructure via dipole-dipole interaction at the interface as compared to graphene only. The minimum detectable concentration of the R6G can reach $5x10^{-8}$M using a non-resonance 632.8 nm laser, which is an order of magnitude higher than that reported on the AuNPs/graphene substrate. SERS substrate based on MoS_2/graphene van der Waals heterostructure is an excellent SERS substrate for optoelectronics and biological detection.

Biography

Mohammed got his bacholer's degree in Physics in 2006 from Umm Al-Qura University and Master's degree in Applied physics in 2010 from Malaya University. He is a PhD student in the Department of Physics at the University of Kansas.

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