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Abstract

Flexible SERS Sensors Based on Carbon Nanomaterials-Supported Au Nanostructures †

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Abstract: Surface-enhanced Raman scattering (SERS) is a powerful technique to detect analytes in a label-free and non-destructive way at extremely low concentrations, even down to the single-molecule level. In the present study, a series of anisotropic Au nanostructures are integrated onto the platforms of carbon nanomaterials, mainly carbon nanotubes (CNT) and graphene, in order to fabricate high-performance flexible SERS sensors. Sizes, dimensions and shapes of Au nanostructures can be well controlled through this strategy, based on which Au nanowires, nanoribbons, nanoplates, nanobelts, and nanoframes are successfully deposited onto CNT and graphene templates, respectively. Significantly enhanced plasmonic activity originates from these Au nanocrystals, which provide increased SERS signals of the analytes by many orders of magnitude, while CNT films or graphene substrates offer the superior flexibility and accessibility. For instance, A flexible SERS sensor made of graphene supported Au nanoframes can detect the analyte R6G at the concentration as low as 10^{-9} M. The mechanism for the sensitivity enhancement could be attributed to the homogenous distribution of Au nanoframes on the graphene support as well as the strong molecule adsorption to the graphene nanoporous network.

Keywords: flexible SERS sensors; carbon nanomaterials; au nanostructures; graphene