SERS of isotopically labelled $^{12}C/^{13}C$ graphene bilayer: graphene layer as spacer and probe

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Graphene is envisaged to improve significantly the substrates for surface-enhanced Raman scattering of planar aromatic molecules as it can ensure a more even enhancement at different places of the substrate. For this purpose, the role of graphene as a spacer in such SERS platforms has to be addressed. Here, we prepared and probed by Raman spectroscopy hybrid systems constituted by $^{13}C/^{12}C$ bilayer graphene covered by nanostructured gold. Hybrids with both the ^{13}C over ^{12}C layers and in the flipped geometry, and with both the turbostratic and the A-B stacked order have been investigated, and qualitative as well as quantitative information about the enhancement experienced by phonons of the individual graphene layers by the electromagnetic mechanism of SERS were addressed. Here, the top layer of the isotopically labeled bilayer graphene represents the graphene spacer, while the bottom layer mimics a monolayer of target planar aromatic molecules. Both the calculation and the experiment based chiefly on comparison of the relative intensity ratio of the clearly distinguished ^{13}C layer and ^{12}C layer G mode bands jointly indicate that the enhancement of Raman scattering of the molecular monolayer on graphene spacer by the electromagnetic mechanism of SERS will be only 0.7 times lower than that of a monolayer located directly on the nanostructured Au surface.

References

[1] Johan Ek Weis, Sara Costa, Otakar Frank, Michaela Fridrichová, Blanka Vlčková, Jana Vejpravova and Martin Kalbac: JPC (2017), accepted.