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Enhancement of graphene-related and substrate-related Raman modes through dielectric layer deposition

In this work, we demonstrate a method for the enhancement of Raman active modes of hydrogen-intercalated [1] quasi-free-standing epitaxial chemical vapor deposition graphene and the underlying semi-insulating 6H–SiC(0001) substrate through constructive signal interference within atomic-layer-deposited amorphous Al_2O_3 passivation. We find that an optimum Al_2O_3 thickness of 85 nm for the graphene 2D mode and one of 82 nm for the SiC longitudinal optical A_1 mode at 964 cm^{-1} enable a 60% increase in their spectra intensities. We demonstrate the method's efficiency in Raman-based determination of the dielectric thickness and high-resolution topographic imaging of a graphene surface [2,3].

References

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Figures

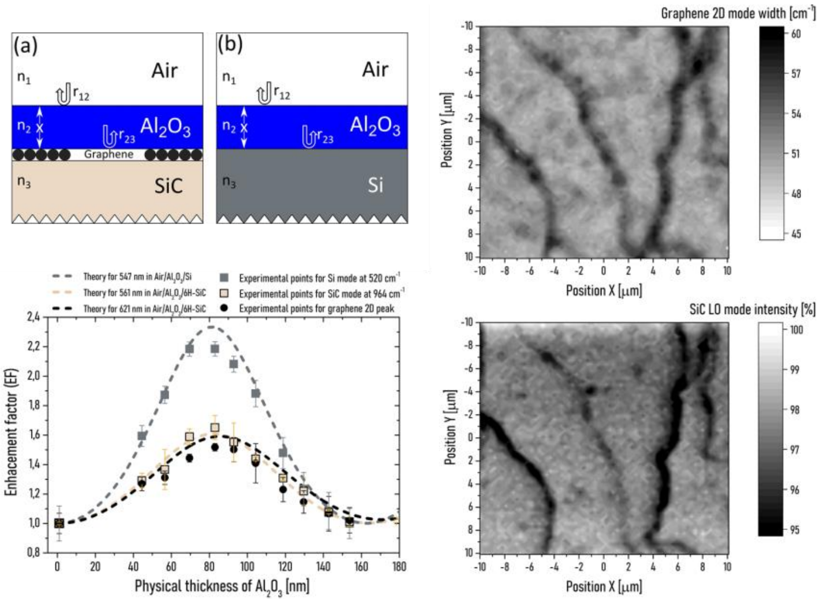

Figure 1: Schematic of the two considered systems.Theoretical and experimental enhancement factor (EF) for the SiC LO A_1 mode, the Si mode and the QFS graphene 2D mode all as a function of the Al_2O_3 physical thickness. High-resolution Raman map of hydrogen-intercalated QFS epitaxial CVD graphene on semiinsulating vanadium-compensated on-axis 6H-SiC(0001) passivated with 69-nm-thick Al_2O_3: (a) Graphene 2D mode FWHM. (b) Relative intensity of the SiC longitudinal optical A_1 mode at 964 cm^{-1} [2].