Buffer layers inhomogeneity and coupling with epitaxial graphene unravelled by Raman scattering and graphene peeling

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The so-called buffer layer (BL) is a carbon rich reconstructed layer formed during SiC (0001) sublimation [1]. The covalent bonds between some carbon atoms in this layer and underlying silicon atoms makes it different from epitaxial graphene. We report a systematical and statistical investigation of the BL signature and its coupling with epitaxial graphene by Raman spectroscopy. Three different BLs are studied: bare buffer layer obtained by direct growth (BL_0, figure 1), interfacial buffer layer between graphene and SiC (c-BL_1) and the interfacial buffer layer without graphene above (u-BL_1). To obtain the latter, we develop a mechanical exfoliation of graphene by removing an epoxy-based resin [2] or nickel layer [3]. The BLs are ordered-like [4,5] on the whole BL growth temperature range. BL_0 Raman signature may vary from sample to sample but forms patches on the same terrace. u-BL_1 share similar properties with BL_0, albeit with more variability. These BLs have a strikingly larger overall intensity than BL with graphene on top. The signal high frequency side onset upshifts upon graphene coverage, unexplainable by a simple strain effect. Two fine peaks (1235, 1360 cm^{-1}), present for epitaxial monolayer and absent for BL and transferred graphene. These findings point to a coupling between graphene and BL.

References

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Figures

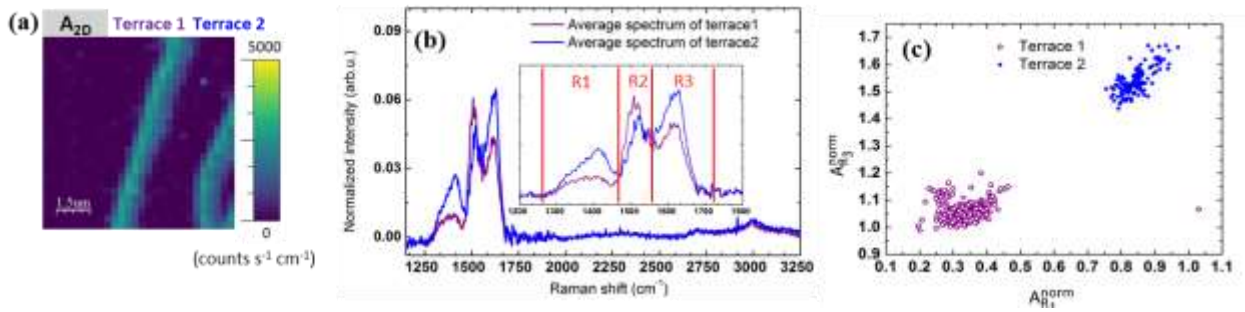

Figure 1: Raman analysis of sample DG1. (a) Raman A2D map. Navy-blue areas correspond to BL_0 on two terraces, while green areas correspond to EG. (b) Average spectra of terrace 1 (purple) and terrace 2 (blue). Inset: zoom between 1200 and 1800 cm^{-1}. The vertical bars at 1260, 1460, 1550 and 1710 cm^{-1} delimit the 3 regions R1, R2 and R3 used in our analysis. (c) Relationship between A(R1) and A(R3) for the two terraces.