Combined Raman spectroscopy and reflection/transmission measurements for graphene characterization

J.-L. Sauvajol, M. Paillet, J.-R. Huntzinger, A. Tiberj, P. Landois, M. Bayle, A. A. Zahab

Laboratoire Charles Coulomb, University of Montpellier–CNRS, 34400 Montpellier, France
jean-louis.sauvajol@univ-montp2.fr

Abstract
Raman spectroscopy (RS) of graphene-related materials (GRM) is being considered as a fast, versatile, powerful and non-destructive characterization technique. RS is sensitive to the number of layers, their stacking order, the nature and density of defects, the charge carrier density and in-plane strain variations. However, the positions, linewidths, profiles, intensities of the graphene/MLG Raman bands are not only affected by all these perturbations but also depends on the uniformity across the probed area (laser spot size and field depth) and on the substrate (through optical interference effects, dielectric screening, doping…) [1]. An accurate interpretation of Raman spectra becomes then extremely complex and deserves the combined use of complementary diagnosis.
We recently developed an expertise in terms graphene/MLG characterization. This know-how is based on instrumental developments (including laser power, transmission, reflection and Raman signal simultaneous monitoring), as well as the development of data treatment (including specific algorithms to subtract the substrate Raman background), interpretation tools and a detailed modeling of the Raman scattering and optical properties of graphene/MLG on a wide set of substrates (including SiC, Cu, SiO_2/Si,…). Special care was paid to define protocols that ensure a high reproducibility and repeatability of calibrated measurements.
In this contribution, we apply this tool for counting the number of layers of any kind of graphene samples and we propose standard procedures for GRM characterization on different substrates.

References

[1] A. Tiberj, M. Rubio-Roy, M. Paillet, J. -R Huntzinger, P. Landois, M. Mikolasek, S. Contreras, J.-L. Sauvajol, E. Dujardin and A.-A Zahab, Reversible optical doping of graphene, Scientific Report, **3** (2013) 2355