New insights into graphene-based materials using spectroscopic and operando imaging ellipsometry

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Imaging Ellipsometry has been used for many years in the research on two-dimensional materials due to its outstanding thin-film sensitivity and microscopic lateral resolution. Many studies have been actively carried out for 2D materials produced by the exfoliation method [1],[2],[3],[4]. These applications typically require microscopic resolution, as the flakes are too small to be measured with conventional ellipsometers, even when microprobes are applied. To measure the optical constants and thickness of individual exfoliated flakes, spectroscopic IE was applied. Because of the high lateral resolution, not only the optical properties of exfoliated materials, but also the microscopic in-plane homogeneity of those flakes can be characterized. For CVD-grown graphene, Imaging Ellipsometry enables the visualization of the inhomogeneity as well as gain boundaries of polycrystalline CVD graphene. Especially the Ellipsometric Contrast Micrography mode is a fast, noncontact, wafer-Scale, atomic layer Resolved Imaging technique for Two-Dimensional Materials [6]

Operando imaging ellipsometry has been applied for in-situ measurements of multi-layer graphene as an electrode for rechargeable batteries [] modulation of the optical properties of graphene by back-gating [2]. This is because the back-gating changes the charge carrier density in graphene, which in turn affects the dielectric function.

To round off the lecture, new applications from the everyday laboratory work of the Accurion Application Lab and new technical developments will be presented.

References

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Figures

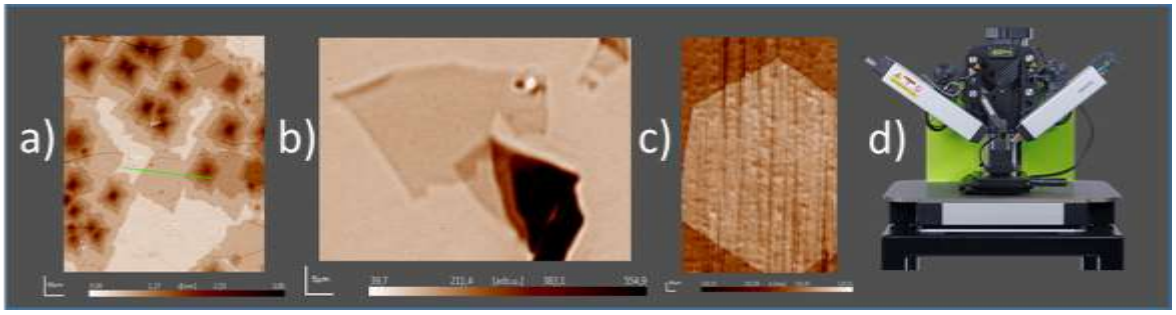

Figure 1: Thickness map of CVD graphene (a), ECM of MoS2/WSe2 heterostructure (b) Delta map of graphene on copper (c) measured with an imaging ellipsometry (d).