Imaging Ellipsometry for full wafer analysis of Graphene and hexagonal Boron-Nitride

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Imaging ellipsometry (IE) combines the resolution of an optical microscope with the sensitivity of ellipsometry for thin films. It allows to measure monolayers of 2D-materials but also to visualize these monolayers on arbitrary substrates. It overcomes the need of specially tuned SiO_2 thicknesses to visualize e.g. Graphene in an optical microscope.
In the talk we present [1], that IE is able to characterize Graphene throughout all stages of the manufacturing process from the growth on Cu-foil up to the transferred sample on Si wafers. Unlike other methods we can directly visualize graphene on the rough Cu. Figure 1 shows a large area map of Graphene on Cu. The Graphene is directly characterized on the Cu-foil, no oxidation of the Cu is needed. To overcome the waviness of the foil, an autofocus algorithm is developed and applied.
Figure 2 shows a Graphene monolayer and hBN monolayer after the transfer process to a Si/SiO_2 substrate. The contrast mode of IE is able to distinguish the different regions: (a) substrate only, (b) hBN only, (c) Graphene only and (d) an overlapping region of hBN and Graphene. The complete sample approx. 1cm x 0.8 cm is recorded in less than 6 minutes and shows defects and wrapping of hBN of a size as small as 4 µm.
Lastly, we demonstrate that this method can be used to characterise full 4'' wafers of graphene on Si within short time spans at 4 µm resolution.

References

[1] Braeuninger, Funke, et al. *submitted*.

Figures

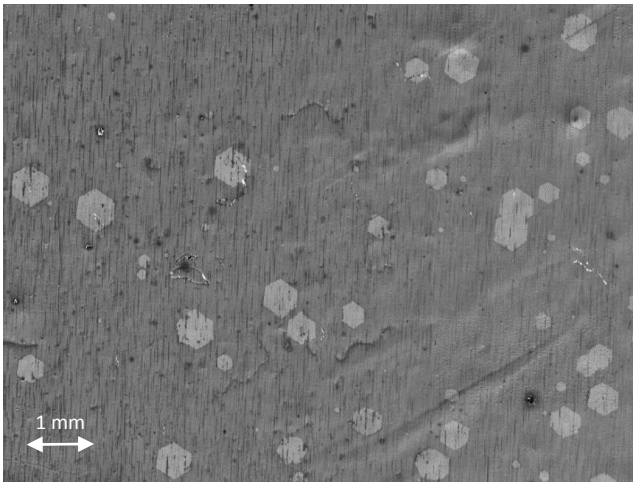

Figure 1: IE measurement of graphene on Cu prior to oxidation

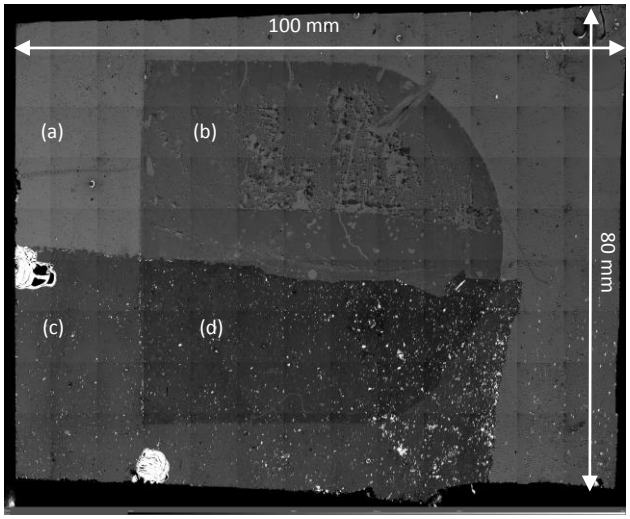

Figure 2: hBN and Graphene monolayer on Si/SiO_2 substrate. Visualized in less than 6 minutes. (a) substrate only, (b) hBN only, (c) Graphene only and (d) monolayer graphene on monolayer hBN.