Raman Characterization of 2D Materials

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In recent years there has been increased interest in exploiting the remarkable properties of 2D materials for novel electronic devices. The synthesis of 2D materials is still under development and is always in need of quality control. Post-growth processing often includes lithography and transfer techniques allowing the integration of 2D materials on full wafer scale. Raman spectroscopy provides a fast and contactless method for accessing material quality and homogeneity. With this it enables monitoring of the device fabrication helping to find ways preserving material integrity while undergoing several processing steps.
Raman spectroscopy performed as imaging provides material data distributed over the materials surface. Homogeneity, composition, and location of structural defects can be identified. With high lateral and vertical resolution in the sub-μm range, even 3D-data of materials stacks can be extracted.
Raman imaging was successfully employed in the characterization of heterostructures of large-scale MoS_2 and graphene on silicon wafers, fabricated by wafer bonding [1].
Also, functionalization of 2D materials can be evaluated by Raman spectroscopy. The arrangement of perylenes on thin MoS_2 and graphene films was analysed. Preferred accumulation of the molecules to the 2D materials rather than the SiO_2 substrate was observed [2].
Direct post-growth analysis after synthesis of 2D materials such as of TAC-grown $PtSe_2$ is performed to gauge material quality. The Raman mode width of the grown materials can be used as quality metric and was correlated to electrical properties such as field-effect mobility and sheet resistance [3].
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References

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Figures

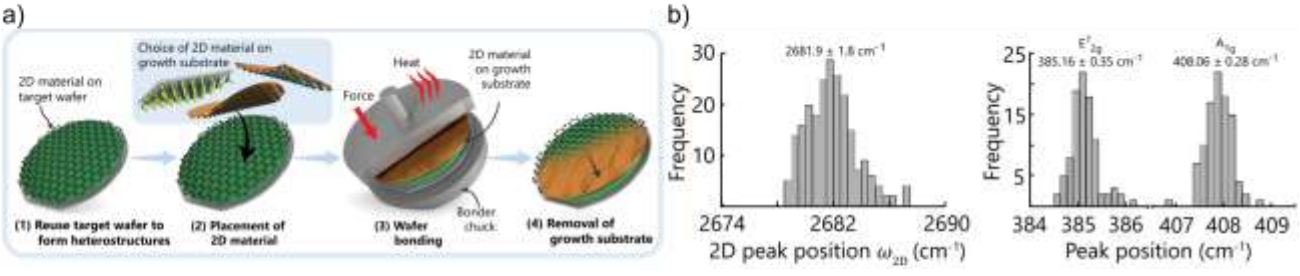

Figure 1: a) Formation of 2D material heterostructures by wafer-bonding. b) Raman characterization of the formed MoS_2/graphene heterostructure by statistical analysis of imaging data.