Correlative Raman imaging characterizes crystal properties of 2D materials

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Due to their unique optical and electronic properties, two-dimensional (2D) materials have great potential for application in optoelectronic devices. Diverse crystal properties such as the number of layers and growth defects influence the optical and electronic properties of the 2D materials. Research, development and quality control thus require powerful and non-destructive imaging techniques for monitoring these crystal properties and to evaluate synthesis processes. To comprehensively characterize the 2D material, it is advantageous to combine several imaging techniques. Here, we present correlative Raman imaging as a versatile tool for investigating prominent examples of 2D materials, namely graphene and the transition metal dichalcogenides (TMDs) molybdenum disulfide (MoS2) and tungsten disulfide (WS2). In combination with imaging techniques such as second harmonic generation (SHG), photoluminescence (PL), atomic force microscopy (AFM) or scanning electron microscopy (SEM), Raman imaging is able to provide a thorough characterization of the 2D materials. Crystal properties and features such as grain boundaries, surface structure, layer number, defect density, doping and strain fields can thus be identified and visualized.

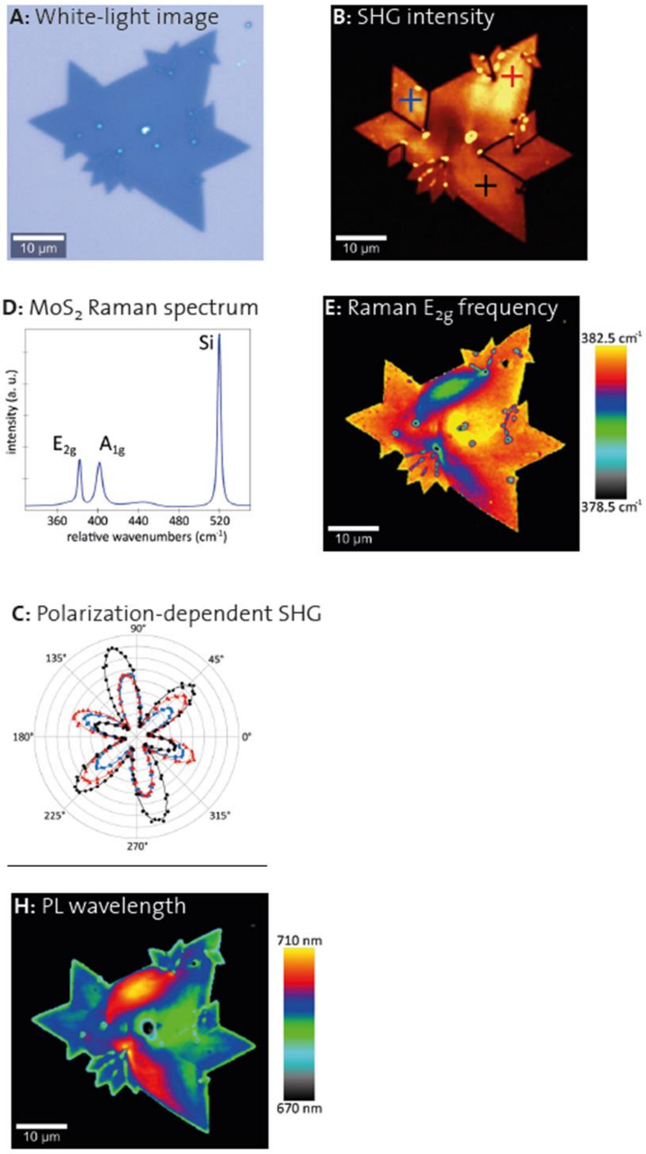

Figure 1. Correlative imaging of a MoS2 crystal using white light imaging (A), SHG intensity revealing grain boundaries (B), polarization dependent SHG characteristic for crystal orientation and strain (C), Raman spectrum of a monolayer of MoS2 (D) intensity of the E2g (E) and PL image revealing strain fields.