Investigation and Characterization of 2D Materials using Transmission Electron Microscopy – recent advances

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Abstract

The detailed characterization of materials at the nanoscale down to the atomic level is highly important to better understand many different material properties. Transmission electron microscopy (TEM) and scanning TEM (STEM) are essential tools as they offer a variety of different characterization methods ranging from imaging at the atomic level to the analysis of the chemical composition and the detailed investigation of the electric structure. In addition, these methods can readily be combined with a wide range of in-situ techniques like heating, electrical biasing or laser excitation, to name a few.
The characterization of graphene and many other 3D materials can be a very challenging topic in S/TEM especially if the goal is the direct observation of the atomic structure. In particular, electron beam induced modifications and damage during image tuning can make visualizing the sample at atomic resolution an extremely difficult task.
Here we will give an overview of recent advances in instrumentation and methods highlighting new low-dose imaging techniques [1] as well as application examples detailing the various characterization possibilities of modern TEMs. We also discuss the possibilities combining S/TEM techniques with ultra-fast electron shutters and continuous wave laser systems [2,3].

References

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