Metrology of defects and local temperature in graphene

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Abstract

Raman spectroscopy has been used to evaluate the crystallinity of sp2 carbon materials. Although defect-induced Raman peaks can be used to quantitatively measure the amount of disorder, they have been hardly used to differentiate types of defects, for example point defects, like vacancies or dopants, against grain boundaries in a poly-domain sample. Here the efforts on this direction will be discussed, including what we have learned from tip enhanced Raman spectroscopy, a technique that brings the optical resolution down to the nanometer scale. Raman spectroscopy is also broadly used to measure local temperature, from the ratio between the anti-Stokes and Stokes scattering. However, correlated Stokes-anti-Stokes generation adds another degree of complexity on this protocol, and the use of the Bose-Einstein phonon distribution function has to be generalized. Quantum mechanical calculations including field correlation can be used to quantitatively describe the phenomena.