Nano-imaging of graphene with terahertz scattering-type scanning near-field optical microscopy (THz-SNOM)

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Scattering-type scanning near-field optical microscopy (s-SNOM) have been shown as an excellent tool for investigating structures well below the diffraction limit. Combining this technique with terahertz (THz) illumination will open the doors for new possibilities of studying the electronic properties of materials at the nanoscale.

For graphene, some of the deciding factors for its electronic properties are grain boundaries and impurities [1]. Conventional THz spectroscopy is a standard metrology for characterization of sheet conductivity and its underlying parameters [2], but the spatial resolution is severely limited due to the long wavelength of THz. Combining s-SNOM with THz illumination will however, allow us to study the electronic properties through THz time-domain spectroscopy at the nanoscale.

Mechanically exfoliated graphene has previously been shown to perform as a near perfect reflector in the near-field for THz, thus no distinction between different layers has been possible [3]. We however, with our instrument, which is a commercial s-SNOM system (Neaspec, Attocube Systems AG) with a THz illumination unit (Neaspec and Menlo Systems) observe contrast between different layer thicknesses of exfoliated graphene on a silicon substrate.

Thus, the basic principle behind the instrument will be discussed and some results highlighting the remarkable capabilities of the system will be presented.

References

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