Raman Spectroscopy of Graphene

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Research Topics

- Optical properties of graphene
- Optical transition energy of carbon nanotubes
- Calculation of Raman spectra, electronic structure, and phonon dispersion of graphene

Research Seeds

Physical properties of few-layer graphene are affected by the number of graphene layers and their stacking structure. Resonance Raman spectroscopy has been used widely to investigate the physical properties of graphitic materials. Raman spectra provide clues to characterizing not only the graphene layer number, but also the stacking structure. We developed our computer programs to calculate the electronic structure, phonon dispersion, electron-phonon matrix elements, and electron-photon matrix elements of few-layer graphene and carbon nanotubes. Our calculated results are compared with experimentally obtained results.

Figure 1 dipicts the crystal structure of ABA-stacked and ABC-stacked trilayer graphene. We found that the stacking structure is distinguishable by M bands in the Raman spectra (Cong *et al*., ACS Nano 5, 8760). Figure 2 shows the crystal structure of twisted bilayer graphene. Since the physical properties of twisted bilayer graphene depend on the twisting angle θ_{TW}, it is important to reveal the relation between θ_{TW} and physical properties. From analysis of the Raman spectra of twisted bilayer graphene, we developed the relation between θ_{TW} and excitation laser energy for Raman spectroscopy (Ribeiro *et al*., Carbon 90, 138).

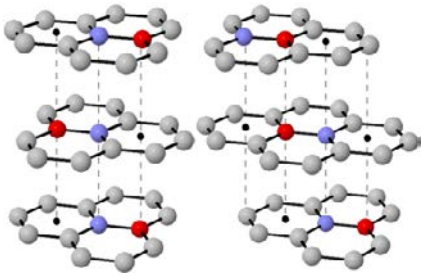

Fig. 1. Crystal structure of ABA-(left) and ABC-(right) stacked trilayer graphene.

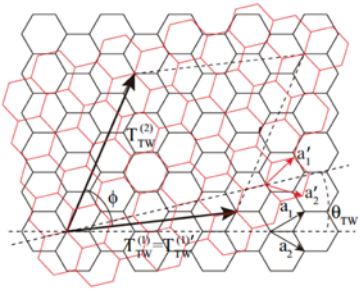

Fig. 2. Crystal structure of twisted bilayer graphene.

Related Technology

- Optoelectronic applications