Twisted multilayer graphene grown on iron thin film catalyst

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Twisted multilayer graphene grown by CVD technique possesses unprecedented characteristic due to high degree of decoupling arising from interlayer twists. [1-3]

The twisted multilayer graphene was synthesized by the low-pressure chemical vapor deposition with a single injection of acetylene on iron film catalyst deposited on oxidized silicon substrate. [4]

The Raman spectroscopy and Transmission Electron Microscopy (TEM) were used for characterization of the films. Raman spectra collected from the graphene show the symmetric 2D band with a full width at half maximum (FWHM) of 20-35 cm⁻¹, which can be well fitted by a single Lorentzian curve, and the I₂D/Iᴳ intensity ratio is 2-6. The very low D-band intensity (intensity ratio between D and G peaks smaller than 0.04) indicates a low defect density in the graphene. The spectra are characteristic of monolayer graphene. However, in the majority of these spectra small peaks are observed (R), indicating multilayer graphene with twisted layers (Figure 1).

Parallel strip-like features were observed in TEM images (Figure 2), obtained from the twisted multilayer graphene. The features are attributed to moiré superlattice which forms due to the layers rotation. The selective area electron diffraction (SAED) pattern from the area shown in Figure 2, shows intermittent diffraction spots which could be related to angular rotations of the graphene layers.

References


Figures

Figure 1: The Raman spectrum from the twisted multilayer graphene. Inset: the zoomed-in portion of the spectrum. Sharp R modes are presented.

Figure 2: The TEM image of twisted multilayer graphene. Inset shows SAED pattern obtained from the image.