The role of interlayer distance in the electronic properties of twisted bilayed graphene

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Abstract

Twisted bilayer graphene (tBLG) have recently attracted an increased attention when exploring the different ways of tuning the electronic properties of graphene. In tBLG samples the alignment of the two layers deviates from the Bernal stacking order, turning every tBLG with a particular twist angle into a unique material in terms of optoelectronic properties [1]. While the dependence with the rotation angle has been extensively studied, little is known about the effect of the interlayer distance on the electronic properties of tBLG. Raman spectroscopy represents a powerful tool for characterizing these kind of samples, since when the incident laser energy matches with the electronic band-gap of a given tBLG the normal vibrational modes (G band) intensity is enhanced [2]. In this work we follow the evolution of the Raman spectrum of a certain tBLG sample, in terms of the G band intensity, as the interlayer distance is reversibly modulated, by means of a gem anvil cell device. Our results prove that the electronic properties of twisted bilayer graphene can be fine-tuned by changing the interlayer distance, a parameter that affects the energy separation between van Hove singularities in the electronic density of states. The experimental findings are supported by theoretical calculations based on the tight binding approximation, an extended method with proven efficiency in the simulation of tBLG systems and their optoelectronic properties [3].

References

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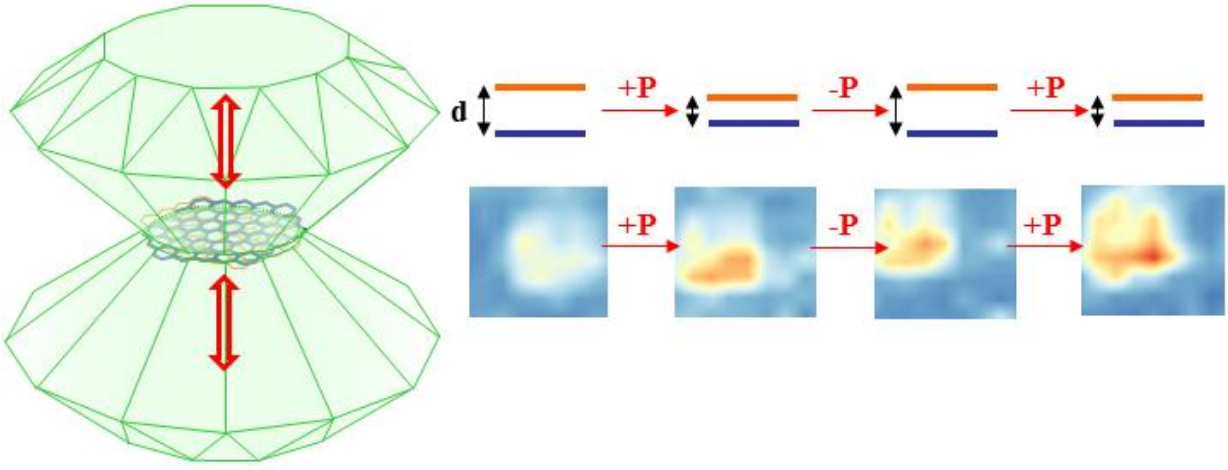
Figures



Schematic view of the gem anvil cell device used for modulating the interlayer distance. Evolution of Raman maps (G band intensity) of tBLG upon compression-decompression cycles. Mapping region of 40x40 μm^2. Color scale: blue – minimum, red – maximum. Laser excitation energy is 2.54 eV.