

Raman study of twisted bilayer graphene isotopically substituted

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Abstract

There is a growing interest these days in bilayer graphene samples where the layers are rotated by a relative angle, loosing the *AB* stacking. This new superstructure is usually called twisted bilayer graphene and exhibits a larger unit cell with a unique electronic structure that strongly depends on the twisting angle.[1] In this work, we present a resonant Raman study of twisted bilayer graphene synthesized using the CVD method and with an additional interest since one layer is of natural isotope composition and the other one is enriched by the ¹³C isotope. Such isotopic substitution allow us to distinguish the behaviour of each individual layer. Moreover, since the layers present crystal domains randomly oriented, the bilayer graphene sample exhibits regions with different twisting angles which can be determined from the enhancement profile of the so called G band.[2] For this purpose we use up to 12 laser energies (between 1.92 and 2.70 eV).[3] From these results, other characteristic parameters of the sample, such as the energy gap, can be obtained. Finally, from the energy dispersion of the 2D band we estimate the Fermi velocity of each region, and analyze the relationship between such parameter and the twisting angle.

References

- [1] K. Kim, S. Coh, L. Z. Tan, W. Regan, J. M. Yuk, E. Chatterjee, M. F. Crommie, M. L. Cohen, S. G. Louie, and A. Zettl, *Phys. Rev. Lett.* **108** (2012) 246103.
- [2] M. Kalbac, H. Farhat, J. Kong, P. Janda, L. Kavan, and M. S. Dresselhaus, *Nano Lett.* **11** (2011) 1957.
- [3] E. del Corro, M. Kalbac, C. Fantini, O. Frank, and M. A. Pimenta¹, *Phys. Rev. B* **88** (2013) 155436.