

Raman Spectroscopy in Graphene and Layered Materials

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Raman spectroscopy is an integral part of graphene research[1-3]. It is used to determine the number and orientation of layers, the quality and types of edge, and the effects of perturbations, such as electric and magnetic fields, strain, doping, disorder and functional groups. This, in turn, provides insight into all sp²-bonded carbon allotropes, because graphene is their fundamental building block. I will review the state of the art, future directions and open questions in Raman spectroscopy of graphene. The essential physical processes will be described, in particular those only recently been recognized, such as the various types of resonance at play, and the role of quantum interference[3-6]. I will update all basic concepts and notations, and propose a terminology that is able to describe any result in literature[3]. Few layer graphene (FLG) with less than 10 layers do each show a distinctive band structure. There is thus an increasing interest in the physics and applications of FLG. I will discuss the interlayer shear mode of FLG, and show that the corresponding Raman peak, named C, measures the interlayer coupling[7]. A variety of layered materials can also be exfoliated to produce a whole range of two dimensional crystals [8,9]. Similar shear and layer breathing modes are present in all these materials, and their detection provides a direct probe of interlayer interactions. A simple chain model can be used to explain the results, with general applicability to any layered material [10]

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