MAR09-2008-001345

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Graphene electronics via strain engineering[1]

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Recently, graphene has been confirmed as the strongest material ever measured, being able to sustain reversible deformations in excess of 20%. These mechanical measurements arise at a time where graphene draws considerable attention on account of its unusual and rich electronic properties. Besides the great crystalline quality, high mobility and resilience to high current densities, they include a strong field effect, absence of backscattering and a minimum metallic conductivity. While many such properties might prove instrumental if graphene is to be used in future technological applications in the ever pressing demand for miniaturization in electronics, the latter is actually a strong deterrent: it hinders the pinching off of the charge flow and the creation of quantum point contacts. In addition, graphene has a gapless spectrum with linearly dispersing, Dirac-like, excitations. Although a gap can be induced by means of quantum confinement in the form of nanoribbons and quantum dots, these "paper-cutting" techniques are prone to edge roughness, which has detrimental effects on the electronic properties. We explore an alternative route for tailoring the electronic structure of graphene, based on a strain engineering. We will discuss how local and global strain profiles can be suitably tailored to impact the bandstructure of graphene and control its transport characteristics. Electron confinement, electron beam collimation, energy filtering, surface modes and bulk spectral gaps are some examples of what might be achieved.

[1]Work supported by FCT via SFRH/BPD/27182/2006.