Probing the bandgap of bilayer graphene with thermal and optical excitations

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The opening of a tunable bandgap in bilayer graphene is an interesting problem that has attracted great recent attention. We study the bulk of dual-gated bilayer graphene using a Corbino-disk geometry which excludes the edge conductance channels. The temperature dependence of the maximum resistivity is found to be well described by simple thermal activation at high temperatures and variable range hopping at low temperatures, consistent with other transport studies, from which we conclude that edge transport is not significant [1]. The electric-field-dependent band gap extracted from thermal activation is found to be in good agreement with infrared spectroscopic studies [2, 3]. We further investigate the band gap effect by infrared photoconduction measurements in non-Corbino dual-gated devices. We have measured the photoconductive response as a function of band gap, temperature, incident wavelength, and power. We find that the response is proportional to the source-drain current and that it increases for larger band gap. Interestingly, the signal does not always vanish at zero source-drain voltage and it exists even when the average electric field is zero, corresponding to zero band gap in a disorder-free sample.

References

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[3] K. F. Mak et al., Phys. Rev. Lett. **102** (2009) 256405.

Figures

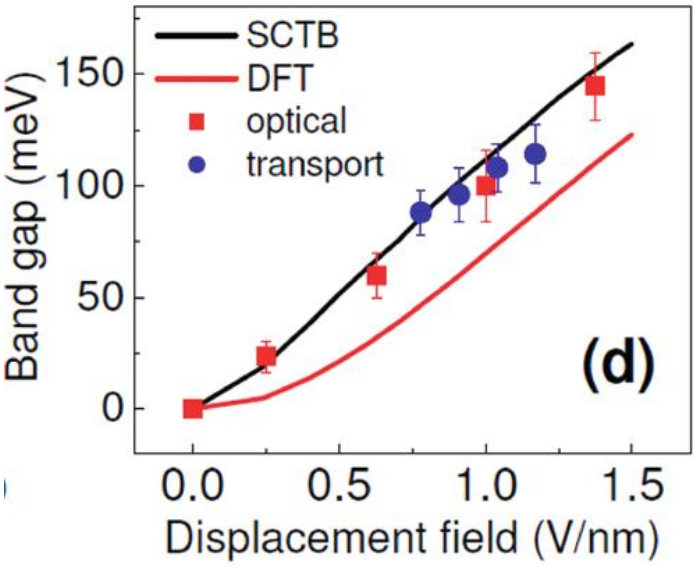

Figure caption
Bandgap of dual-gated bilayer-graphene Corbino-disk. Transport measurements (blue dots) are from Ref.[1]. Optical data (red squares) and self consistent tight binding (SCTB) as well as density functional theory (DFT) calculations are taken from Ref.[2].