

Scanning Raman spectroscopy of graphene antidot lattices: Evidence for p-type doping

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Since the first report about the preparation of graphene single layers via mechanical exfoliation technique, the interest in this seemingly ideal two-dimensional system has grown enormously. For the most part, this is motivated by the vision that the two-dimensional carbon system is potentially a promising candidate for future electronic devices. Scanning Raman spectroscopy has proven to be a powerful technique for the characterization and investigation of graphene samples. It enables a fast and nondestructive investigation of the electronic and structural properties of layered and laterally-structured samples with micron or even submicron spatial resolution.

We have investigated antidot lattices, which were prepared on exfoliated graphene single layers via electron-beam lithography and ion etching, by means of scanning Raman spectroscopy. The peak positions, peak widths and intensities of the characteristic phonon modes of the carbon lattice have been studied systematically in a series of samples. In the patterned samples, we found a systematic stiffening of the G band mode, accompanied with a line narrowing, while the 2D mode energies are found to be linearly correlated with the G mode energies. We interpret this as evidence for p-type doping of the graphene antidot lattices [1].

References

[1] S. Heydrich, M. Hirmer, C. Preis, et. al, Appl. Phys. Lett., **97** (2010) 043113.

Figures

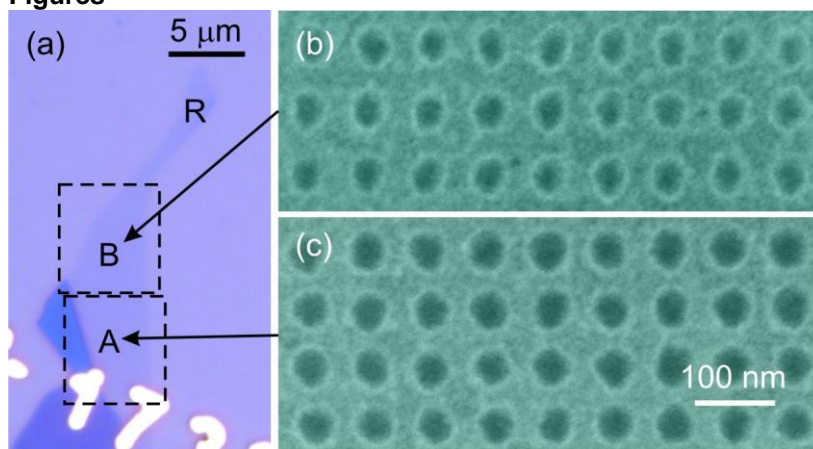


Fig. 1 (a) Microscope image of a single-layer graphene flake, patterned with antidots in areas A and B. Distance of the etched holes is 80nm in both sections. The diameter of the antidots is about 60nm in area A and about 50nm in area B. Region R was left unpatterned as reference section. (b) and (c) SEM images of parts of regions A and B. from Ref. [1].

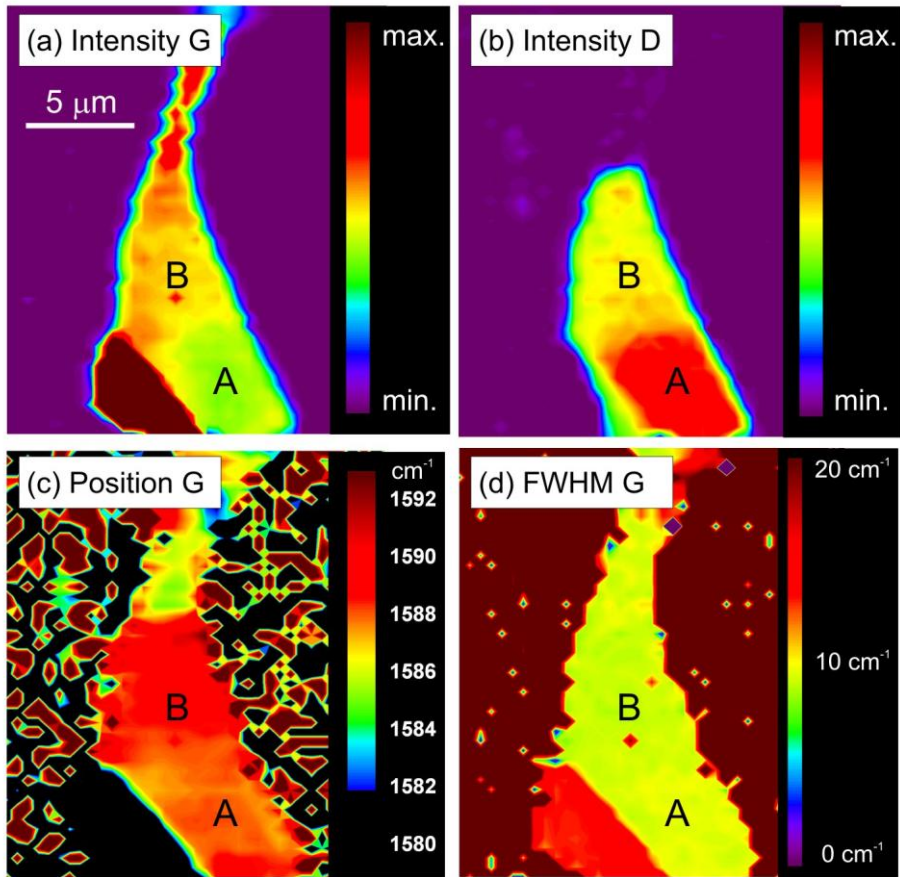


Fig. 2: Raman scan of single-layer graphene flake depicted in fig. 1. (a) shows the intensity of the G peak, (b) the intensity of the D peak. (c) and (d) show the position (energy) and FWHM (full width half maximum) of the G peak. The G peak is stiffened on the patterned areas and appears sharp everywhere on the flake. from Ref. [1].