Supplementary information

Tuning epitaxial graphene sensitivity to water by hydrogen intercalation

C. Melios1,2, M. Winters3, W. Strupiński4, V. Panchal1, C. E. Giusca1,
K.D.G.I. Jayawardena2, N. Rorsman3, S.R.P. Silva2, and O. Kazakova1*

1National Physical Laboratory, Teddington, TW11 0LW, UK
2Advanced Technology Institute, University of Surrey, Guildford, GU2 7XH, UK
3Chalmers University of Technology, Dept. of Microtechnology and Nanoscience, Göteborg, 412-96, Sweden
4Institute of Electronic Materials Technology, Warsaw, 01-919, Poland

The effect of atmospheric contaminants on the carrier concentration of epitaxial graphene on SiC(0001)

To investigate the effects of the atmospheric contaminants (i.e. N₂, O₂, NO₂, and CO₂) magneto-transport measurements were performed on an epitaxial graphene on SiC(0001) sample. The concentrations of CO₂ and NO₂ were chosen to simulate those naturally occurring in ambient air. The effect of O₂ was simulated using synthetic air (SA), which contains 21% O₂, balanced with nitrogen. Prior to each measurement, the sample was annealed at 150°C in vacuum (P=1×10⁻⁶ mbar) for two hours and then allowing time for the sample to cool down to room temperature. The measurements in figure S1 show a minor p-doping of 1LG due to O₂ in SA, however a significantly larger p-doping effect is observed due to CO₂ and NO₂ exposures, i.e. ~13% and ~23% decrease in \( \frac{n-n_0}{n_0} \), respectively. In the case of 2LG, both NO₂ and CO₂ result in p-doping of graphene (with ~6% and <1% change in carrier concentration, respectively). These measurements demonstrate the thickness dependent atmospheric doping on epitaxial graphene.

Figure S1: Carrier concentration of epitaxial graphene on SiC(0001) (top 1LG and bottom 2LG) under exposure to different atmospheric contaminants: (black) ambient, (red) nitrogen, (green) synthetic air (SA), (blue) SA + 450 ppm CO₂ and (pink) SA + 120 ppb NO₂.