Non-covalent functionalisation of graphene: Optimising molecular packing density and stability

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Abstract
The application of graphene in gas and biological sensors is currently of great interest due to the high sensitivity of graphene to external influences. However, in order to produce selective sensors the graphene surface must be modified to respond to a specific analyte.[1] Non-covalent functionalization of graphene via π-π stacking of aromatic molecules is an attractive strategy as it allows surface modification without disturbing the graphene lattice.[2] Implementing this technique faces certain challenges, such as characterising the molecular layers, particularly in the presence of contamination on the graphene surface.

We investigated the non-covalent functionalization of chemical vapour deposited (CVD) graphene with aromatic molecules *via* wet chemical adsorption. A method of producing high-packing density molecular films on graphene has been developed by addition of a functionalization step to the standard CVD graphene transfer process. Raman spectroscopy and scanning tunneling microscopy give insight into the arrangement and packing density of the molecules on the graphene surface.

The influence of packing density on the stability of the molecules upon further derivatisation was also studied, which is important for additional of selective sensing markers onto graphene. X-ray photoelectron spectroscopy (XPS) is used to characterise the surface modification. These measurements provide insight into the behaviour of molecules on pristine graphene, an important step towards implementation in selective sensing applications.

References

[1] Allen, M. J.; Tung, V. C.; Kaner, R. B., Chem. Rev. **110** (2010) 132–145.

[2] Mann, J.; Dichtel, W., J. Phys. Chem. Lett. **4** (2013) 2649–2657.