Weaving molecular meshes on nano-carbon flatland

Title of the dissertation
Molecular self-assembly on graphene – structure and effects

Contents of the dissertation
The wonder material graphene, a single-atom layer thick layer of graphite, can be potentially used to make ultra-fast and energy-efficient electronic circuits. However, this would require modification of its electronic properties without sacrificing its desirable elements. Single layers of organic molecules adsorbed on graphene is a facile method to achieve this. Under suitable conditions, the molecules can spontaneously assemble into periodic structures and can be utilised in achieving the holy-grail of graphene electronics – opening a gap in its band-structure.

In this work, molecular self-assembly on graphene is experimentally investigated with scanning tunnelling microscope, an instrument that enables us to visualise individual atoms and molecules on surfaces. The structure and electronic properties of several organic molecules adsorbed on graphene is studied in this manner. Finally, the effect of these molecules on the electronic properties of graphene is studied by observing how the electrical field dependent resistance across an ultra-clean flake of graphene changes on molecular adsorption. The results demonstrate graphene to be a unique substrate for molecular assembly and point to fruitful directions for using molecules to tune the amount of charge carriers in graphene.

Field of the dissertation
Engineering physics

Doctoral candidate
Kaustuv Banerjee, M.Sc.(Tech.)

Time of the defence
15.9.2017 at 12 noon

Place of the defence
Aalto University School of Science, lecture hall U1 (U154), Otakaari 1, Espoo

Opponent
Associate Professor Sabine Maier, University Erlangen-Nürnberg, Germany

Custos
Professor Peter Liljeroth, Aalto University School of Science, Department of Applied Physics

Electronic dissertation

Doctoral candidate’s contact information
Kaustuv Banerjee
Department of Applied Physics, Aalto University School of Science.
Mob: +358414747428
email: kaustuv.banerjee@aalto.fi