Noncovalent functionalization of graphene with large organic molecules

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Since the isolation of single layer graphene by mechanical exfoliation [1] and the subsequent discovery and demonstration of its outstanding electronic and mechanical properties [2], graphene has attracted a very high level of interest. Its exceptionally high charge carrier mobility, combined with its high surface area and biocompatibility, make it a particularly promising material for gas and biomolecular sensing applications [3]. However, the pristine graphene surface is chemically inert and therefore requires further functionalization to enable molecular recognition, i.e. sensor selectivity. Noncovalent functionalization by π-interactions is an attractive strategy to introduce functional groups on the surface since it does not adversely affect the electronic properties of the graphene backbone [4]. With the goal of identifying the most suitable organic molecular compound for the fabrication of graphene-based biosensing devices, we investigated the wet-chemical deposition and adsorption characteristics of several different perylene bisimide and porphyrin compounds on large-area chemical vapor deposition (CVD) grown graphene. We further demonstrate the subsequent bioconjugate functionalization of some of those organic molecular thin films for the application in a quintessential selective biosensing device.

References

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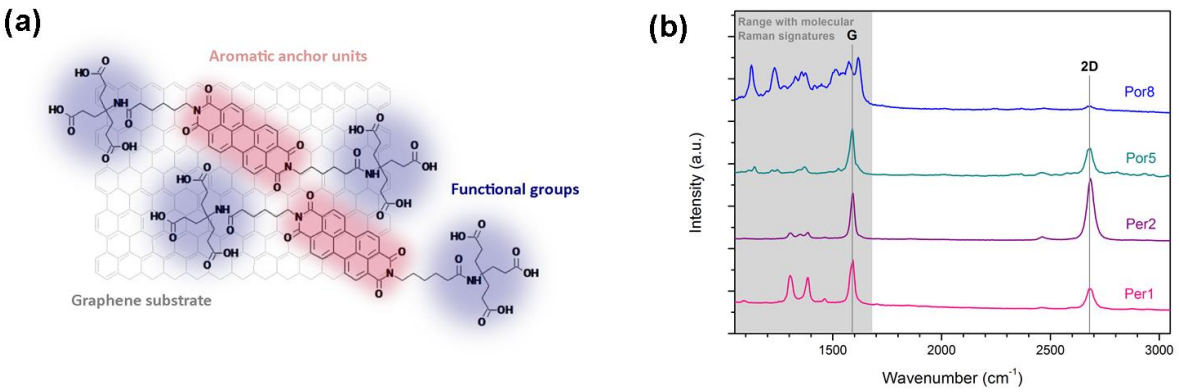

Figure: (a) Schematic of the noncovalent functionalization of graphene with an example of a large organic molecule, (b) Raman spectra of several different large organic molecules adsorbed on CVD graphene.