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Graphene edge functionalisation and characterisation

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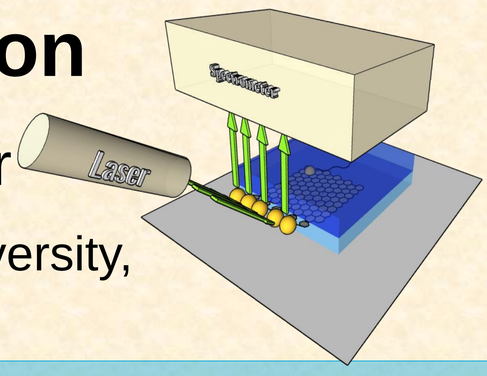
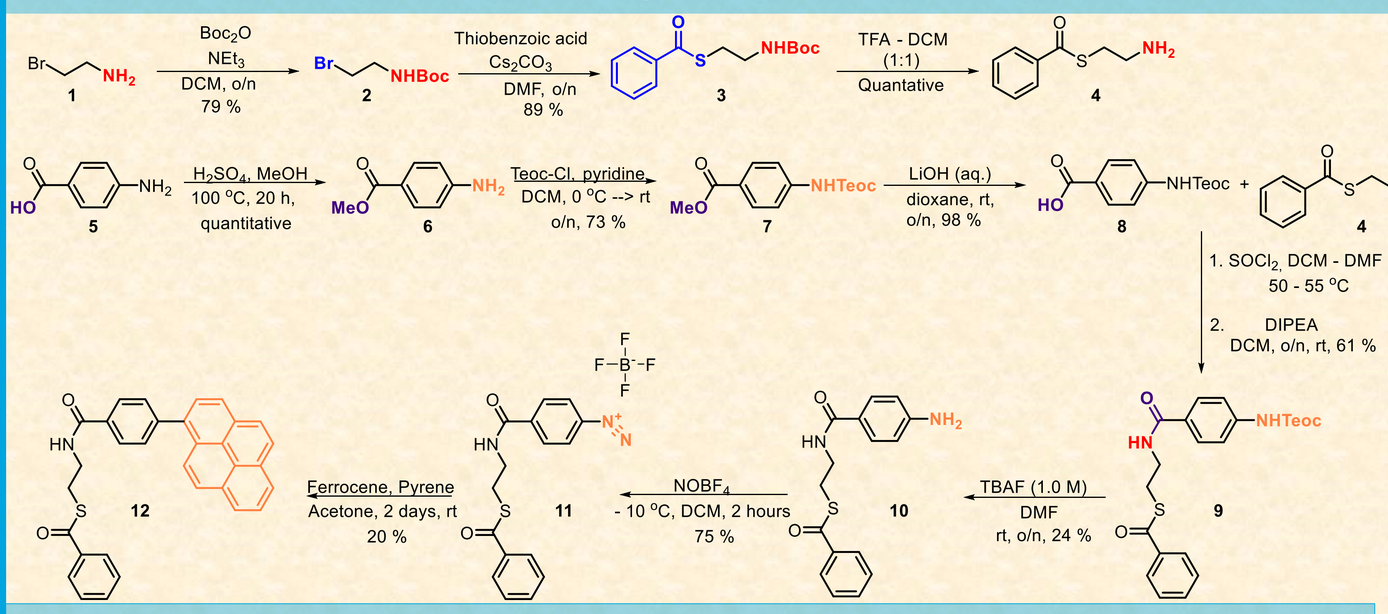


Background and scope

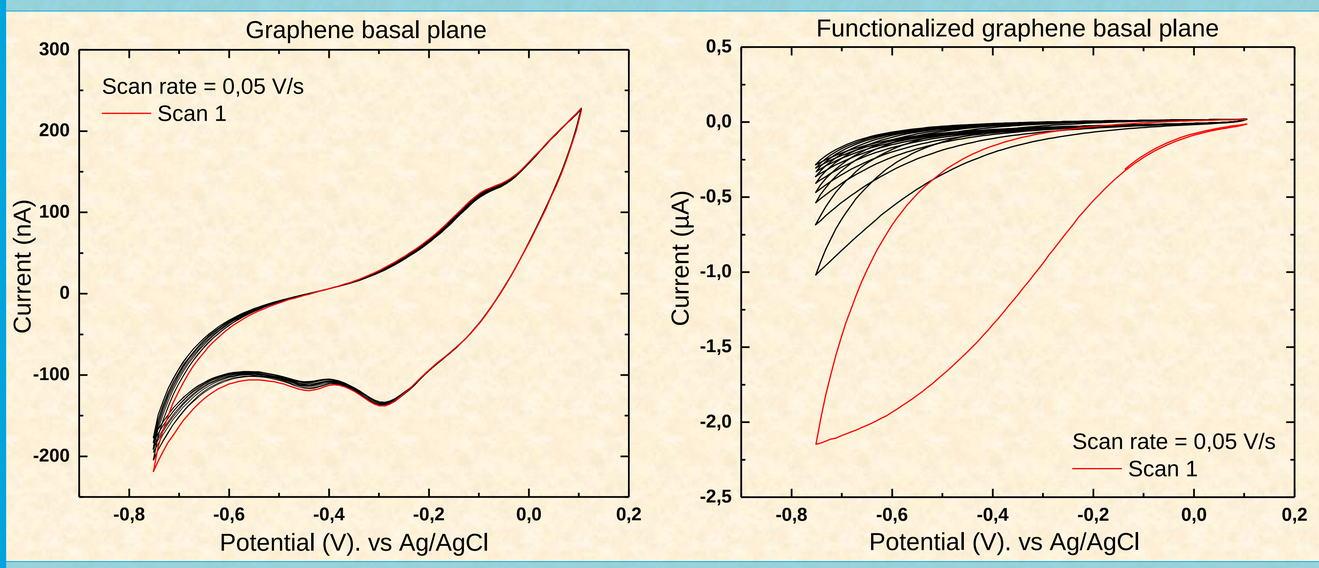
Covalent graphene edge chemistry has obtained increased interest due to the ability of forming stable bonds to alter the chemical - and electronic properties of graphene whilst preserving the electron mobility. Selective edge chemistry of graphene has been achieved by electrochemical reduction of 4-nitrobenzenediazonium tetrafluoroborate on an edge – only exposed graphene electrode[1], surface-assisted covalent coupling[2], immobilization by using an inert anchor[3] and through bipolar electrochemistry asymmetric metal functionalized graphene edges[4] have been obtained. Microscopy techniques do not provide information about the chemical composition of the reacted molecule and conventional characterization methods such as Raman are hampered by the low quantity of functionalized edge molecules versus the basal plane. Surface-enhanced Raman spectroscopy (SERS) has emerged as a tool and the most promising work has been achieved by Yadav et al., (2019) who have been able to exclusively functionalize the graphene edge non-covalently with 4-aminobenzylamine through electropolymerisation and characterize this by SERS, through electrodeposition of gold nanoparticles (AuNP) onto this polymerized layer.[5] The main issue was that, upon covalent functionalization, electrodeposition of AuNPs was not possible due to the formed passivation layer.

The goal is to characterize covalently functionalized graphene edges by functionalizing AuNPs on the GrEdge through AuNP-sulfur interactions

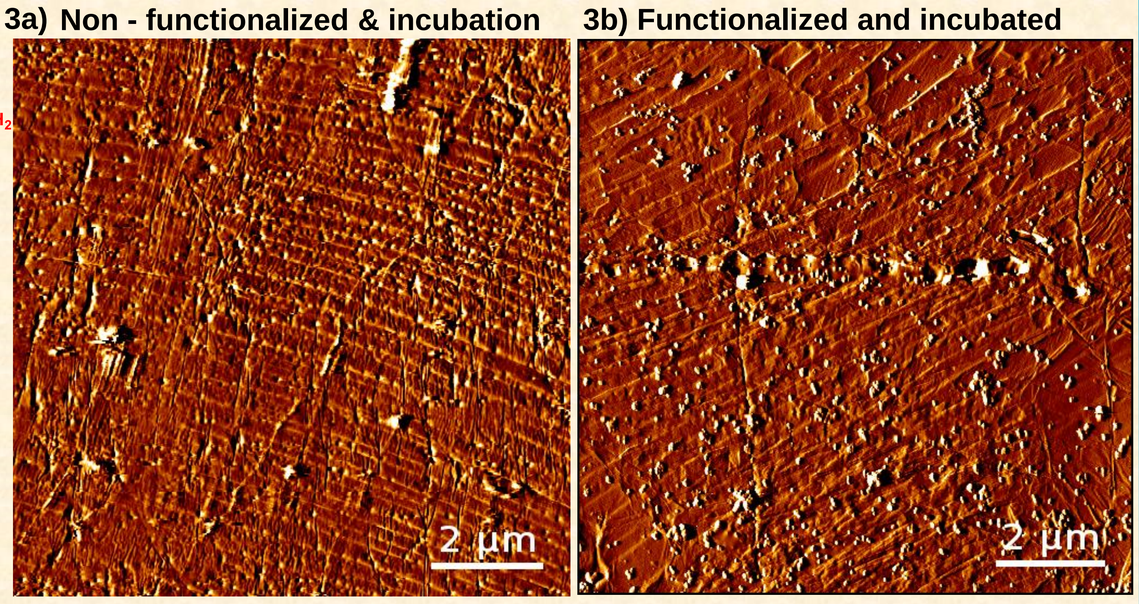
1. Linker synthesis



2. CV measurements



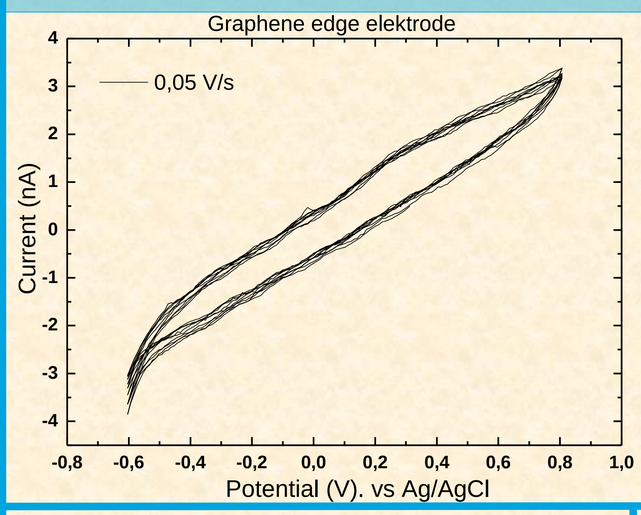
3. AuNP incubation

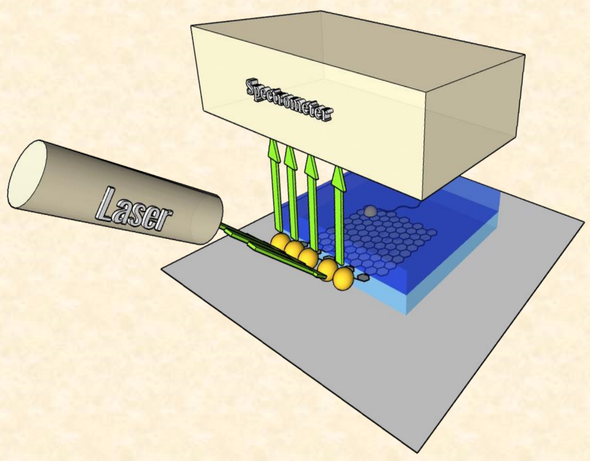


Preliminary results:

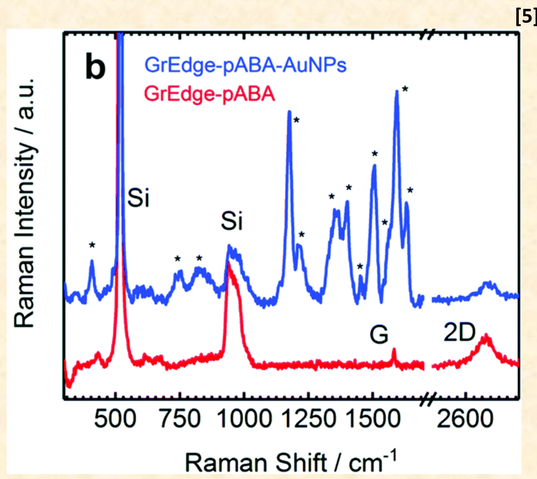
- Confirmation of the diazotization was achieved by obtaining compound **12**
- CV measurement depict reduction upon addition of compound **11**
- AFM images reveal absence of AuNP when incubated without the molecule
- Small-sized particles (35-60 nm) upon AuNP incubation with the functionalized graphene electrode, after deprotection, were observed

4. Future prospect: Chemistry on the edge





[5]



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References

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