GRAPHENE AND 2DM VIRTUAL CONFERENCE & EXPO

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TOWARDS VAPOUR SENSING WITH GRAPHENE-METALLIC NANOPARTICLE HYBRIDS

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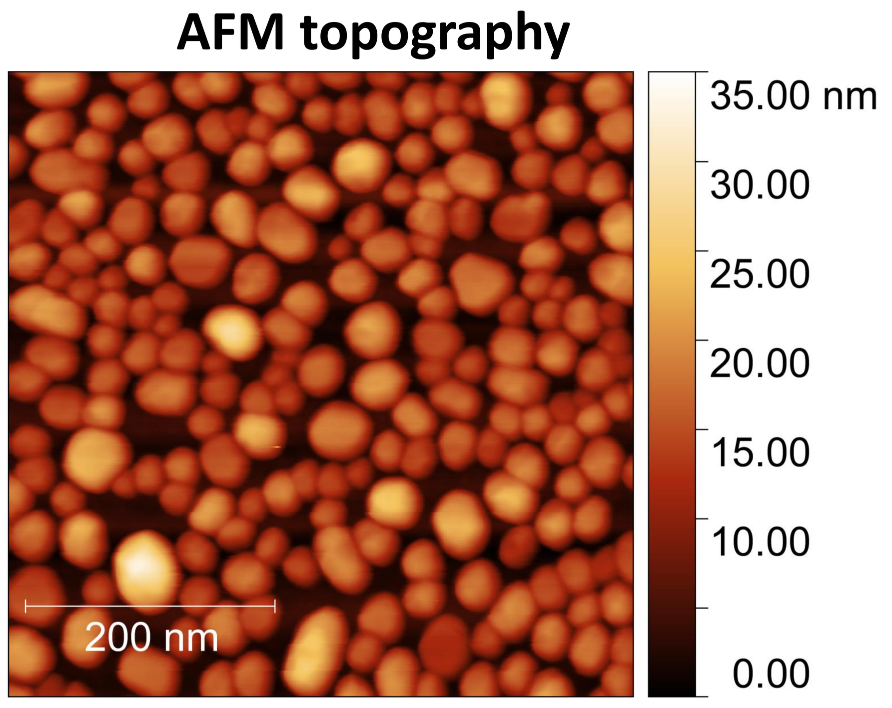
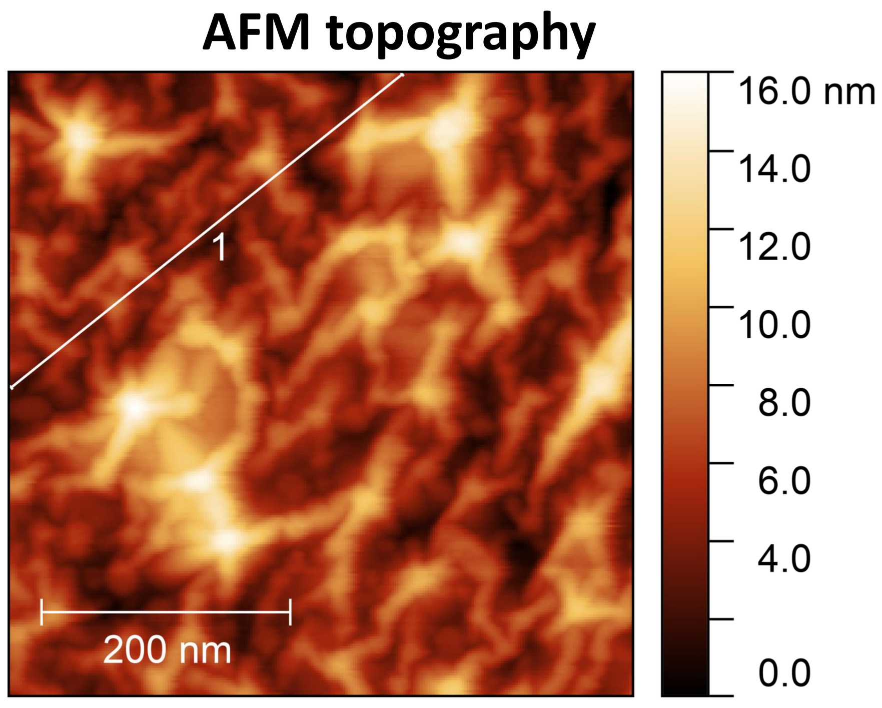
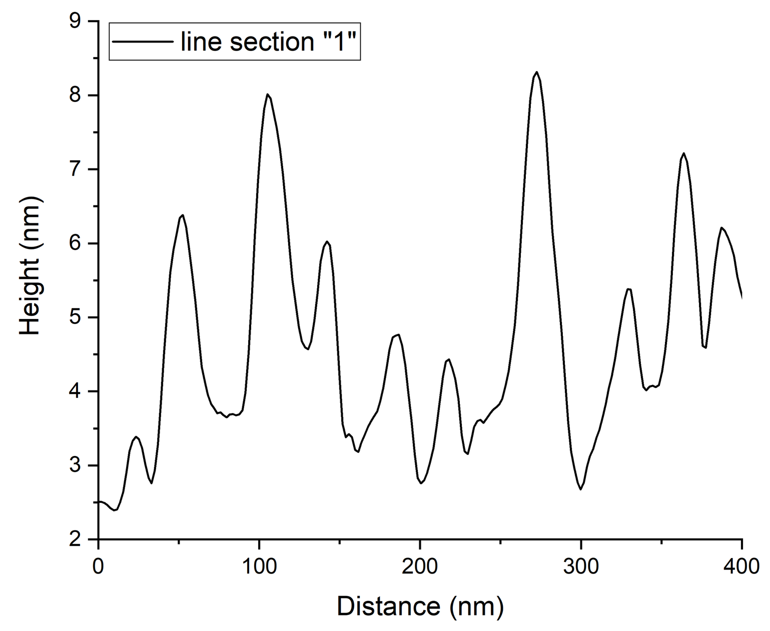
Graphene/Au nanoparticle hybrids



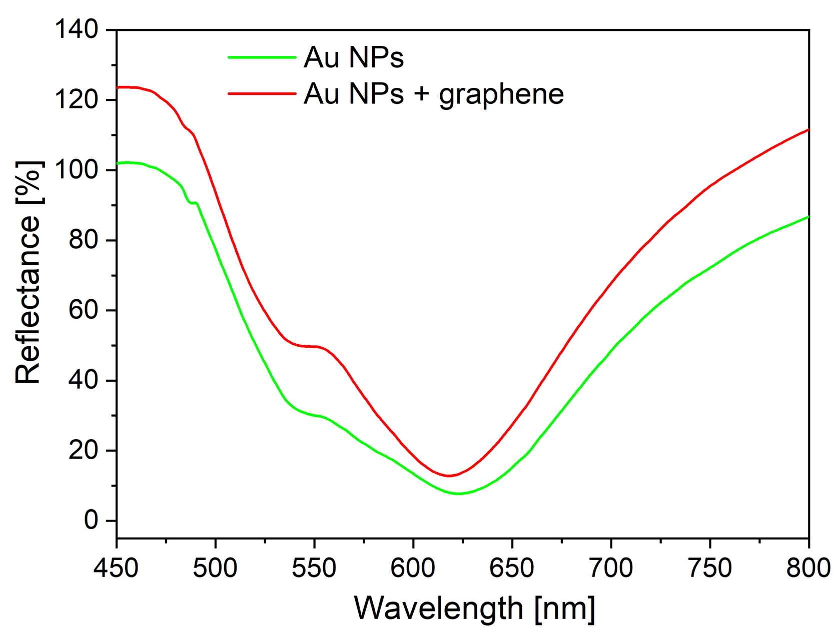
Step 1: Gold films of 5 nm thickness were deposited on SiO_2 substrates. The deposited films were transformed into nanoparticles (NPs) by annealing at 400 °C under Ar atmosphere for 30 minutes.



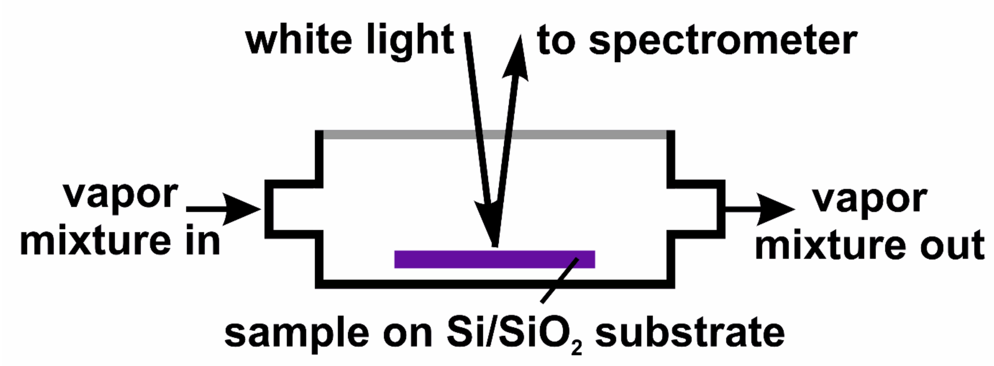
Step 2: Large area graphene grown by CVD on copper foil was transferred onto the gold nanoparticles using transfer release tape. The graphene-covered samples were further annealed at 400 °C for 60 minutes to improve the adhesion of graphene to the NPs.

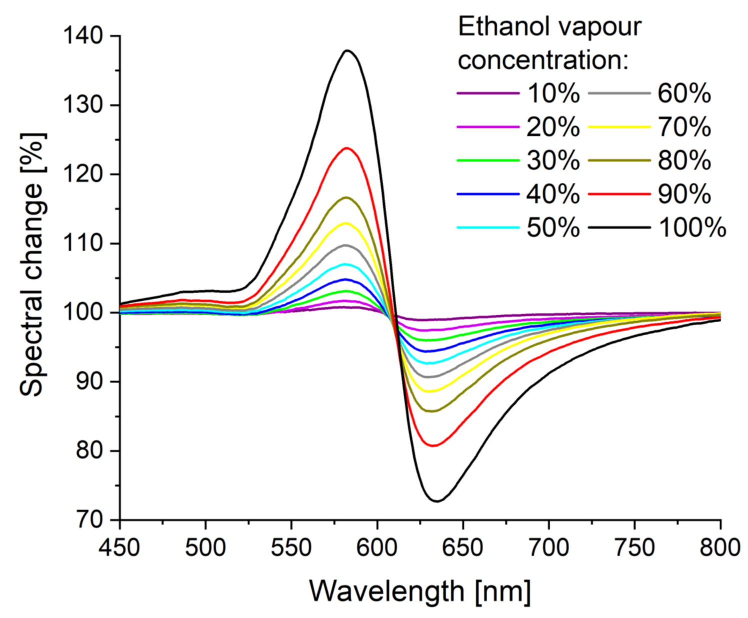


Height profile of line section "1" showing corrugated graphene.

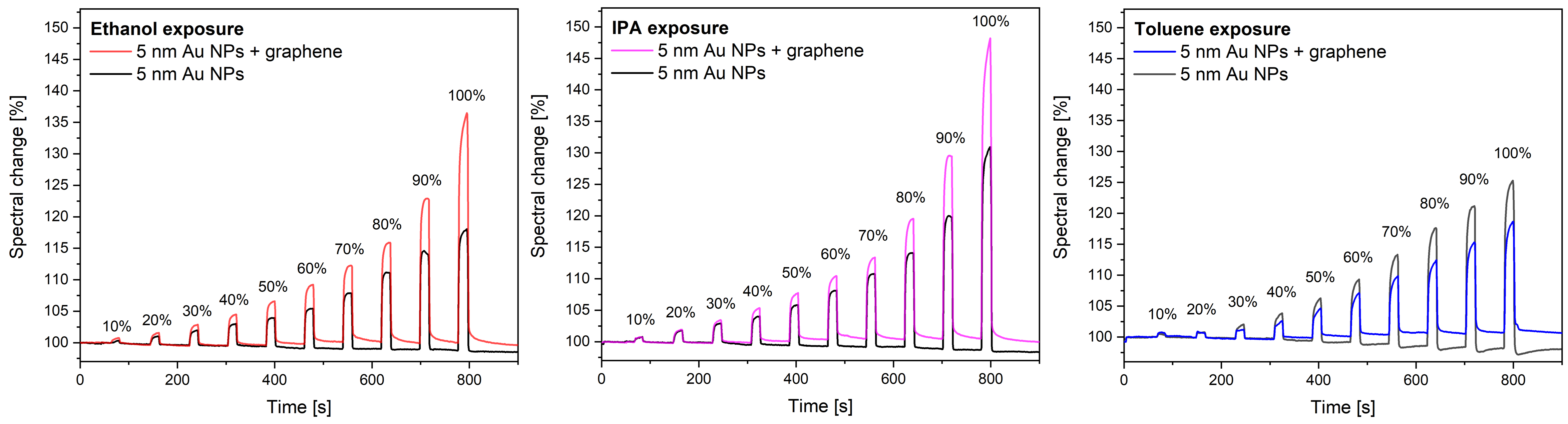


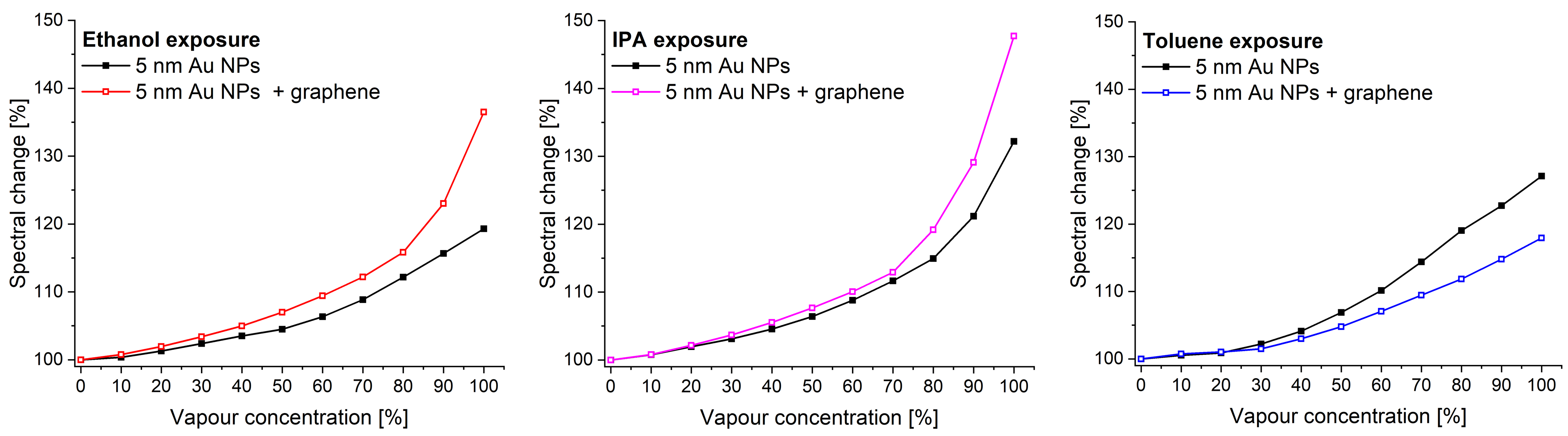
Step 3: The initial optical reflectance spectra of Au NPs and graphene/Au NPs was measured.





Step 4: Vapour sensing experiments were carried out by changing the concentration and the type of test vapours while monitoring the spectral variations in time: 20 s mixture flow was followed by 60 s of synthetic air flow, to purge the cell. Purging (60 s) was also used to recover the initial reflectance value before the introduction of the next vapour mixture.





CONCLUSIONS

Fast optical response and recovery of Au NPs were observed, which preserved on the graphene-covered samples as well. We demonstrated that the presence of a corrugated graphene overlayer increased the sensitivity to ethanol and 2-propanol (IPA), while it decreased it towards toluene exposure (at concentrations ≥ 30%).

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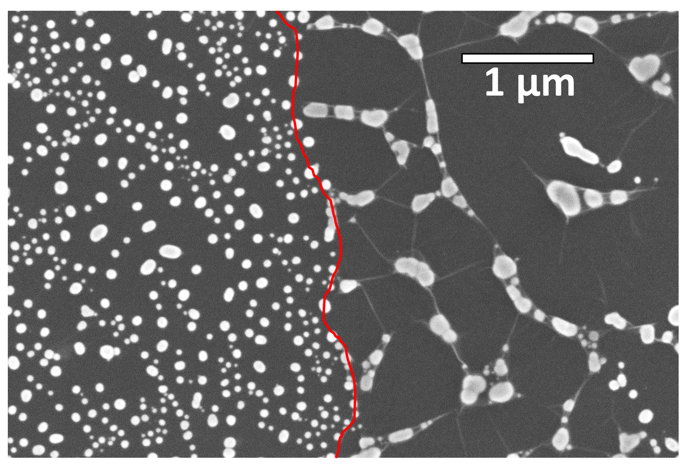
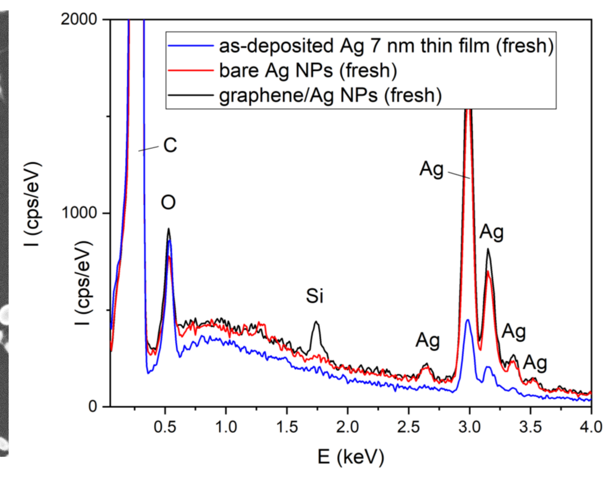
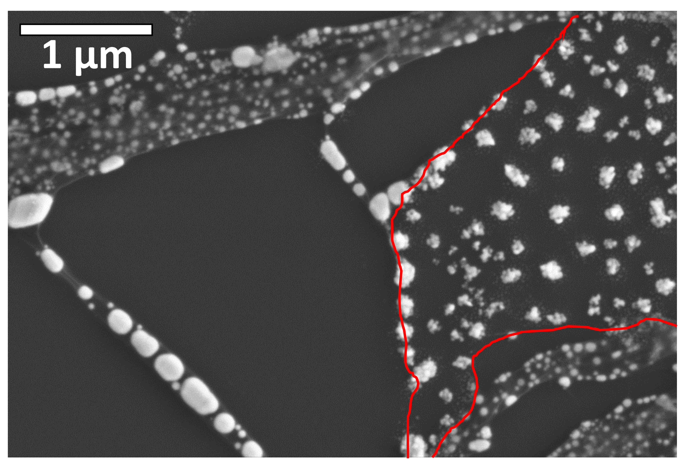
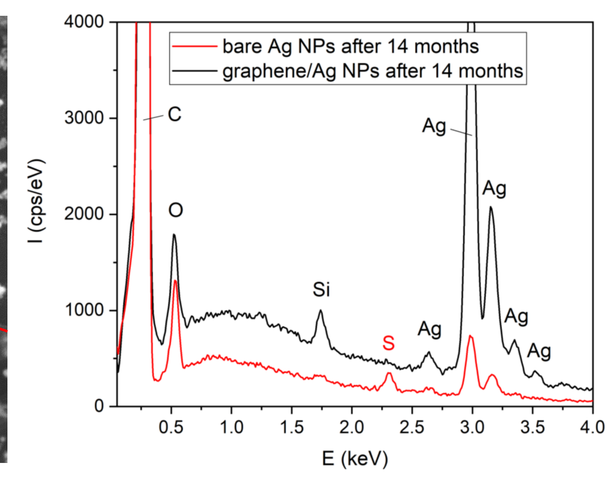
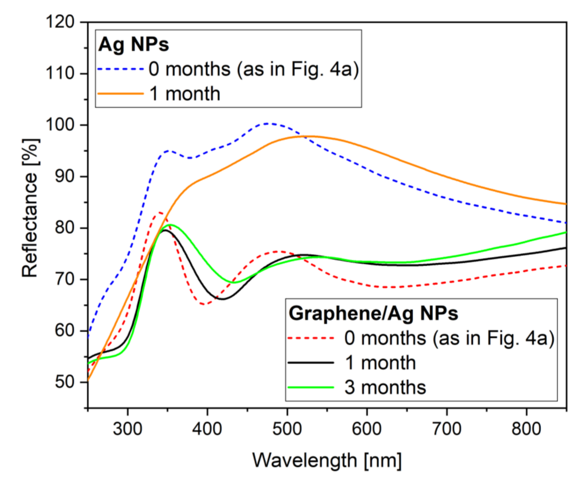
Graphene/Ag nanoparticle hybrids











A graphene overlayer preserves the local surface plasmon resonance properties of Ag NPs for at least three months, although the LSPR is gradually redshifted. This is primarily attributed to the spontaneous sulphurisation of non-covered Ag NPs.

Vapour sensing propereties: work in progress.

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