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Colloidal InSe nanostructures: effect of morphology on their chemical sensitivity to methanol and formaldehyde fumes

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Abstract content
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Two morphologies of indium monoselenide nanocrystals have been obtained by varying reaction parameters (time and precursor concentration) during their colloidal synthesis. The synthesized nanostructures crystallized in the same phase, rhombohedral InSe. However, the different morphologies had an influence in the optical properties with the nanoparticles more blue shifted from bulk. Herein we report for the first time, on the synthesis and characterization of indium monoselenide nanoparticles and nanosheets and their application as chemical sensors. We investigate the effect of the different morphologies on methanol and formaldehyde sensing. Since sensing ability is related to the electronic structure, it was palpable that the different morphologies will bring about different results. The sensors fabricated using the InSe nanoparticles gave a good response to HCOH fumes and methanol vapour. The sensor also showed selectivity towards HCOH fumes by giving a better response compared to that of acetone and chloroform vapours. The sensors fabricated using the InSe nanosheets similarly gave good response towards HCOH; however it recovered half way. For the methanol detection using a similar device, the noise to signal ratio was relatively high. The operating temperature range for the InSe sensor devices was determined to be near room temperature. The sensors' response was observed to decrease with increasing temperature from 30 deg:C – 90 deg:C. The low sensing abilities of the nanostructures observed could be attributed to the surface capping molecule (oleylamine) employed to stabilize the nanostructures during synthesis.

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