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Solid state precursors mediated growth of single-wall carbon nanotubes with defined doping towards gas sensing

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Abstract:

Single-walled carbon nanotubes (SWCNTs) are of particular interest as they possess a broad range of interesting properties like superior mechanical, electronic and optical properties. In this PhD study, I address some open questions regarding the controlled synthesis of functionalized nanocarbons including N-doped SWCNTs, BxCyNz SWNTs and N-doped Graphene studying their interactions with gases. The synthesized materials were characterized regarding their quality, purity, overall morphology and especially regarding the modification in their bonding environment due to the doping and chemical functionalization by the incorporated heteroatoms using X-ray Photoemission Spectroscopy, Raman Spectroscopy and Electron Microscopy as probes. Novel precursors offering N doping levels of >5% and a good scalability has been successfully achieved. In addition I performed synchrotron photoemission experiments on metallicity sorted SWCNTs endohedral filled with Nickel(II) acetylacetonate in order to understand the gas sensing mechanism with NO₂. Results show a selective and sensitive material for NO₂ sensing with the unique ability of room temperature recovery. This paves the way to apply these nanotubes with tailored surface chemistry in the next-generation of advanced gas sensors.