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Use of chlorinated carbon materials to make nitrogen doped and un-doped carbon nanomaterials and their use in water treatment

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2018

https://hdl.handle.net/10539/26296

Maboya, Winny Kgabo. (2019). Use of chlorinated carbon materials to make nitrogen doped and un-doped carbon nanomaterials and their use in water treatment. University of the Witwatersrand, https://hdl.handle.net/10539/26296

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ABSTRACT

Carbon nanomaterials (CNMs) and nitrogen doped CNMs (NCNMs) with different morphologies were obtained by decomposition of various chlorinated organic solvents using a chemical vapor deposition (CVD) bubbling and injection methods over a Fe-Co/$CaCO_3$ catalyst. CNFs, CNTs with secondary CNT or CNF growth, bamboo-compartmented and hollow CNTs were obtained. Increasing the growth time to 90 min resulted in growth of ~ 90 % of secondary CNFs on the surface of the main CNTs, using dichlorobenzene (DCB) as source of chlorine. The secondary CNFs grew at defects sites of the CNT wall. Secondary CNFs were not observed at other studied temperatures, 600, 650. 750 and 800 °C.

Using an injection CVD method, horn-, straw- and pencil-shaped closed and open-ended CNTs/CNFs were obtained from CH_3CN/DCB solutions of various volume ratios. CNT growth was enhanced after addition of chlorine. Highly graphitic carbon materials were produced from feed solutions containing low and high DCB concentrations. CNTs with defects were obtained from solutions containing 66.7 vol.% DCB. Post-doping of the N-CNTs with chlorine and of the chlorinated CNTs with nitrogen resulted in production of highly graphitic materials. Using a bubbling CVD method, mixtures of CNMs namely, hollow and bamboo-compartmented CNTs with and without intratubular junctions and carbon nano-onions filled with metal nanoparticles were obtained from feed solutions containing TTCE.

MWCNT/PVP composite nanofibers were successfully synthesized using an electrospinning technique. Adsorption capacities of 15–20 g/g were obtained in pure oil or in oil-water mixtures. The adsorption capability of the MWCNT/PVP composite depended on the type of oil and its viscosity.