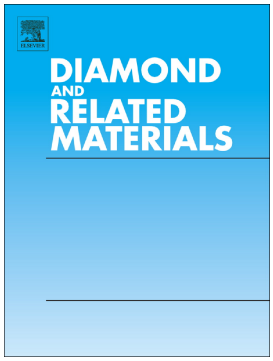

Chemical vapour deposition syntheses and characterization of boron-doped hollow carbon spheres

Z.N. Tetana, S.D. Mhlanga, N.J. Coville

PII: S0925-9635(16)30668-9
DOI: doi: 10.1016/j.diamond.2017.02.005
Reference: DIAMAT 6814

To appear in: *Diamond & Related Materials*

Received date: 15 December 2016
Revised date: 29 January 2017
Accepted date: 6 February 2017

Please cite this article as: Z.N. Tetana, S.D. Mhlanga, N.J. Coville , Chemical vapour deposition syntheses and characterization of boron-doped hollow carbon spheres. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Diamat(2016), doi: 10.1016/j.diamond.2017.02.005

Chemical vapour deposition syntheses and characterization of boron-doped hollow carbon spheres

Z.N. Tetana [a,b,c], S.D. Mhlanga[d], N.J. Coville[b,c,*]

[a]Microscopy and Microanalysis Unit, University of the Witwatersrand, Private Bag 3, WITS, 2050, Johannesburg, South Africa

[b]Molecular Sciences Institute, School of Chemistry, University of the Witwatersrand, Private Bag 3, WITS, 2050, Johannesburg, South Africa

[c]DST/NRF Centre of Excellence in Strong Materials, University of the Witwatersrand, Private Bag 3, WITS, 2050, Johannesburg, South Africa

[d]Nanotechnology and Water Sustainability Research Unit, College of Science, Engineering and Technology, University of South Africa, Florida, 1709, Johannesburg, South Africa

* Corresponding author
E-mail address: neil.coville@wits.ac.za (N.J. Coville)

Keywords

Hollow carbon spheres; CVD synthesis; boron doping; trimethyl borate

Abstract

We report a novel and simple method for the growth of boron-doped hollow carbon spheres (B-HCSs) synthesized *via* chemical vapour deposition (CVD) at 900 °C using acetylene as the carbon precursor and trimethyl borate as a carbon and boron source. The B-HCSs as well as BO_x filled CSs were synthesized using a vertical (or horizontal) furnace and the properties of the produced materials were compared to undoped carbon spheres (CSs) synthesized in a vertical furnace. The morphology and size, as well as the shell thickness of the B-HCSs was not substantially affected by varying the ratio of Ar to H_2 carrier gas ratio and the type of furnace used (horizontal vs. vertical furnace); the yield was affected by the Ar/H_2 ratio. TGA analysis confirmed the presence of B_2O_3 (25-35%) in the core of the unpurified product and this B_2O_3 could be removed by boiling water. HAADF-STEM analysis confirmed the presence of B_2O_3 in the centre of the carbon spheres. B-HCSs synthesized with 100% Ar and also 100% H_2 were analysed by XPS. The level of boron content in these samples was found by XPS to be 0.19 wt% B when made under H_2 while the product made under Ar contained