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Modulating properties of solid carbon nanospheres via ion implantation with heteroatoms.

Solid carbon nanospheres of about 4 nm diameter have been prepared and then doped by ion implantation, using a specialized end-station adapted for the uniform implantation of powders. Boron, nitrogen and neon ions were chosen initially, the latter for control purposes. Herein, the dependence of the physicochemical properties of solid carbon spheres on the fluence of the implanted ions was investigated by controlling the dosage of the 100 keV B+, N+ and Ne+ ions into the carbon shell over 7h and 14h implantation periods at room temperature. SEM analysis revealed significant surface deformation in the form of cracks for the N+ implanted samples, whilst little structural deformation was observed with Ne+ and B+ implanted samples. On the other hand, TEM micrographs showed formation of varying thicknesses of the amorphous carbon depending on the implantation period. In particular, both N+ and Ne+ implanted samples exhibited thicker amorphous layers of ˜21 ± 2 nm and ˜12 ± 3 nm, respectively, whilst a reduction to ˜12 ± 2 nm was observed after the 14h implantation period with B+ ions. Raman spectroscopy indicated significant structural changes upon implantation, as evident by large values for the defect density ratios. Moreover, compromised BET surface area was observed for B+ and N+ implanted samples, whereas an improved thermal stability was recorded for both Ne+ and B+ implanted samples. Finally, electrical measurements were carried out. The study showed the importance of the choice of the heteroatom ion on the properties of the solid carbon spheres for the development of next generation carbon-based electronic devices.

Apply to be considered for a student ; award (Yes / No)?

No

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