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GRAPHITIZED CARBON SPHERES (CSs) WITH HIERARCHICAL SURFACE MORPHOLOGY BY CHEMICAL VAPOUR DEPOSITION (CVD)

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In recent years, different forms of carbon structures with extraordinary properties and multidisciplinary applications have been discovered. Among them, carbon spheres (CSs) are unique materials because they can be fabricated with significant characteristics, such as adjustable porosity, uniform geometry, surface functionality, flexible particle size distribution, and outstanding chemical and thermal stability. In this work, graphitized CSs with varying diameters and hierarchical surface morphology were synthesized on iron-coated silicon (100) substrate, at 750 °C, using catalytic chemical vapor deposition (CCVD). CSs with different sizes were produced by varying the flow rates of the carbon source and the method of catalyst coating. Scanning electron microscopic examination shows that CSs produced in this manner have a regular and uniform shape with smooth surface properties. The catalyst coating methods employed in this work produce high yield CSs with the diameter ranging from 0.5 - 3.5 μm. By using ImageJ, the effect of the catalyst prepared by spin-coating and dip-coating methods on the variation of the diameter (surface morphology) of the carbon spheres was investigated. The results show that the formation of micro-sized carbon spheres (1.0 - 3.5 μm) is favoured on catalyst coated on silicon (100) by spin-coating method at a lower flow rate of carbon source, acetylene. The average diameter of the CSs was 3.1 μm under optimum conditions of acetylene to nitrogen ratio of 500:200 sccm. Results of Raman spectroscopy and X-ray diffraction confirmed the presence of graphitized hexagonal carbon networks of the products, and their applications depend significantly on the shape and size of the particles. The results observed are explained with the view of using such CSs in the unit process of water treatment plants, sodium-ion batteries and nano-composites.

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Keywords: Carbon spheres (CSs), Chemical vapor deposition (CVD), Dip coating, Hierarchical surface morphology, Spin coating