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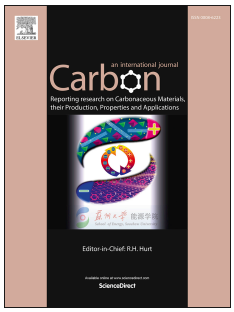

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Large-scale synthesis of defects-selective graphene quantum dots by ultrasonic-assisted liquid-phase exfoliation

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Abstract

Graphene quantum dots (GQDs) exhibit unique physical and chemical properties due to their quantum confinements, edge effects and defect contents. Synthesis of GQDs with controlled defect content is an important issue for various applications. In this paper, an environmental friendly, fast and industrial promising method for synthesizing GQDs in large scale is reported via an ultrasonic-assisted liquid-phase exfoliation technique. The production yield of GQDs in N-methyl-2-pyrrolidone (NMP) can reach 3.8 mg/ml. GQDs with different sizes, structures and defect contents were obtained by using different graphitic carbon precursors for exfoliation. Hereby we synthesized high-defects GQDs (HD-GQDs) and low-defects GQDs (LD-GQDs) from acetylene black and nano-graphite, respectively. By luminescent and absorbance investigations, different light absorption and photoluminescence (PL) properties were identified relevant to the defect characters. The different edge structures, defect contents and sizes of GQDs are responsible for the variation of luminescent properties induced by changing the excitation wavelength and the pH values of the GQDs dispersions. Attributed to the high water dispersancy, excellent biocompatibility and controllable fluorescent performances, the as-synthesized HD-GQDs show high potential as fluorescence nanoprobes for bioimaging.

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