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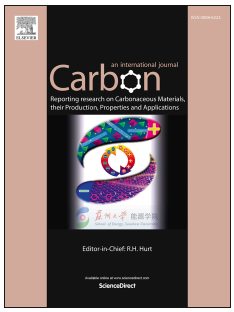

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Direct Photodissociation of toluene molecules to Photoluminescent Carbon Dots under Pulsed Laser irradiation

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Abstract:

Herein, we report a facile method of direct photodissociation of toluene molecules to photoluminescent carbon dots (CDs) under pulsed laser irradiation in the absence of surfactants or catalysts. The as-synthesized CDs with diameters 1.3-4.0 nm present regular emission peaks and the crystallographic structure of these species has been identified as graphite 2H from the analysis of high resolution transmission electron microscope (HRTEM) images, X-ray photoelectron spectroscopy (XPS) and Raman spectrum. In addition, First-Principle calculations were performed to discuss the photon-induced excitation in the photodissociation processe. The results demonstrate that electrons can be transited from Highest Occupied Molecular Orbital (HOMO) to Lowest Unoccupied Molecular Orbital (LUMO) in toluene molecule by 248 nm single photon excitation processe and the Stark effect plays a crucial role in the photodissociation processe. These CDs exhibit excellent stable emission due to the stability of crystal structure, which could be considered for promising luminescent applications.

1. Introduction

Carbon nanomaterials have a broad range of applications in energy, environmental and biomedical fields [1-6]. In particular, photoluminescent carbon dots (CDs) including graphene dots (GDs) have received considerable interests due to their

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