

FLUORESCENT CARBON DOTS PREPARED THROUGH THERMAL PROCESSING OF SUCCINIMIDE

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In this work, we report a simple, low-cost synthesis procedure of fluorescent Carbon dots (C-Dots) through pyrolytic processing of succinimide. The resulted C-Dots presents excitaton dependent fluorescent emission located in the blue interval of the visible spectrum. The average size of the resulted C-Dots is about 2-5 nm. The structure and morphology of the synthesized carbon nanoparticles were investigated through FT-IR, P-XRD, DLS, AFM, TEM while their luminescent properties were investigated in detail by steady-state and lifetime fluorescence. The recorded absolute PL quantum yield varies between 11.23 to 23.45% according to the excitation wavelength. Their photoluminescent properties, low toxicity and convenience of fabrication are only of the few arguments for applications ranging from biolabeling to optoelectronic devices.

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1. Introduction

Carbon Dots are new members of the carbon nanomaterials class that includes fullerenes, grapheme, graphite oxide or carbon nanotubes. Generally, they contain sp^2/sp^3 hybridized carbon in a graphitic core with various functional groups such as amino, carboxyl or hydroxyl groups attached on the surface [1]. C-Dots are generally very small carbon nanoparticles > 10 nm, depending on their preparation conditions and precursors. One of the most interesting features of C-Dots is their excitation dependent photoluminescent (PL) emission. Generally, C-Dots have strong absorption in the ultraviolet region, which can also is extended to visible region, usually their emission being located in blue-green and even red regions of the visible spectrum [2, 3].

Luminescence properties of Carbon Dots seems to be rather a result of the radiative transitions occurring within or between the functional groups located on the C-Dots surface and seem to be less dependent on their size. The PL mechanism relying on functional groups attached on the surface of the C-dots may provide an additionally insight on observed excitation wavelength dependence of the emission peaks. Recent studies emphasize the role of functional groups such as carbonyl, carboxyl and nitrogen containing groups in PL properties of C-dots and the possibility to alter the PL emission through modification of these surface localized groups. Several very recent studies attribute the origin of the C-Dots photoluminescence to certain organic fluorophores created during the thermal destruction of the primary precursor [4]. During the synthesis, carbonaceous nanostructured species are also produced but their PL emission is less intense. While the emission peak of the organic fluorophore is independent of the excitation wavelength, the C- Dots resulted from the thermal process behave in a “classic” manner with excitation dependent emission peaks. In another view, C- dots are seen as a blend of polycyclic aromatic hydrocarbons (PAH) with their PL properties resulting from the inner emissive states of each species [5]. This model, according to the authors view, could explain both the large Stokes shifts and the excitation dependent emission of the C-Dots which is a result of slightly different energy gaps of each of the PAHs.

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