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Editorial corner – a personal view

Carbon nanodot – a new rising fluorescence star

*Z. Sun**

State Key Laboratory of Luminescence and Applications, Changchun Institute of Optics, Fine Mechanics and Physics, Changchun, Jilin 130033, P. R. China

Since carbon nanodots (CDs) were accidently found in 2004 (DOI: 10.1021/ja040082h), they rapidly attracted great research interest due to their unique properties and potential applications. They show excellent bio-compatibility and tunable light emitting and two-photon adsorption properties, which can be potentially used in bio-imaging, light-emitting devices, and for photocatalysis.

Currently, researchers mainly focus on the synthesis of CDs. The synthesis methods can be divided two categories: top-down and bottom-up routes. So called, top-down routes consist in delaminating bulk graphite or carbon materials into nanosize graphite particles via physical or chemical methods. These include arc discharge, laser ablation, electrochemical oxidation and chemical oxidation, and so on. However, there is no fluorescence from these nanosize graphite particles. Another passivation step is necessary to produce light emission, which is associated with defects in the grapheme structures. Bottom-up methods are approaches, which convert non-graphite carbon sources into nanosize graphite particles via chemical reactions, for examples, combustion, pyrolysis, microwave, ultrasonic, hydrothermal methods. In the recent half decade the bottom-up methods have attracted more and more attention due to the simple preparation route and cheap carbon sources. Luminescent carbon nanodots can also be obtained from the following biocompatible sources, such as, citric acid, glucose, coffee grounds, grass, egg yolk, and orange juice via a simple heat treatment.

The most attractive properties of carbon nanodots are excellent biocompatibility and luminescence. Although the carbon nanodots are prepared by different methods, they all show good biocompatiblity with cells, tissues of animals and plants. Their luminescence exhibits interesting wavelength dependence. That means that carbon nanodots show a tunable light-emitting range from blue to red under different exciting wavelength irradiations. Two-photon adsorption phenomenon is also observed for the carbon nanodots, which emit visible light under excitation by near infrared or infrared light. Based on the above properties, carbon nanodots may exert a huge impact in both health- and bio-related applications because of their potential to serve as non-toxic replacements of traditional heavy metal-based quantum dots.

On the other hand, carbon nanodots may also serve as a fluorescent sensor for detection of metal ions and DNA, as emitting materials for light-emitting devices (LED) and photocatalysis for degradation dye molecules. Within a decade, the researchers have made a huge progress in the development of new synthesis strategies and potential applications of CDs. So, a bright future of carbon nanodots is facing us.

Dr. Zaicheng Sun
Member of International Advisory Board

*Corresponding author, e-mail: sunzc@ciomp.ac.cn