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New development in carbon quantum dots technical applications

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Abstract

As a newly emerged member in carbon nanomaterials family, carbon quantum dots (CQDs) attracted everincreasing attention owing to their ultracompact size, excellent photoluminescence, favorable biocompatibility, versatile surface and superior electron transfer ability. The past decade has witnessed continuous advancements in the production of CQDs with high photoluminescence quantum yields for various applications. Herein, we track the newest development of CQDs with advanced physicochemical properties and their applications in sensing, bioimaging, nanomedicine and catalysis, and propose the challenges and perspectives in this exciting and promising field.

Keywords carbon quantum dots; physicochemical properties; sensing; imaging; nanomedicine; catalysis

1. Introduction

Carbon quantum dots (CQDs) are quasi-spherical carbon nanoparticles below 10 nm [1]. CQDs possess comparable photoluminescence (PL) properties as semiconductor quantum dots, while CQDs outperform their counterpart in low toxicity, environmental friendliness, low cost, a great selection of simple synthetic routes and apt to surface functionalization. By virtue of the superior physicochemical properties, CQDs triggered large scale studies on their synthesis, properties and technical applications in the fields of optical sensing, electrochemical sensing, imaging, nanomedicine, photocatalysis and electrocatalysis. The exploration of effective synthetic pathways for CQDs was the focus around 2010. To sum up, synthetic approaches for CQDs comprise “top-down” and “bottom-up”. The former refers to

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