

Illuminating the Future: Cutting-Edge Advances in Carbon Quantum Dots

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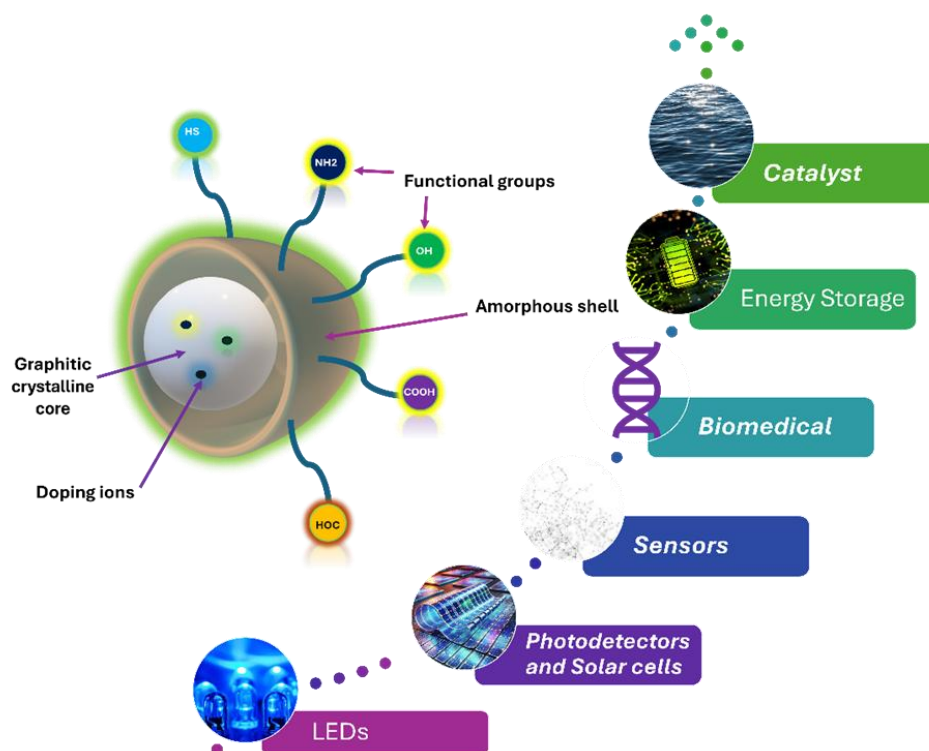
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Abstract

Carbon quantum dots (CQDs) are a diverse class of nanomaterials with numerous properties and applications, and CQD research has shown an upward trend during the last decade. This review examines CQDs, covering synthesis methods, structural properties, and a range of applications. Their unique optical, electrical, and chemical capabilities are discussed, with emphasis on their potential applications in optoelectronics, sensing, bioimaging, catalysis, anticounterfeiting, and energy storage. Surface functionalisation tactics for enhanced performance, innovative medication delivery and the ragnostics applications, and research into sustainable synthesis procedures are all current developments. Furthermore, the article provides up-to-date information on the applications of CQDs in critical research areas and across diverse domains. In addition, comparative studies of synthesis techniques and the applications and properties of different CQDs are presented in detail. Challenges such as standardisation of characterisation techniques and scalability are also discussed, providing insights into CQD research and the current state of applications, opportunities, and future perspectives.

Table of Contents



Innovative Description: This review highlights recent advancements in the synthesis methods, properties, and diverse applications of carbon quantum dots (CQDs).