

Carbon quantum dots (CQDs, C-dots or CDs), which are generally small carbon nanoparticles (less than 10 nm in size) with various unique properties, have found wide use in more and more fields during the last few years. In this feature article, we describe the recent progress in the field of CQDs, focusing on 10th Anniversary: Most popular articles JMC C Top Picks collection: The ...

Additionally, CQDs feature tunable photoluminescence and electronic properties, enabling customizable optical and electronic applications. Therefore, for applications prioritizing biocompatibility, safety, and sustainability, carbon quantum dots emerge as the preferred choice over inorganic quantum dots.

ing, energy storage, and photocatalysis. Here, we review carbon quantum dots with focus on their synthesis from biomass, ... est progress of carbon quantum dots application in energy, environment, and medicine, emphasizing the advantages of selecting biomass waste as the precursor, is highlighted. Finally, the future perspective and challenges ...

Carbon quantum dots are a novel form of carbon material. They offer numerous benefits including particle size adjustability, light resistance, ease of functionalization, low toxicity, excellent biocompatibility, and high-water solubility, as well as their easy accessibility of raw materials. Carbon quantum dots have been widely used in various fields. The preparation ...

Carbon quantum dots (CQDs) have gained substantial attention as multifunctional nanomaterials with distinctive characteristics, positioning them as highly promising candidates across various applications. ... Furthermore, the chemical stability of CQDs contributes to their longevity in practical applications. Whether used in energy storage ...

quantum dots in energy storage and conversion, and predict the future developm ent trend, challenges, and opportunities of quantum dots research. Keywords: Quantum Dots, electrochemical ...

Batteries and supercapacitors are the next-generation alternative energy resources that can fulfil the requirement of energy demand worldwide. In regard to the development of efficient energy storage devices, various materials have been tested as electrode materials. Graphene quantum dots (GQDs), a new class of carbon-based nanomaterial, have ...

Carbon Quantum Dots are a family of zero-dimensional carbon nanomaterials with exceptional fluorescence capabilities. CQDs consist of ultra-fine, distributed, quasi-spherical carbon nanoparticles smaller than 10 nm in size (Fig. 1) not only overcomes some shortcomings of traditional organic dyes and nanomaterials, but also has superior performance than ...

Carbon quantum dots (CQDs) are fluorescent nanomaterials with small size, broad excitation spectrum, stable

# Carbon quantum dots energy storage applications

fluorescence, and adjustable emission wavelengths. They are widely used in optoelectronics, medical diagnostics, and energy storage due to their biocompatibility, low toxicity, rich surface functional groups, abundant electron-hole pairs ...

Carbon dots (CDs) and their composites as energy storage materials and electrocatalysts have emerged as new types of quasi-zero-dimensional carbon materials. CDs can provide a large ...

Carbon quantum dots can be used in bioimaging applications due to their low cytotoxicity and excellent biocompatibility. Because of their small size, good electrochemical ...

Carbon-based Quantum dots (C-QDs) are carbon-based materials that experience the quantum confinement effect, which results in superior optoelectronic properties. In recent years, C-QDs have attracted attention significantly and have shown great application potential as a high-performance supercapacitor device. C-QDs (either as a bare electrode or composite) give a ...

Carbon quantum dots (CQDs), also known as carbon dots (CDs), are novel zero-dimensional fluorescent carbon-based nanomaterials. CQDs have attracted enormous attention around the world because of their excellent optical properties as well as water solubility, biocompatibility, low toxicity, eco-friendliness, and simple synthesis routes. CQDs have ...

Quantum dots (QDs) generally refer to nanoscale particles of conventional semiconductors that are subject to the quantum-confinement effect, though other nanomaterials of similar optical and redox properties are also named as QDs even in the absence of strictly defined quantum confinement. Among such nanomaterials that have attracted tremendous recent ...

Electrocatalytic applications of carbon quantum dots. The remarkable features of carbon-based materials, including high conductivity, active surface area, and chemical resistance, have attracted researchers worldwide in recent years. ... Design, and fabrication of carbon dots for energy conversion and storage. Chem Soc Rev, 48 (2019), pp. 2315 ...

DOI: 10.1007/s43979-022-00002-y Corpus ID: 248274726; Recent progress of quantum dots for energy storage applications @article{Xu2022RecentPO, title={Recent progress of quantum dots for energy storage applications}, author={Quan Xu and Yingchun Niu and Jiapeng Li and Ziji Yang and Jiajia Gao and Lan Ding and Huiqin Ni and Peide Zhu and Yinping Liu and Yaoyao Tang ...

Although there is significant progress in the research of carbon dots (CDs), some challenges such as difficulty in large-scale synthesis, complicated purification, low quantum yield, ambiguity in structure-property correlation, electronic structures, and photophysics are still major obstacles that hinder the commercial use of CDs. Recent advances in synthesis, ...

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The 0D carbon quantum dot doping efficiently avoids agglomeration of  $\text{NiCo}_2\text{O}_4$  nanoparticles while improving electric conductivity. The use of 2D carbon nanosheets as an intermediate layer can increase the durability of the electrode. ... et al.: Recent progress of quantum dots for energy storage applications. Carbon Neutrality 1(1), 13 (2022 ...

Wu et al. [38] prepared a 3D porous hierarchical  $\text{CuCo}_2\text{O}_4$  @carbon quantum dots (CQDs) ... large-scale preparation approaches and systematic regulation mechanisms of CDs are full of challenges for the practical applications of CDs in energy storage systems. Besides, the application of the CDs in supercapacitors is still in its early stages ...

Several excellent literature works have highlighted quantum dots in supercapacitors, lithium-sulfur batteries, and photocatalytic hydrogen production. Here, we outline the latest achievements of quantum dots and their composites materials in those energy storage applications.

On the other hand, carbon quantum dots -also called carbon dots (C-dots)- are quasi-spherical carbon nanoparticles consisting of graphite and turbostratic carbon mixture in different ratios and are in the size range of 2-10 nm [63, 64]. They are composed mainly of  $sp^3$  hybridized carbon and are usually amorphous. Their XRD pattern show ...

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Zero-dimensional (0D) carbon nanomaterials such as carbon (CQDs) and graphene quantum dots (GQDs) have been attracting attention due to their outstanding properties of biocompatibility, nontoxicity, chemical inertness, tunable photoluminescence, low cost and facile surface functionalization. Their potential applications range from biomedical, drug ...

One of the most unique optical properties of carbon quantum dots compared with conventional semiconductor quantum dots was their tunable fluorescence emissions (that is, the emission wavelength of carbon quantum dots was red-shifted with the increase of the excitation wavelength, and the fluorescence emission was easy to adjust).

As one kind of carbon nanomaterials, since their discovery at the beginning of the century, carbon dots (CDs) have been attracting extensive attention in sensing, bioimaging, catalysis, organic light-emitting diodes, etc. due to their rich and diverse physical and chemical properties. Although the precise structures of CDs need to be further analyzed and elaborated, ...

Quantum dot physics and application will someday play a revolutionary role in advancing technologies such as microelectronics, and as cross-disciplinary research continues the quantum dot will likely shape the ideas of future device applications. ... Graphene quantum dots for energy storage and conversion: from fabrication to

applications ...

Carbon nanomaterials such as carbon quantum Dots (CQDs) and graphene quantum dots (GQDs) have been attracting a great deal of attention recently due to their unique properties in terms of electrical conductivity, thermal stability, mechanical strength, chemical resistance, photoluminescence, low cost, and facile surface functionalization virtue of their ...

Carbon quantum dots (CQDs) offer many advantages across diverse applications, making them highly sought-after materials in optoelectronics, biomedicine, environmental remediation, and energy storage .

For the first time we report biological synthesis of carbon quantum dots from Halimeda opuntia green algae as a material with excellent optical properties as well as superior electrochemical performance for possible energy storage applications such as fabrication of high-performance supercapacitors. The CQDs thus obtained were characterized for ...

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