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ARTICLE

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QUANTUM DOTS: BRIDGING THE GAP BETWEEN NANOSCIENCE AND REAL-WORLD APPLICATIONS

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Quantum dots (QDs) have emerged as a transformative technology, seamlessly connecting the realms of nanoscience to practical applications across various industries. These nanoscale semiconductor particles exhibit unique optical and electronic properties due to quantum confinement effects, making them highly attractive for a plethora of applications including optoelectronics, biomedicine, energy and environmental monitoring. This paper explores the fundamental aspects of QDs, encompassing their synthesis, characterization and manipulation at the nanoscale. Additionally, it delves into the diverse array of real-world applications where QDs have demonstrated remarkable potential, such as light-emitting diodes (LEDs), solar cells, bioimaging agents and quantum computing. Furthermore, challenges associated with QD-based technologies, such as toxicity concerns and scalability issues, are discussed alongside ongoing research efforts aimed at addressing these obstacles. Through a comprehensive examination of the current state-of-the-art and future prospects, this paper underscores the pivotal role of QDs in bridging the gap between nanoscience and tangible technological advancements with profound societal implications.