Quantum Dots - Market Share Analysis, Industry Trends & Statistics, Growth Forecasts 2019 - 2029

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Report description:

The Quantum Dots Market size is estimated at USD 5.53 billion in 2024, and is expected to reach USD 12.34 billion by 2029, growing at a CAGR of 17.41% during the forecast period (2024-2029).

Quantum dots are an ideal choice for probing plasmonic devices because of their desirable emission properties and nanoscopic size. Quantum dots (QDs) can be used as the building blocks of quantum computers because they can emit photons one by one on demand. The rising demand for optimized devices with better performance and high resolution and an increase in demand for miniaturized technology are the key driving factors for the growth of the market studied.

Key Highlights
-Cadmium-based QDs are in trend, which have the advantage of broad UV excitation, bright photoluminescence (PL), narrow emission, and high photostability. Thus, Cadmium-based QDs have applications in electroluminescence (EL) and photovoltaic (PV) devices, bio-imaging, sensors, and catalytic hydrogen production.
-The demand for quantum dots in high-quality display devices is a crucial driver for the market. A widespread practical application of QDs is in the quantum dot enhancement film (QDEF) layer, which improves the LED backlighting in LCD televisions. By using quantum dots, one can get rid of all the in-between colors and generate pure colors, thus, creating a much wider color gamut. Additionally, enhanced energy efficiency can be achieved for the LCD TV.
-Demand for energy-efficient solutions is driving the market. Nanomaterial-based white-light-emitting diodes (LEDs) exhibit a record luminous efficiency of 105 lumens per watt. With further development, the new LEDs can reach efficiencies of over 200 lumens per watt, making them a promising energy-efficient lighting source for homes and offices with the help of quantum dots.
-In June 2022, to enhance the color conversion process of quantum dots for use in LEDs, micro-LEDs, near-field displays, and other devices, researchers from the Beijing Institute of Technology developed perovskite quantum dot (PQD) microarrays. The assembly

strategy aims to overcome a common problem facing conventional quantum dot color conversion (QDCC) pixels fabricated by inkjet printing: the pixels' thinness prevents the dots from achieving efficient color conversion.
-Moreover, the quantum dots may have a potential drawback when used in biological applications due to their large physical size, owing to which they cannot diffuse across cellular membranes. The delivery process may be dangerous for the cell and even destroy it. In other cases, a QD may be toxic for the cell and inappropriate for any biological application, which is a key restraint for the market.
-The global outbreak of COVID-19 has adversely affected the growth of the market as businesses experienced downturns or uncertainty in their business operations and revenue because of the economic effects resulting from the spread of COVID-19, which is expected to lead them to decrease their spending on new technologies and delay or cancel assessment and implementation of new technology solutions.
-Furthermore, quantum dots are primarily used in the display products such as TV, monitor, and smartphones. As the world is opening up post-COVID-19, it is expected that the hybrid work culture to drive the demand for innovative display products, in turn increasing the demand for quantum dots during the forecast period.

Quantum Dots (QD) Market Trends

LED Penetration to Enhance the Market Growth

- Quantum dots exhibit several advantages, including color rendering, high illumination efficiency, low cost, and capacity for mass production, in terms of their use in displays. Furthermore, they are environmentally friendly, attracting considerable attention in the display and solid-state lighting applications, especially QDs-based LEDs that exhibit high efficiency and polarization features.
- With increasing LED penetration in the lighting market, the quantum dots market is growing due to the application of quantum dots in manufacturing high-efficiency and color-saturated displays. It is increasingly becoming popular in the consumer electronics segment owing to QDs' applications in appliances, such as LED TVs, which absorb and emit light in pure colors, as much as four times brighter than any other display technology in the world. Several major lighting companies are developing product applications using QDs to create more natural light for LEDs.
- In agriculture, it is possible to produce light-converting coatings, expected to increase yield and the speed of ripening of fruit plants in greenhouses. Dutch farmers are increasingly adopting indoor farming, and they can grow more crops faster and in a smaller space with advanced greenhouses using LED lights.
- With quantum and power conversion efficiencies in the infrared range, Colloidal QD LED has proven that it can also be integrated into inorganic solar cells, which may lead to even higher efficiencies. Additionally, such factors have triggered many applications for QDs, including surveillance, night vision, environmental monitoring, and spectroscopy.
- Additionally, a significant drop in light output exhibited by green LEDs has often been the cause of efficiency problems and high costs in customer applications, such as fitness trackers. Quantum dot (QD) lightemitting diodes (QLEDs) offer unique and attractive characteristics for future displays, including high color purity with narrow bandwidths, high electroluminescence (EL) brightness at low operating voltages, and easy processability. Furthermore, QLEDs can also be very thin, transparent, and flexible, and are also energy efficient and cost much less to manufacture, attracting the attention of significant display manufacturers.
- For instance, recently, Samsung unveiled Neo QLED and MicroLED TVs as its next step in the LCD-based QLED panel technology. Similarly, other display manufacturers such as LG and One Plus are expected to follow the trend, which is expected to drive the growth of the market studied.

Asia-Pacific to Witness a Significant Growth Rate

- The quantum dots market is expected to register the highest growth rate for the Asia-Pacific region during the forecast period. The market's growth in the Asia-Pacific region can be attributed to the inclination of consumers toward adopting technologically advanced products and the involvement of various universities and organizations in the R&D of QD technology, specifically in the display market.
- Due to the low manufacturing cost of quantum-based materials, the quantum dots market is expected to witness an upsurge in its market value in the Asia Pacific region, considering the price sensitivity of customers and the presence of critical electronics companies such as Samsung and LG Corporation.
- Furthermore, with the surging demand for solar energy applications, optoelectronics is also an essential growth factor for the Asian-Pacific region's market. Unique optical properties, such as emission tenability, high quantum yield, narrow emission band, and visual stability, make quantum dots the preferred material for lighting solutions and displays.
- In the following years, there is likely to be a significant increase in demand for quantum dots (QD) displays in the Asia-Pacific region, especially in China, which is expected to drive the quantum dots market. With the introduction of new products, rising expenditures of the TV, monitor, and smartphone industries are increasing the adoption of QD (Quantum Dots) displays, which may enhance the growth of the quantum dots market.

Quantum Dots (QD) Industry Overview

The Quantum Dots market is highly fragmented. The major players have used various strategies, such as expansions, new product launches, joint ventures, agreements, partnerships, and acquisitions, to increase their footprints in this market. Key players in the market are Nanosys Inc., NN-Labs LLC, Ocean NanoTech, Quantum Materials Corporation, Osram Licht AG, Nanoco Group, Nanophotonica Inc., and many more. The businesses are leveraging strategic collaborative actions to improve their market percentage and enhance profitability.

In April 2022, UbiQD's quantum dot technology collaborated with SWM's domain expertise to co-develop next-generation quantum dot interlayers for electricity-producing windows. According to the US Department of Energy, buildings account for 76% of domestic electricity use. UbiQD's 'luminescent solar concentrator technology deploys fluorescent quantum dots between two sheets of glass within the interlayer to provide a modest tint with various color options. The Quantum Dots partially absorb sunlight and convert it into near-IR light harvested into electricity by solar cells hidden in the window frame.

In February 2022, Nnaosys partnered with Smartkem to work together on a new generation of low-cost solution printed microLED and quantum dot materials for advanced displays. Both companies believe combining solution printed displays using SmartKem's high-performance organic semiconductor formulations with TFT interlayer materials using Nanosys's microLED and quantum dot nano-led technologies should create a new low-power class of robust, flexible, lightweight displays. Initial validation work on the equipment, processes, and materials readiness has already occurred.

Additional Benefits:

- The market estimate (ME) sheet in Excel format
- 3 months of analyst support

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