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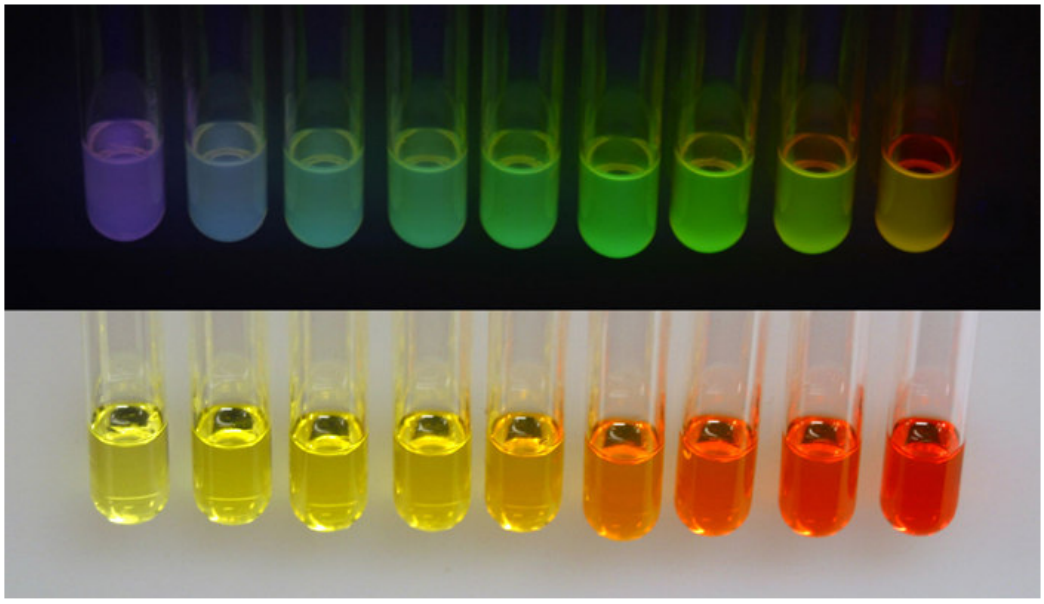
Quantum Dots

Finding a way to quickly transfer electrons has been a goal in an ever expanding computer age. Q-dots, also known as quantum dots, are very tiny particles with a diameter of two to five nanometers. The added advantage of these nano size particles is of interest in computers and other devices where electron speed is important. Quantum dots are currently used for their "electrical and nonlinear optical properties" (1). Atoms that make up Q-dots are mainly on the surface of the 'dot'. Therefore, positive charge is created inside of the 'dot', which allows electrons to leave the small particles at rapid speeds.

Their surface area to volume ratio of Q-dots is very large compared to other microscopic particles. Depending on their size, they appear different colors (under ambient conditions) and have different physical properties. Scientists can achieve the different physical properties just by changing the size of the dots. Traditionally, scientists would have to change the actual substance to achieve the different physical properties, now all they have to change could be the size.

Q-dots are typically made from a synthesis reaction, forming CdS, GaAs, or CdSe. Impurities of Al or P can be inserted in the Q-dots to create more or less opportunities for electrons to leave the particles. In addition, coatings, such as ZnS, are used for increased fluorescence. Much research is still being done to reveal further possibilities.

Another fascinating aspect of Q-dots is that they can absorb a wide spectrum of light to get excited. After excitation, Q-dots can emit light as the result of electrons falling energy levels in a narrow spectrum. The energy of light is dependent upon the size of the 'dot.' The smaller the 'dot', the higher the energy of light emitted. A picture below shows various sizes of Q-dots in ambient and UV illumination conditions. The illumination properties have led to future applications such as biosensors, computer backlights, fluorescence, lasing, and 'ultra-fast switching'. (2) Scientists are excited about the untapped possibilities that Q-dots have over traditional chemical substances.



Top: Long wave UV illumination. Bottom: Ambient illumination. Solutions are in order of increasing particle size (longer growth time).
From www.**mrsec**.wisc.edu/Edetc/background/**quantum_dots**

References Cited:

(1) www.mrsec.wisc.edu/Edetc/background/quantum_dots
(2) http://idol.union.edu/malekis/ESC24/Seyffie's%20Pages/Qdots/Qdots.htm