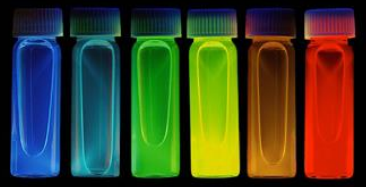
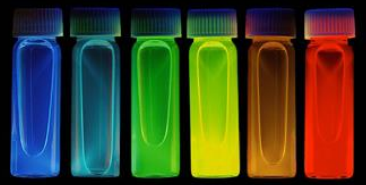
Quantum Dot Display

Display Materials and Engineering
2014.12.04

20113241
Hyejeong Cheon

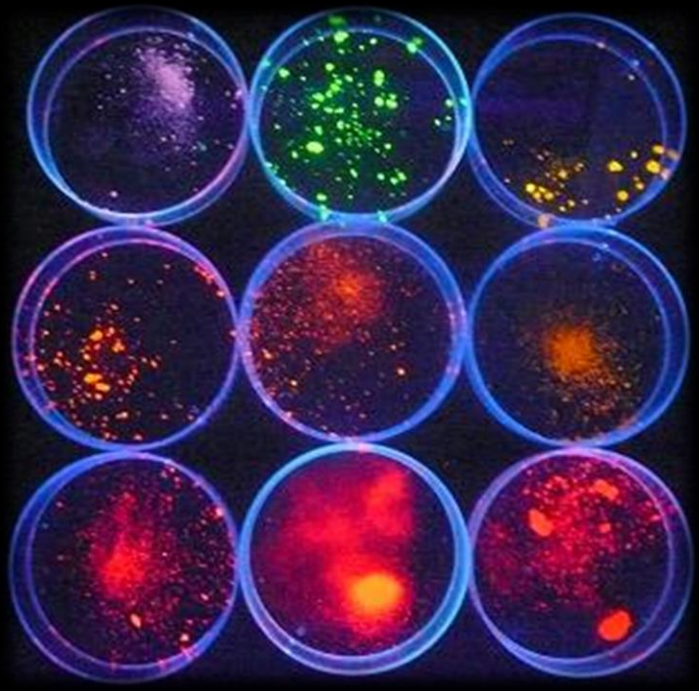


Contents



Introduction

http://www.newscientist.com/articleimages/dn13023/1-quantumdot-displays-could-outshine-their-rivals.html

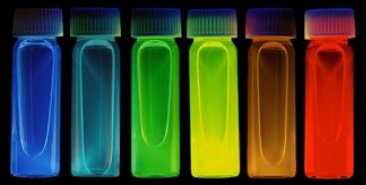


Quantum Dot was

Discovered by *Alexey Ekimov* and *Louis E. Brus* in 1980s

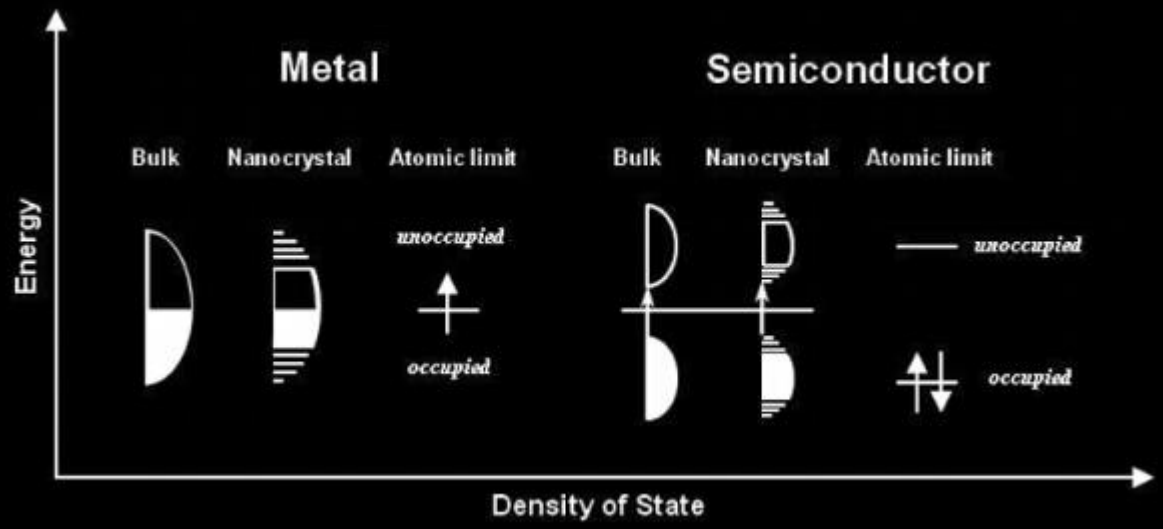
Quantum Dot is

3D nanocrystals of semiconducting materials containing $10\sim10^5$ atoms



Introduction

Quantum Confinement Effect

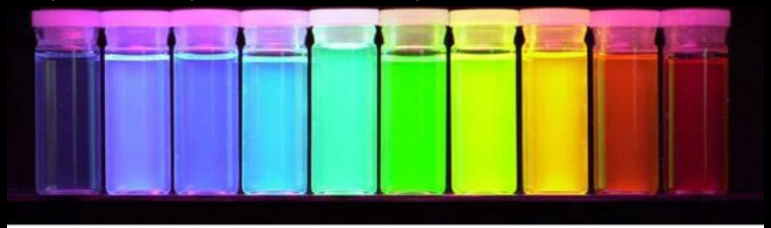


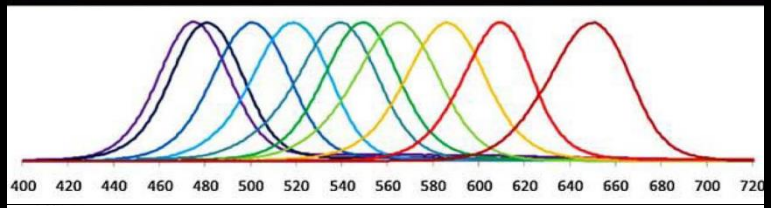
Remind Physical Chemistry!
- Particle in a Box

$$E_n = \frac{n^2 h^2}{8 m_e R^2}$$

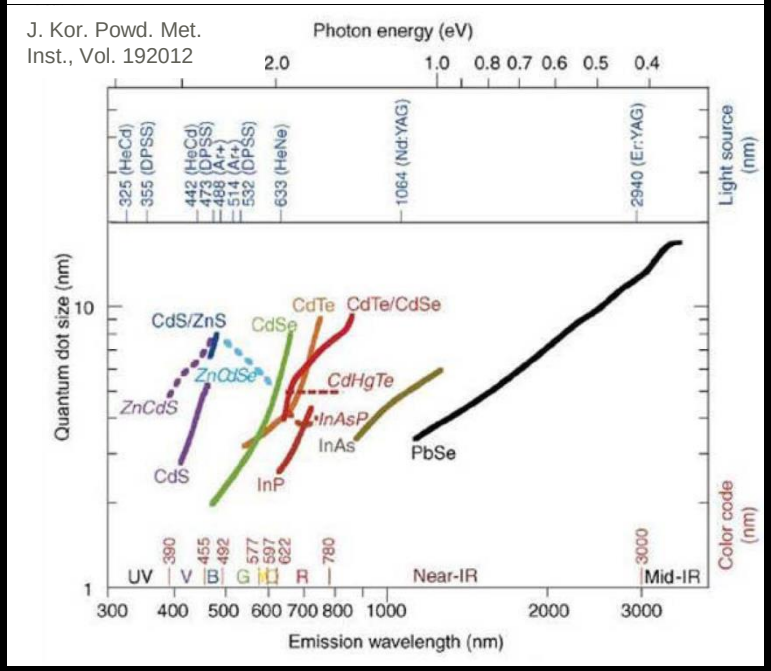
Quantum Dot in Display

http://www.nanosysinc.com/what-we-do/quantum-dots/



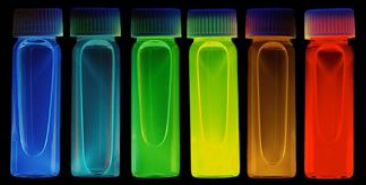


J. Kor. Powd. Met. Inst., Vol. 192012



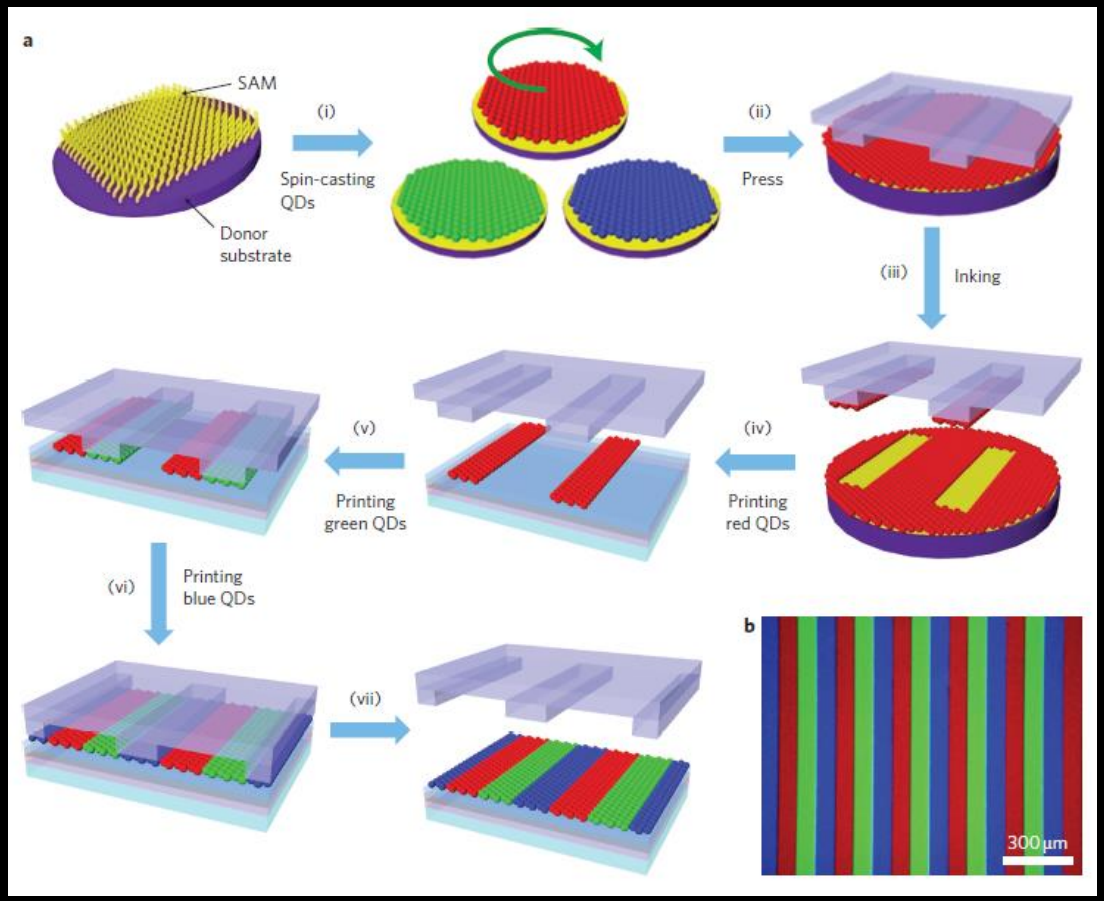
$$E_n = \frac{n^2 h^2}{8 m_e R^2}$$

- Convenient Color Tuning
- High Color Production Rate
- Energy Efficient
- High Stability
- Deposited on including glass and plastic
- Suitable for use in rollable displays

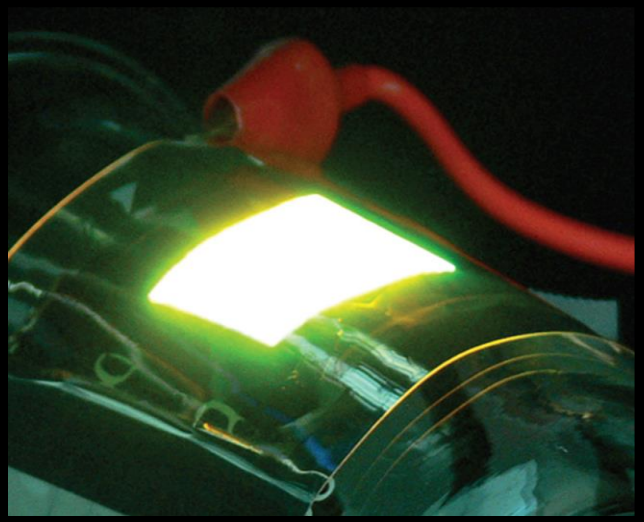


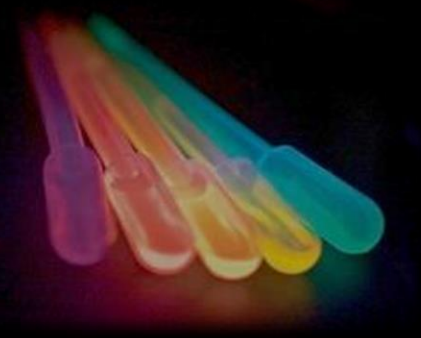
Application of QD Display

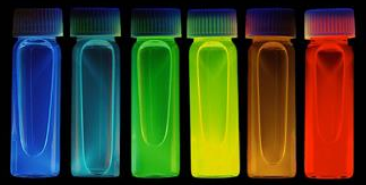
NPHOTON.2011.12



Quantum Dot LED (QLED)



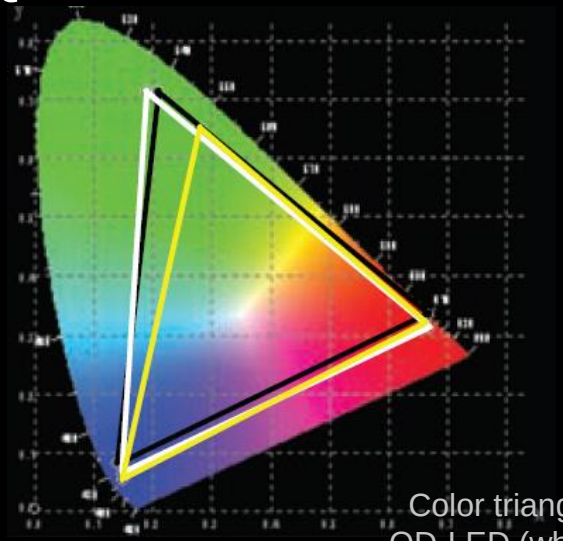




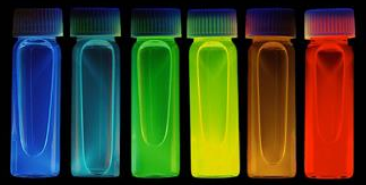
Application of QD Display

Adv. Mater. 2010, 22,

QD-LED BLU in LCD



Color triangles
QD-LED (white)
phosphor-LED (yellow)
NTSC1931 (black)



Future of QD Display

Object

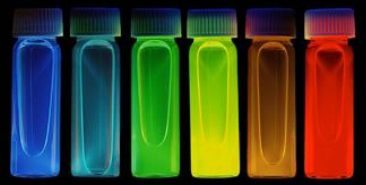
-Environmental issues (Cd-free material ~<10g/1cm^2 until 2016)
-For high reliability – oxidation

Commercialization

-2006 QD vision(QD-LED)
US : QD vision, Nanosys / UK : Nanoco
-Dow Chemical & Nanoco, 3M

-2013 Sony & QD vision : QD-LCD TV
(Bravia X9200A, W900A), Mobile phone (Xperia Z1, Z2)
-Amazon & 3m Nanosys – Kindle fire HDX (Film QDLCD)

-LG Display – 2010 QD vision
-Samsung Electronics – 2011 Full color QLED
-LG Innotech & Nanosys



Reference

- Full-colour quantum dot displays fabricated by transfer printing / Nature Photonics / 2011

- White-Light-Emitting Diodes with Quantum Dot Color Converters for Display Backlights / Ad. Materials / 2010

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- 디스플레이 최근 동향 / www.iitp.kr