Room-Temperature Liquid-Phase Synthesized Ultrafine ZnO Nanoparticles and Their Applications

We have demonstrated the facile synthesis of ultrafine ZnO nanoparticles (NPs) at room-temperature in liquid phase. Via the use of stabilizer, monoethanolamine (MEA), the average size of ZnO NPs can be tuned from 2.4 to 4.5 nm, with the defective **blue** to **orange** photoluminescence (PL) due to quantum confinement effect. The purified ZnO NPs can be well-dispersed in ethanol for several months, for applications such as **electronics**, **optoelectronics**, **chemistry**, **medical/life sciences**, **and industries**.

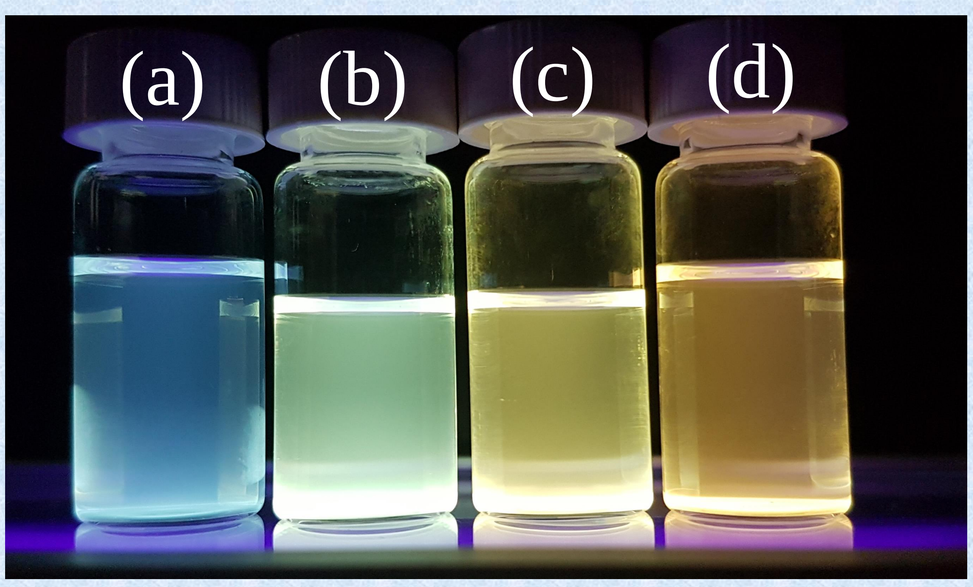

Figure 1. Solutions of ultrafine ZnO NPs under the UV illumination. The estimated size is (a) 2.4 (b) 2.9, (c) 3.4, and (d) 4.5 nm, respectively.

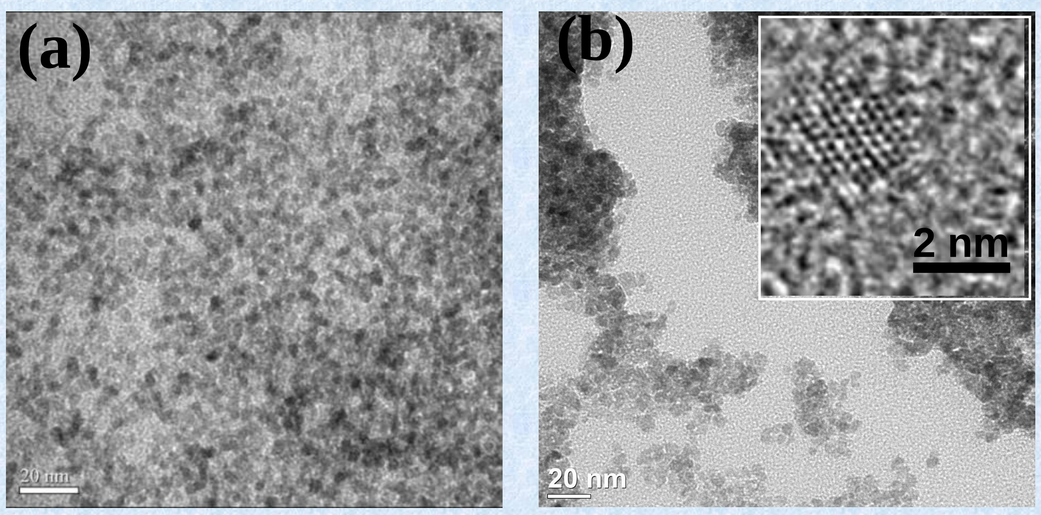

Figure 2. TEM images of ZnO nanoparticles with and without MEA stabilization.

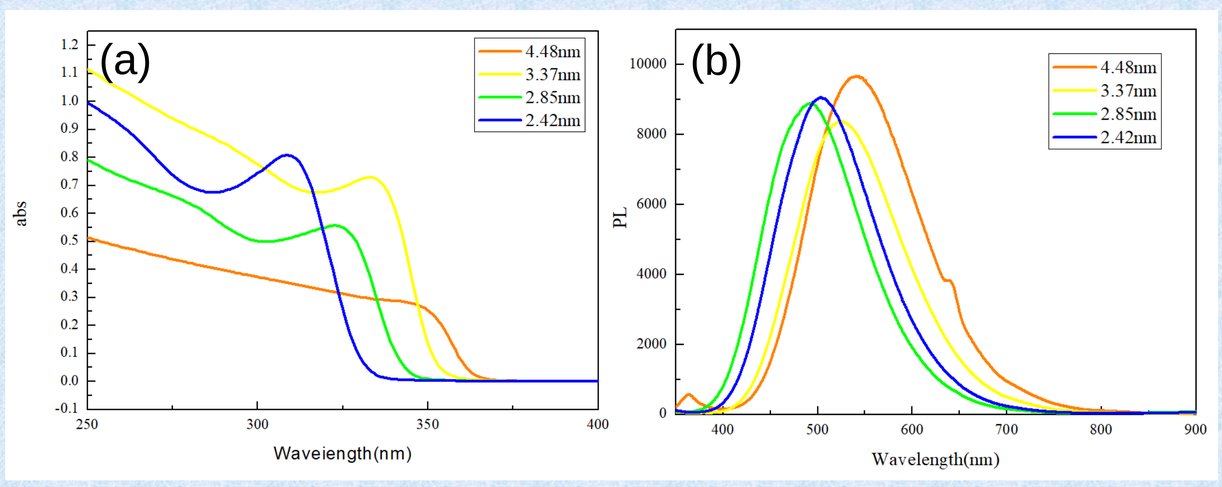

Figure 3. Absorption and PL spectra of ZnO NP solution with different particle sizes.

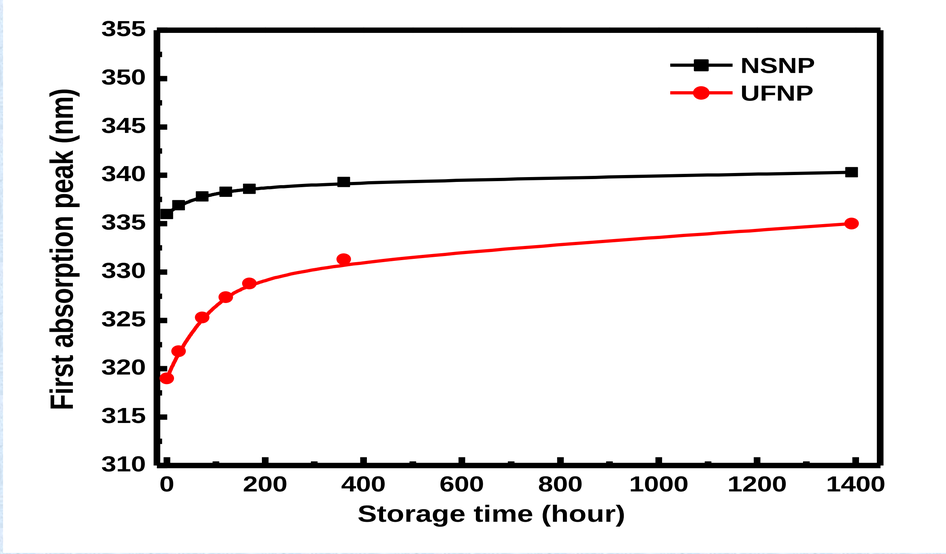

Figure 4. Absorption peak position of ZnO NP as a function of storage time.

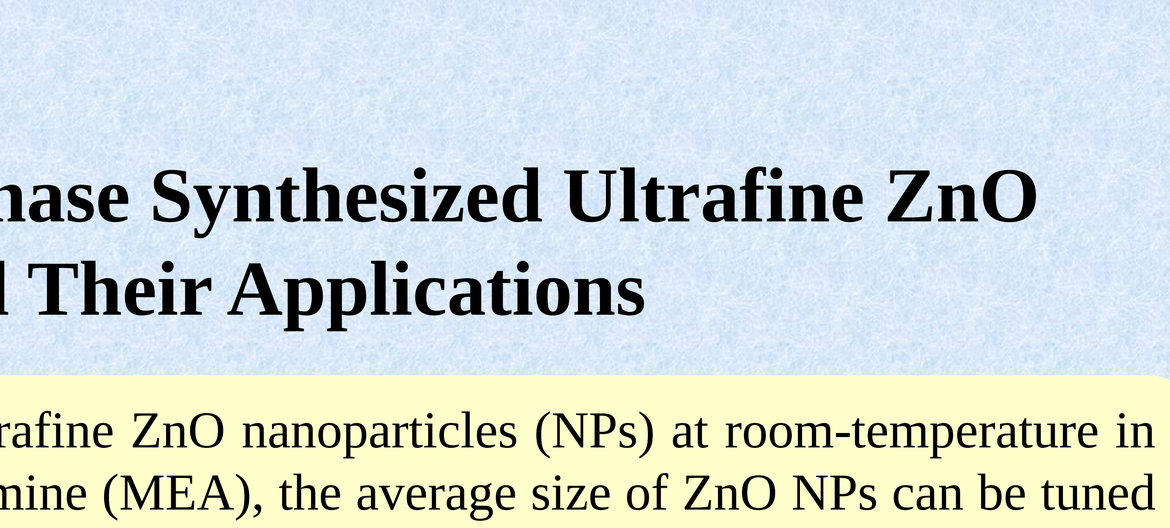

Figure 5. (a) AFM image and (b) XRD patterns of ZnO NPs layers. The root mean-square roughness of (a) is 1.3 nm, respectively. The scale bar is 1 μm.

Figure 6. Applications of ZnO nanoparticles in research fields ever reported.

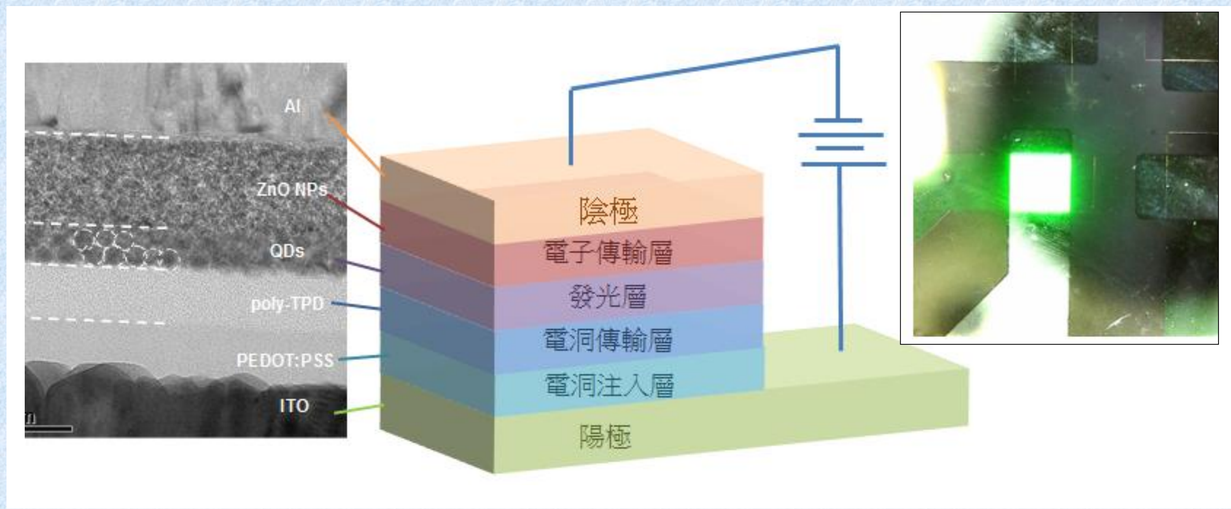

Figure 7. Cross-sectional TEM image, schematic device structure, and emission picture of a quantum-dot light-emitting diode (QLED).

Conclusion:

Ultrafine ZnO nanoparticles with different average sizes were synthesized with and without MEA stabilizer. Besides, we also demonstrated the ultrafine ZnO NPs can act as the electron transport layer in efficient QLEDs.