Self-Assembly of Functionalized ZnO Nano-Particle/Rod Surface Modification via Hydrogen Bonding in Block Copolymer Containing H-Bonded Acceptor Emitters

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In order to clarify the effect of TPM stabilizers on the of ZnO nanoparticles before and after the TPM-modification (Fig. 1), the crystal sizes of ZnO were estimated by (Fig. 1) by the wide angle powder X-ray diffraction (XRD). Synchrotron powder X-ray diffraction (XRD) measurements were performed at beamline BL01C of the National Synchrotron Radiation Research Center (NSRRC), Taiwan, where the wavelength of X-ray was 0.775 Å. The powder samples were packed into a capillary tube. The scattering angle theta was calibrated by a mixture of silver behenate and silicon.

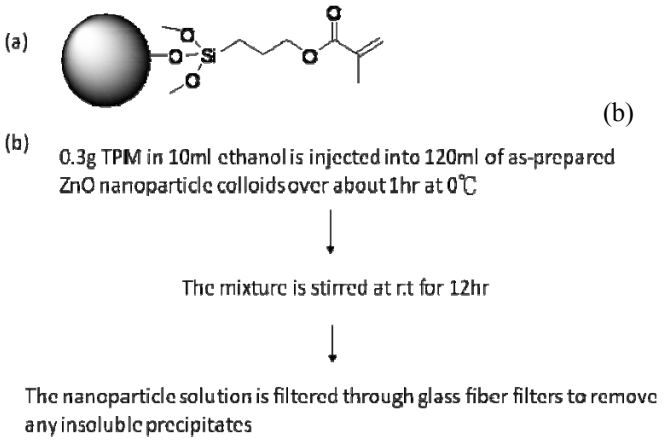

Figure 1. (a)Chemical structures of TPM-modified ZnO nanoparticles, (b)Flow chart of modification procedure

Fig. 2 depicts the result of the powder X-ray diffraction patterns of unmodified and TPM-modified ZnO nanoparticles. All diffraction peaks of these two profiles are consisted with typical wurtzite structure of bulk ZnO. In contrast to the unmodified nanoparticles, the TPM-modified nanoparticles appears a the broad feature around 2θ～17°. In principle, the average ZnO crystal sizes (D) can be obtained by using Scherrer's equation, $D = 0.89\lambda/(\beta\cos\theta)$, where λis the X-ray wavelength (0.775 A°), β is the half-width of the diffraction peak, and θ is the Bragg diffraction angle. By calculating the XRD diffraction peak broadening at (110), the average crystallite size of unmodified ZnO was estimated to be about 4.5 nm, whereas the average size of TPM-modified ZnO was estimated to be about 3.9 nm. This result clearly indicates that the TPM-modification effectively inhibits the growth of nanoparticle crystal size.

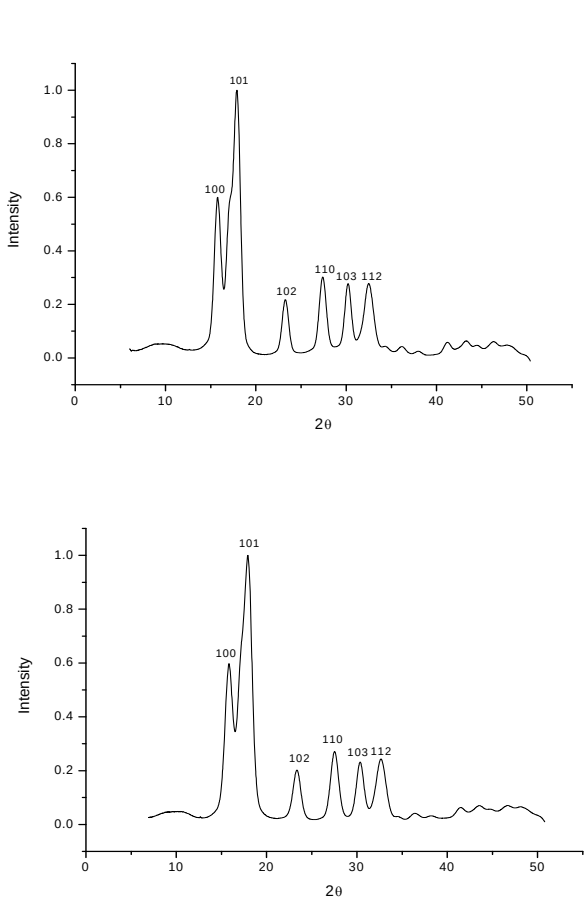

Figure 2. Powder X-ray diffraction spectra of (a) umodified ZnO nanoparticles, (b) TPM-modified ZnO nanoparticles