Fabrication and Characterization of ZnO Nanoneedle Array using Metal Organic Chemical Vapor Deposition

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High density and vertically well-aligned ZnO nanoneedle arrays fabricated on the ZnO thin film deposited on silicon substrates. The ZnO buffer layer and nanoneedle were synthesized by metal organic chemical vapor deposition using diethylzinc and oxygen gas. The ZnO buffer film was grown at 250℃ and the growth temperature of nanoneedles was in the range of 480 ~ 500℃. As-grown ZnO nanoneedles showed single crystalline structure of ZnO(002). The crystalline properties of three samples (A: as-grown ZnO buffer layer, B: annealed buffer film, C: ZnO nanoneedles) were compared using XRD and Raman spectroscopy. The synthesized ZnO nanoneedles (sample C) showed highest crystalline quality among three samples. The field emission properties of ZnO nanoneedles were investigated, which showed low turn on field of 4.8 $V/\mu m^{-1}$ and high field enhancement factor of 3.2×10^3.