Growth and Properties of Ultra-Violet Emitting Aligned Zinc Oxide Nanocones with Hexagonal Caps

Ahmad Umar1*, A. Al. Hajry2, A. A. Al-Ghamdi3, S. Al-Heniti3
1Department of Chemistry, Faculty of Science, Advanced Materials and Nano-Engineering Laboratory (AMNEL), Najran University, P. O. Box 1988, Najran, 11001, Kingdom of Saudi Arabia, 2Department of Physics, Faculty of Science, Najran University, P. O. Box 1988, Najran, 11001, Kingdom of Saudi Arabia, 3Department of Physics, Faculty of Science, King Abdul Aziz University, P.O. Box 80203, Jeddah, Saudi Arabia

Abstract:

Ultraviolet-emitting, single-crystalline aligned zinc oxide (ZnO) nanocones with hexagonal caps were grown on silicon substrate via simple non-catalytic thermal evaporation process. High-purity metallic zinc powder and oxygen were used as source materials for zinc and oxygen, respectively. The detailed structural characterizations confirmed that the formed products are single-crystalline, possess a wurtzite hexagonal phase and grown along the c-axis direction. Raman-active optical-phonon E$_{2}^{high}$ mode at 437 cm$^{-1}$ with sharp and strong UV emission at 385 nm in room-temperature photoluminescence (PL) spectrum demonstrated that the as-grown ZnO nanocones with hexagonal caps possess good-crystal quality with the excellent optical properties. Finally, a plausible growth mechanism for the formation of as-grown ZnO nanocones with hexagonal caps was also proposed.

Journal of Nanoscience and Nanotechnology 10, 6659-6665 (2010)