Structural and optical properties of high-aspect-ratio Sb-doped ZnO nanowires by simple thermal evaporation process

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Well-crystallized high-aspect-ratio antimony (Sb)-doped ZnO nanowires have been successfully synthesized on Si(100) substrates in a large-quantity via simple thermal evaporation process by using metallic zinc and Sb powders in the presence of oxygen. It is observed from the detailed structural characterizations that the grown nanowires are well-crystallized with the wurzite hexagonal phase and preferentially grown aling the [0001] direction. The HRTEM image reveals the infiltration of Sb ions into the lattices of ZnO nanowires confirmed the successful doping of Sb ions. The XRD peaks can be indexed as those from the known wurzite-structured hexagonal phase single crystalline bulk ZnO. In addition to this, the origination of a small peak at 42.1° was due to the Sb. Two distinct peaks have been observed in the room-temperature photoluminescence (PL) spectrum of as-grown Sb:ZnO nanowires, a peak at ~384 nm called as near band edge emission and ~600 nm, known to be as deep level emission.