# Fabrication of single tin-doped ZnO (Sn:ZnO) nanowire based field effect transistors (FETs)

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## Abstract

Well-crystallized high-aspect ratio Tin (Sn)-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 tin powders in the presence of oxygen. It is observed from the detailed structural characterizations that the grown nanowires are well-crystallized with the wurtzite hexagonal phase and preferentially grown along the [0001] direction. The room-temperature photoluminescence (PL) was used to demonstrate the optical properties of the grown nanowires. The obtained PL spectrum exhibited a broad band in the visible region with a suppressed UV emission, indicating the presence of structural defects due to insertion of Sn-atoms in the lattices of as-grown nanowires. Due to the enhancement of green emission in the formed nanowires, these structures show great interest for typical applications of ZnO-based phosphors, such as field emissive display technology, etc. To check the electrical properties of as-synthesized tin-doped ZnO nanowires, single nanowire based field effect transistors (FETs) were fabricated and electrical properties of nanowires were evaluated. The fabricated FETs exhibit good characteristics. The peak transconductances of the fabricated FETs was ~78.6 nS. The field effect mobilities ($\mu_{eff}$) and carrier concentration for the fabricated FETs were measured to be 90.1 $cm^2/V \cdot s$ and 6.94 x $10^{16}$, respectively.