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Finite Size Effect in ZnO Nanowires CHUNG-JEN CHIEN, PAI-CHUN CHANG, ZHIYONG FAN, JIA GRACE LU, University of Southern California, DANIEL STICHTENOTH, CARSTEN RONNING, University of Goettingen, Germany — In this talk, we present electrical and optical measurements on ZnO nanowires whose sizes do not yet reach quantum confinement region. Thin ZnO nanowires were synthesized via carbon thermal chemical vapor deposition method under low growth temperature using tin as catalyst. Electron microscopy reveals that the as-grown nanowires are of high crystalline quality with an average diameter around 12 nm. Electrical transport measurements show significant increase in conductivity with a lack of gate modulation and a reduction in mobility. This phenomenon is attributed to the enrichment of surface states owing to the larger surface-to-volume ratio. This enhanced surface effect in thinner nanowires is confirmed by the temperature dependent photoluminescence measurements. In addition, the photoluminescence spectra clarify the apparent blue shift observed at room temperature with respect to the nanowires with larger diameters. These results provide a fundamental insight into nanowires of smaller diameters, and show that their surface states are extremely important and should be properly tailored or controlled for future device applications.

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