Temperature-Dependent Electrical Properties of Sn-Doped ZnO Nanowires

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Abstract

Herein, we report the growth and characterization of Sn-doped ZnO nanowires on silicon substrate by noncatalytic facile thermal evaporation process. The grown nanowires were further characterized in terms of their structural, morphological and electrical properties. The detailed characterizations revealed that the nanowires are grown in high density and possessing well-crystallinity and wurtzite hexagonal phase. To examine the electrical properties, a heterojunction diode based on n-Sn-doped ZnO/p-Si assembly was fabricated. The electrical properties of the fabricated heterojunction diode were examined at low temperature range (77 K-295 K) in both the forward and reverse bias conditions. The study of low temperature dependence of current-voltage characteristics of the heterojunction diode shows that both the quality factor and Schottky barrier height depend on temperature. However, adopting a simple approach that uses a Gaussian distribution of barrier heights, the mean barrier height of similar to 0.73 eV, at the range of low temperatures was found and compared to that of similar to 1.2 eV obtained recently by the authors for the same diode at the range of higher temperatures from similar analysis. An apparent discrepancy found between the results of barrier height extracted from C-V analysis and those from I-V analysis is attributed to adopting different theoretical approaches based on different physical grounds.

Keywords

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