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**Intrinsic Electrical-Transport Properties of Single ZnO Nanowires** S.P. CHIU, Y.H. LIN, J.J. LIN, Institute of Physics, National Chiao Tung University, Taiwan, W.B. JIAN, Department of Electrophysics, National Chiao Tung University, Taiwan, Z.Y. WU, F.R. CHEN, J.J. KAI, Department of Engineering and System Science, National Tsing Hua University, Taiwan — Single-crystalline zinc oxide (ZnO) nanowires (NWs) were synthesized by the thermal evaporation method. The intrinsic electrical-transport properties of ZnO NWs were studied by carrying out four-probe measurements on individual NWs. The electrodes were made by the standard electron-beam lithography technique. The current-voltage characteristics and the zero-bias resistivities, $\rho$(T), were measured over a wide range of temperatures between 0.25 and 300 K. We found that, in many cases, the temperature behavior of $\rho$ could be well-described by the thermal-activation model involving three activation energies ($E_1$, $E_2$ and $E_3$). Our values of $E_1$ (approximately, several tens meV) extracted from the $\rho$(T) around 300 K are close to the ionization energies of the major known shallow donors in ZnO. Our values of $E_2$ (approximately, several meV) extracted from the $\rho$(T) in the intermediate temperature regime might originate from electron activation from the lower impurity band to the upper Hubbard subband ($D^-$ band). Finally, at very low temperatures ($< 5$ K), the measured $\rho$(T) indicated diminishing values of $E_3$ (approximately, thousandths meV), suggesting essentially metallic behavior.

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