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COMPARISON OF MONTE CARLO AND HYDRODYNAMIC MODEL IN ELECTRON TRANSPORT CHARACTERISTICS OF $n^+ - i(n) - n^+$ ZnO DIODE

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Abstract

An ensemble Monte Carlo simulation has been used to model electron transport in $n^+ - i(n) - n^+$ ZnO diode at 300 K in comparison with hydrodynamic approach. Electronic states within the conduction band are represented by non-parabolic ellipsoidal valleys centered on important symmetry points of the Brillouin zone. An original decomposition of velocity and energy profiles along the structure in terms of field, convective and diffusion contributions are presented. The anode voltage ranges from 0 to 3.75 V. The distributions of electron energies and electron velocities, and the profiles of the electron density, electric field and average electron velocity are computed. Based on these data, the excellent agreement of the hydrodynamic approach with Monte Carlo simulations is discussed.

Keywords and phrases: ensemble Monte Carlo, hydrodynamic, anode voltage, diffusion contributions.