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Role of neutral impurity scattering in the analysis of Hall data from ZnO XIAOCHENG YANG, CHUNCHUAN XU, NANCY GILES, Dept. of Physics, West Virginia University — Zinc oxide is a wide band-gap semiconductor with bright UV emission. To determine donor and acceptor concentrations affecting electrical properties in n-type ZnO crystals, the relaxation time approximation has been used to analyze mobility (μ) and carrier concentration data measured from 80 to 400 K. Five scattering mechanisms are included: polar-optical-phonon, piezoelectric potential, deformation potential, ionized impurity, and neutral impurity (NI) scattering. The NI scattering is often ignored but plays an important role in limiting the total μ. By including NI scattering, the experimental deformation potential $E_1 = 3.8$ eV can be used. Temperature dependences of the intrinsic Hall r factor and intrinsic μ are determined. At 300 K, "pure" ZnO has an electron μ of about 210 cm^2/Vs. Analysis of Hall data from commercial hydrothermally and CVT-grown n-type ZnO crystals is presented. Donor and acceptor concentrations from Hall data are compared with those estimated using infrared absorption and EPR data. Intrinsic hole mobility in p-type ZnO is also discussed. This work was supported by NSF Grant No. DMR-0508140.

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