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Observation of 0.4 eV electron trap in electron-irradiated InP:Fe single crystals

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Abstract

There has been increasing attention focused on the investigation of the /spl ap/0.4 eV electron trap in indium phosphide. According to G. Hirt et. al. (1993), the defect corresponding to that trap plays a major role in the conductivity compensation process of semiinsulating InP obtained by annealing of specially undoped crystals in phosphorus overpressure. The density of this defect seems to depend on the deviation of the sample composition from the stoichiometric one. Apart from that, fast-electron irradiation of InP single crystals leads to the Fermi-level pinning at energies E/sub pinn/ 0.3 to 0.4 eV below the bottom of the conduction band, this effect being explained by the predominance in the crystal lattice of a donor-like host defect having /spl ap/0.4 eV ionization energy. The defect involved appears to be inherent to semiinsulating InP:Fe as well. For instance, the activation energy derived from the temperature dependence of the dark conductivity in some InP:Fe single crystals equals 0.4 eV. At the same time one can note the absence of 0.4 eV electron trap among the deep levels evidenced recently in InP:Fe crystals by employing the thermally stimulated current (TSC) spectroscopy. The goal of this report is to present experimental data proving the existence of the 0.4 eV electron trap in as-grown and fast-electron (E=3.5-4 MeV) irradiated InP:Fe single crystals.

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