COLIBABA, Gleb, AVDONIN, A., SHTEPLIUK, I., CARAMAN, Mihail, DOMAGAŁA, Jarosław Zbigniew, INCULET, Ion. Effects of impurity band in heavily doped ZnO:HCl. In: *Physica B: Condensed Matter*. 2019, Vol. 553, pp. 174-181. ISSN 0921-4526.

A comparative study of properties of ZnO:HCl single crystals obtained by various methods is presented. Characterization by photoluminescence, optical and electrical measurements in the wide temperature range has allowed to analyze the energy spectra of Cl-containing stable defects in ZnO. Presence of shallow Cl donors, deeper donor complexes, incorporating several Cl atoms or stable H-Cl pairs and presence of compensating deep acceptors, attributed to $V_{Zn}Cl_O$ centers, are demonstrated. The presence of shallow donor impurity band, as well as strong dependence of its activation energy on the doping level is shown. The controversy of various models for estimation of this dependence is discussed. It is demonstrated, that 90% of this dependence is caused by feature of temperature dependence of Hall coefficient related to conductive impurity band, and a more correct equation for activation energy is suggested. An abnormally low efficiency of neutral impurity scattering of charge carriers and strong optical absorption in the near-IR spectral range are demonstrated and attributed to upper conductive impurity band of negatively charged donors with an extra electron.