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ON THE TWO-DIMENSIONAL DETERMINATION OF p-n JUNCTIONS WITH THE EBIC COLLECTION PROBABILITY

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Both the intrinsic defect structure in semiconducting materials and the technological steps during microcircuit manufacturing (e.g. implantation, rapid thermal processing) affect the diffusion process of dopants. Using the electron-beam-induced current (EBIC) technique it is possible to determine in an experimental way the site of the space charge region and of the electrical p-n junction, respectively.

In this paper the capabilities of reconstructing the one-dimensional depth distribution $\varphi(z)$ and the cross-sectional distribution $\varphi(x,z)$ of the charge collection probability $\varphi(x)$ are discussed. Based on the assumption, that $\varphi(x)$ achieves its maximum value at the site of the electrical junction, $\varphi(x)$ can be used for the p-n junction delineation from EBIC measurements. This practical method of EBIC data interpretation suits in situations, in which the material parameters of the devices under investigation, i.e., the diffusion length of the minority carriers and the surface recombination velocity, are widely unknown.

The starting point in our discussion consists in the recovery of the depth distribution $\varphi(z)$ from EBIC collection efficiency measurements by both, a trial-and-error method (POSSIN, KIRKPATRICK 1980) and an analytical solution of the inversion problem (DONOLATO 1986). Emphasis is put on the possibility to determine the two-dimensional charge collection probability $\varphi(x,z)$ from EBIC measurements on cleaved samples.