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Study of electromigration phenomena in Au/P-type CdTe of two Schottky contacts

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In spite of the importance of understanding and controlling the electromigration (drift and diffusion of the intrinsic ion defects in external bias) of defects in CdTe based optoelectronic devices, there is, according to our knowledge, no systematic study about the phenomena in the literatures. The reasons for that are the complexity to prepare samples with the same distributions of defects and the interpretation of measured data. According to our model [1] the electric field confined in the depletion region below the Schottky M-S interface causes electromigration of donor defects in the semiconductor bulk, which leads to time change in the resistance of the depletion region values. The immigrated ions showed no tendency to revert to their initial distribution even after longtime, which is necessary to obtain comparative measuring data at different T. Such limitation of measurements results in a lack of understanding of the electromigration phenomena, and limitation of extracted parameters.
We present in this work transient measurements of Au/CdTe/Au structure in the temperature range of 323K-363K. Removal of anode contact and of a thin layer below was necessary after each measurement to have similar distribution of the donor ions in depletion region for each new measurement. The diffusion coefficients at different T have been determined and the activation energy of the electromigration process was extracted - Fig 1. Current –Voltage measurements have been carried out to determine the reverse current transport mechanisms, and the concentration of the acceptors ions was determined from the resistivity measurements.

Fig. 1. Arrhenius plot of the diffusion coefficients of the donor ions based on values extracted from our experimental data.
[1] H. Elhadidy, R. Grill, J.Franc, O.Šik, P.Moravec, O.Schneeweiss, Solid State Ionics 278 (2015) 20–25.

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