XXII International Seminar on Physics and Chemistry of Solids

Book of Abstracts

June 17-19, 2020
Lviv, Ukraine

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MODELING OF IDEALITY FACTOR VALUE IN SILICON SOLAR CELLS

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Ideality factor (n) is one of a commonly used parameter of solar cell (SC). In the simplest case, $n = 2$ is used for Shockley-Read-Hall recombination current. But in fact, n depends on ambient conditions and recombination center parameters. The purpose of this work is to evident such dependencies for Si-SC.

The current-voltage characteristics of silicon n^+-p-p^+ structure were calculated by using of one-dimensional code SCAPS in the temperature range 290-340 K. The both base depth d and acceptor (boron) concentration N_A were varied over 150-240 μm and $10^{15} \div 10^{17}$ cm^{-3} respectively. The iron atoms are suggested to be present in p-layers with $N_{Fe} = 10^{10} \div 10^{13}$ cm^{-3}. The case of Fe_iB_s pairs as well as the case of interstitial Fe_i was under consideration. The ideality factor was determined according to the two-diode model. Some results are presented in Fig.1.

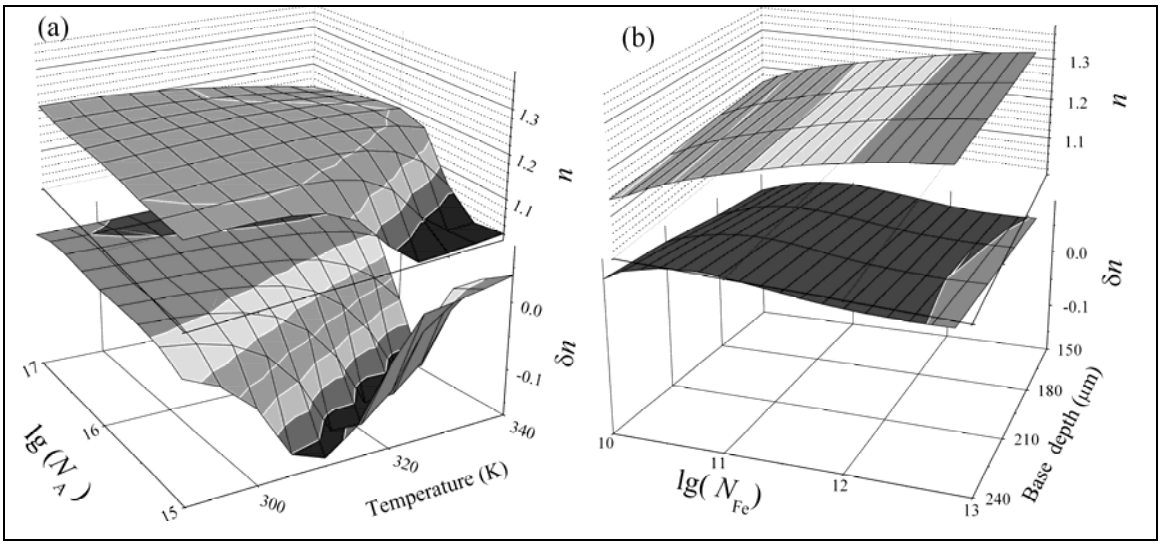

Figure 1: Dependencies of ideality factor in equilibrium state (n, upper surfaces) and alteration in ideality factor after Fe-B pair dissociation (δn, lower surfaces). $N_{Fe} = 10^{10}$ cm^{-3}, $d = 240$ μm (a), $N_A = 10^{17}$ cm^{-3}, $T = 340$ K (b).

It was established that i) the base depth affects the ideality factor value in the case of minority carrier diffusion length $L_n >> d$; ii) the influence of temperature and doping level deals with change in a recombination level population mainly; iii) the dependence of n on the iron concentration is a monotonic function.