

Evidence of deep defects in CIGSe solar cells from DLTS trap filling study

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Deep Level Transient Spectroscopy (DLTS) is often used to identify and quantify defects in semiconductors. In the DLTS spectrum of CIGS (CuInGaSe_2) solar cells generally two types of signals are observed: one for which the capacitance transients are measured well below room temperature (RT) labeled N1, and a second corresponding to transients measured close to RT, N2. We have recently shown that the N1 signal can be related to a non-ideal contact in the solar cell [1].

In this work the N2 signal was investigated using isothermal DLTS (capacitance transients at constant voltage) and isothermal constant-capacitance DLTS (CC-DLTS, voltage transients at constant capacitance) experiments at RT. In CC-DLTS a non-exponential factor in the transients due to high trap concentrations is avoided. The effect of filling pulse duration (t_p) on the N2 signal is studied here in detail.

Both the DLTS and CC-DLTS methods point to an anomalous filling behavior. From a certain t_p onwards a peak appears that shifts towards larger emission time as t_p increases. The relation between these results and the energy level diagram of the metastable In-on-Cu antisite defect is discussed. DLTS experiments with variation of t_p may help to understand the nature of the metastable defects causing the N2 signal.

[1] J. Lauwaert et al., Progr. Photovolt. 2012, in press.