Trap filling experiments on the N2 DLTS signal of CIGS solar cells

Lisanne Van Puyvelde,[a] Johan Lauwaert,[a] Marc Burgelman,[b] Ayodhya N. Tiwari,[c] Henk Vrielinck[a]

[a] *Ghent University, Department of Solid State Sciences,Research Group Defects in SemiConductors , Krijgslaan 281-S1, B-9000 Gent, Belgium*

[b] *Ghent University, Department of Electronics and Information Systems, Research Group Solar Cells, Sint-Pietersnieuwstraat 41, B-9000 Gent, Belgium*

[c] *Laboratory for Thin-Films and Photovoltaics, EMPA, Swiss Federal Laboratories for Materials Science and Technology, Ueberlandstrasse 129, CH-8600 Duebendorf, Switzerland*

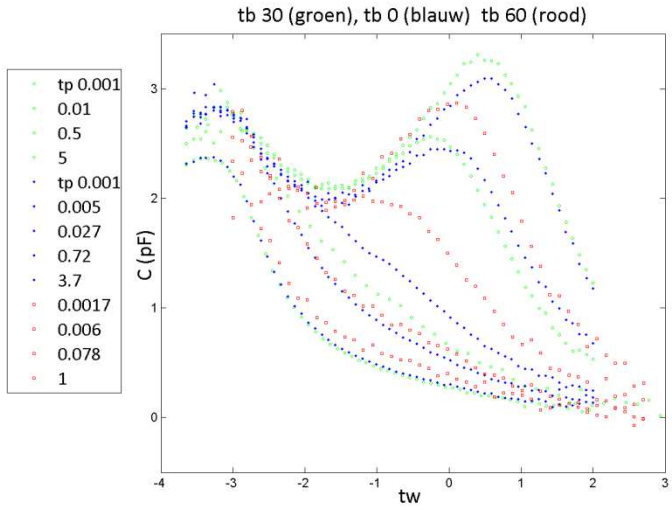
Deep Level Transient Spectroscopy (DLTS) is often used to identify and quantify defects in semiconductors. In the DLTS spectrum of CIGS (CuInGaSe2) solar cells generally two types of signals are observed : one for which the capacitance transients are measured well below room temperature (RT) labeled N1, and a second corresponding to transients measured close to RT, N2. We have recently shown that the N1 signal can be related to an 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 (tp) on the N2 signal is studied here in detail.

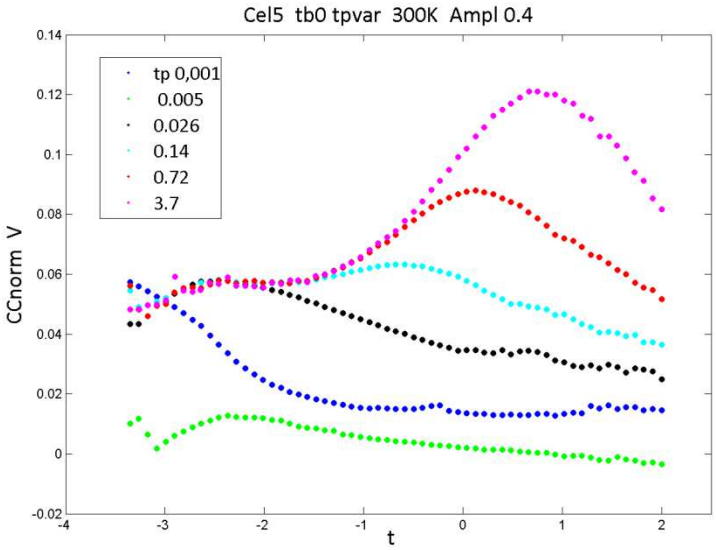
Both the DLTS and CC-DLTS methods point to an anomalous filling behavior. From a certain tp onwards a peak appears that shifts towards larger emission time as tp increases. The relation between these results and the energy level diagram of the metastable In-on-Cu antisite defect is discussed. DLTS experiments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

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

DLTS meting tb 0, 30, 60



CC-DLTS tb0



CC-DLTS tb 30 en 70s