# Aging effect on alkali treated $Cu(In,Ga)Se_2$ solar cells

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**Abstract:**

This study presents the beneficial effect of the aging on standard (Ref) and alkali (KF, RbS) post deposition treated (PDT) CIGS solar cells with two buffer-based (ZnOS, CdS) front contacts after several months stored under air condition in the dark. The CIGS film for cells with ZnOS-based front contact have been treated with KF under selenium atmosphere while CIGS for cells with CdS have been treated with RbF deposited under sulphur atmosphere (here named RbS).

The well-known effect of alkali treatment is presented in both structures with the improvement of the performances (in absolute values) mainly on the voltage (Voc) (~+ 30mV for cells with ZnOS and ~+40 mV for cells with CdS) and on the fill factor (FF) (~+5% for cells with ZnOS and ~+4% for cells with CdS).

The cells have been measured after fabrication (t0) and re-measured several month later after 1h light soaking; Five months later (t0+5) for cells with ZnOS and 8 months later (t0+8) for cells with CdS. For both cell structures, we observed no significant change in the current (Jsc) with the time, but an improvement of the fill factor is observed (~+2% for cells with ZnOS and ~+4% for cells with CdS). However, we observe some variations on the Voltage values. In the case of cells with ZnOS, the Voc of the reference (Ref) increased after 5 months (~+10mV) but decreased for the alkali-treated (PDT KF) cells (~-20 mV). However, opposite trends are observed for cells with CdS, a slight decrease of the Voc for the reference cell after 8 months (~-10 mV) while the Voc of the alkali treated cell improved significantly (~+20 mV).

These results suggest an evolution of the interface and/or CIGS bulk properties with a possible passivation of defects during the time in air condition especially when the CIGS is treated with alkali elements. We highlight here the significant improvement of performances of CIGS solar cells with first an alkali post deposition treatment of CIGS and further with aging of full cells in air condition. Further electrical analyses are ongoing in order to understand the mechanisms behind this improvement.

## Figures of merit:

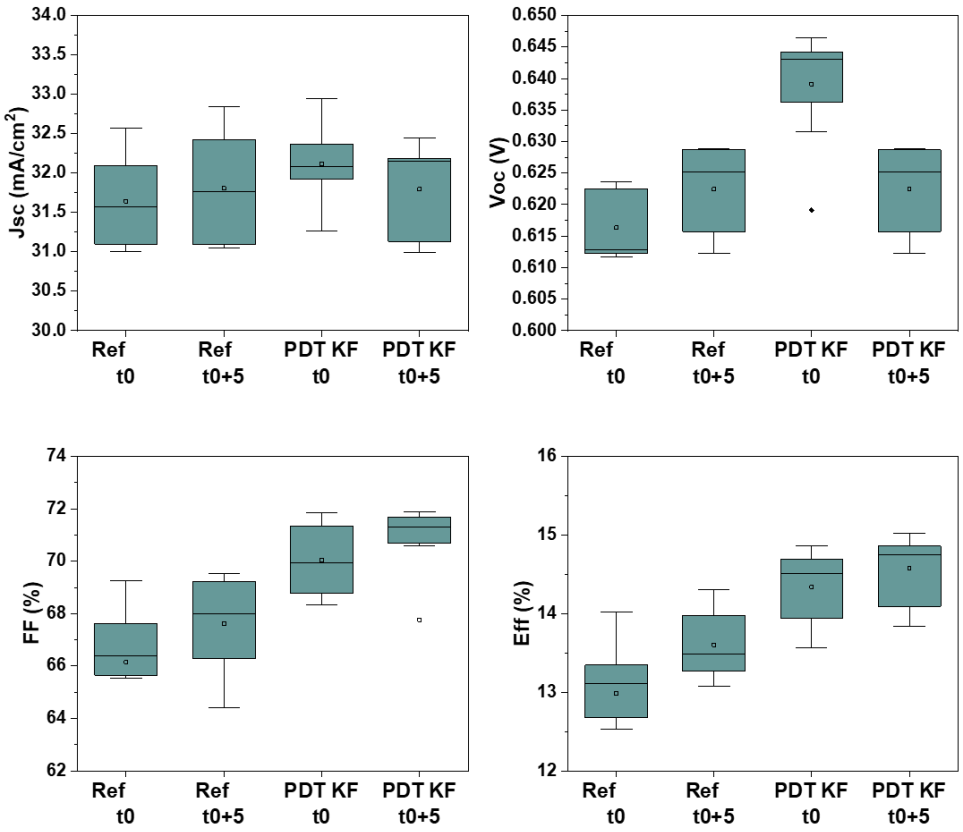


*Figure 1: figure of merit of photovoltaic performances of ZnOS-based solar cells measured after fabrication (t0) and re-measured after 5 months (t0+5).*

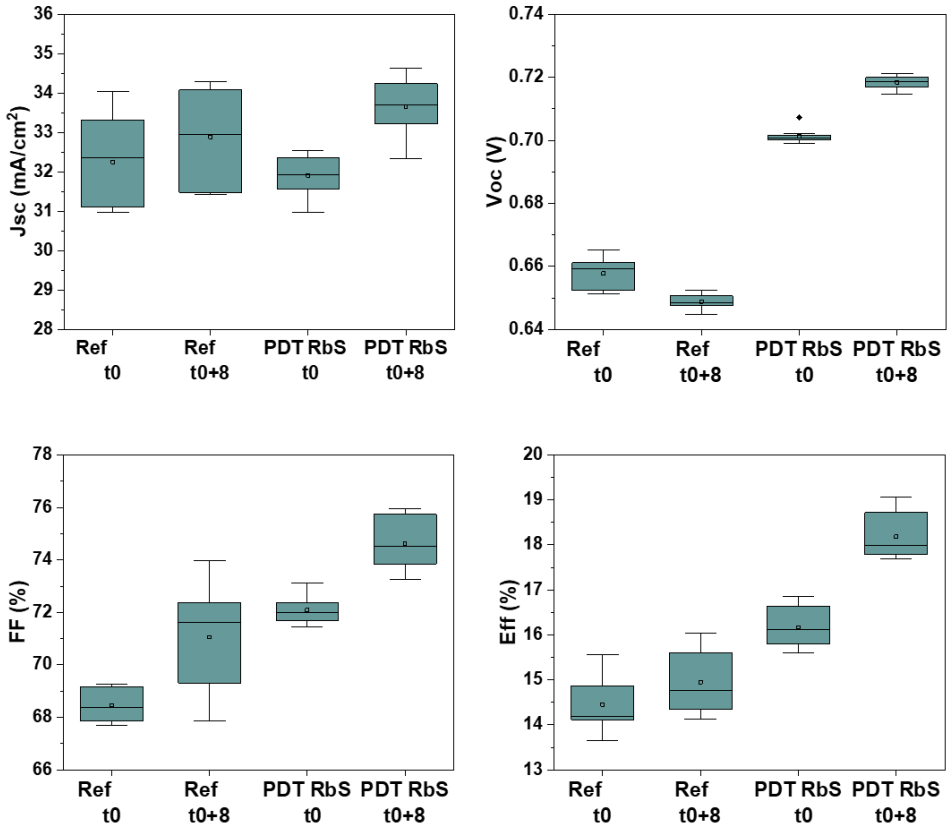


*Figure 2: figure of merit of photovoltaic performances of CdS-based solar cells measured after fabrication (t0) and re-measured after 8 months (t0+8).*