Ultrathin, nanostructured CIGS solar cells (ULTRACIS-M project)

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Large-scale and sustainable development of copper indium gallium diselenide (CIGS) thin film photovoltaics requires thickness reduction to avoid indium scarcity and to reduce fabrication cost. This thickness reduction induces a absorption reduction in the cell leading to a global efficiency decrease. We propose to compensate for the low absorption in ultrathin CIGS layers by introducing a novel light trapping strategy based on a nanostructured back mirror. We show numerically that short circuit current density above 35 mA/cm² can be reached for CIGS absorbers as thin as 150 nm.

We have developed a fabrication process based on the transfer of the solar cell on a host glass substrate, and nanoimprint lithography on the back side. We will present the first experimental results of CIGS solar cells with nanostructured gold mirror, and demonstrate EQE enhancement as well as global efficiency increase due to light trapping effects. We will show our latest experimental results and discuss the perspectives of CIGS solar cells with thicknesses in the 200-300nm range with efficiencies above 15%.

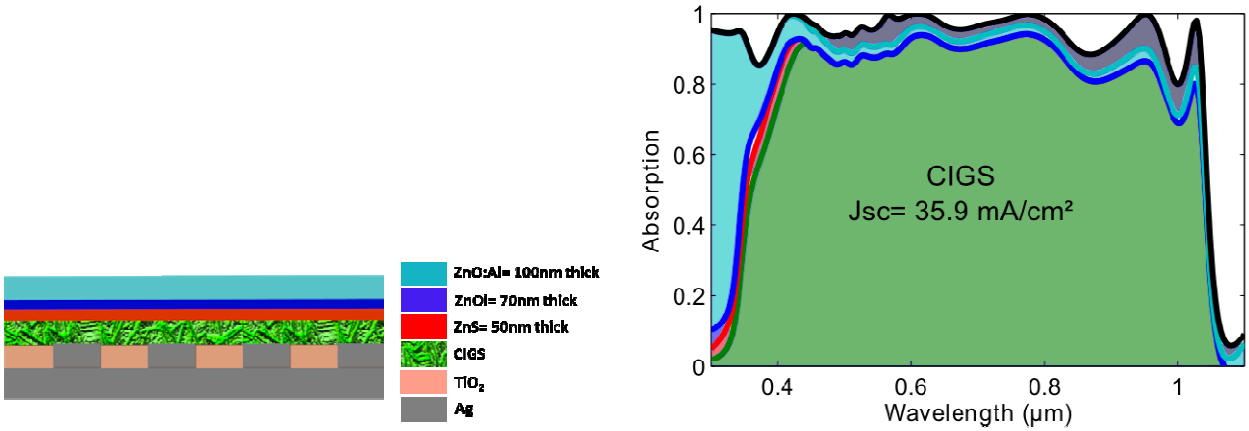

Figure 1: RCWA calculation of a 150 nm-thick CIGS solar cell on a nanostructured Ag mirror.

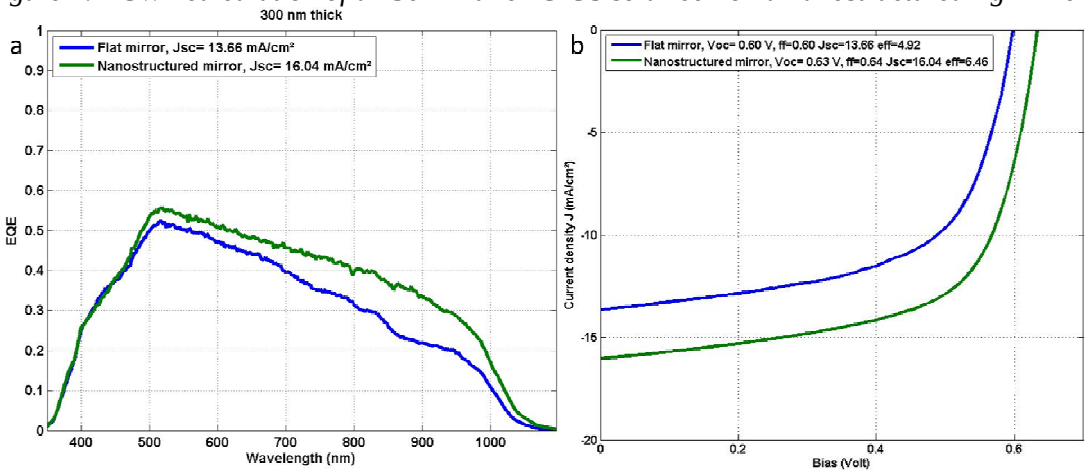

Figure 2:300 nm-thick CIGS solar cell a) EQE measurment b) One sun measurements