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A very promising new concept of 3-terminal (3T) tandem cells with selective band offset barrier (3T-SBOB) tandem cells has been developed at GeePs and has many advantages over 2- and 4-terminal cells.
The ANR THESIS project aims at 3T-SBOB tandem cell. The perovskite based top subcell absorbs energy photons while the silicon based interdigitated back contact (Si-IBC) bottom subcell absorbs lower energy photons.
We focus here on the optoelectronic properties of IBC-Si « that will be used as bottom cell in 3T », investigated using the spatially and spectrally resolved electroluminescence (EL) characterization. EL consist of light emission by application of an electrical bias enables rapid characterization of the entire cell and allows the visualization of microscopic defects on micrometer scale of the cell that can not be detected by photoluminescence (PL) imaging on the device. Figures **1** and **2** show examples of the spatially resolved EL and PL of a 13.8% efficiency Si-IBC solar cell fabricated at INL-Lyon and characterized at GeePs. The fill factor of this cell is of about 67%. Absorption is quite homogenous as shown in PL image. But in EL image we notice locally reduced emission which may caused by resistive losses, low surface recombination velocity and low diffusion length.
In Figure **3** we present spectrally resolved EL emission(red curve) and the directly mesured quantum efficiency (EQE) (magenta curve). By scaling the EL emission with the EQE and integrating it, one can obtain the correct saturation current density and then quantify the radiative recombination open circuit voltage ($V_{oc,rad}$). The difference between $V_{oc,rad}$ and V_{oc} directly mesured ($\Delta V_{oc} = V_{oc,rad} - V_{oc}$) gives the losses due to non-radiative recombination in the cell.

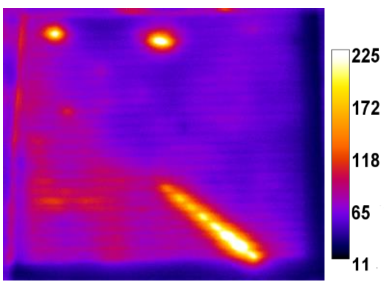

Fig. 1 : EL image of 1cm^2 monocristalline Si-IBC at 0.9V bias applied. We note locally reduced EL emission due to variation of electronic properties.

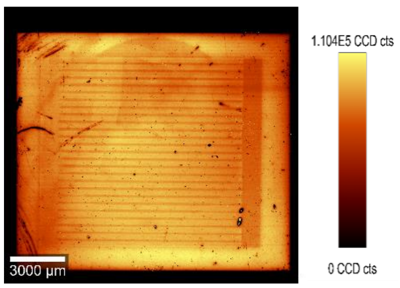

Fig. 2 : PL image of 1cm^2 monocristalline Si-IBC. Beam used is laser 532 nm at room temperature.

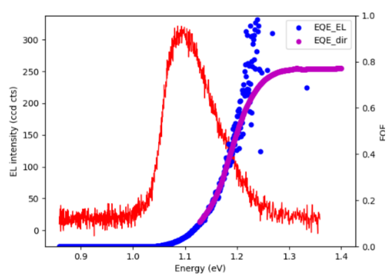

Fig. 3 : Comparison of EL spectra (red curves) and quantum efficiencies (magenta point). The blue points represent the quantum efficiencies that follow from the EL spectra.