BRIGHTSIDE Project: Towards Highly Efficient 4 Terminals Perovskite/Si Tandem Modules with Low Carbon Footprint

Thibaut DESRUES[a], Quentin RAFHAY[b], Anne KAMINSKI[b], Jean ROUSSET[c], Armelle YAICHE[c], Thomas GUILLEMOT[c],Van-Son NGUYEN[c], Florian HILT[c], Barbara BAZER-BACHI[d], Samuel WILLIATE[d]

[a]Univ. Grenoble Alpes, CEA, Liten, Campus Ines, 73375 Le Bourget du Lac, France
[b]Université Grenoble Alpes, Cnrs, Univ. Savoie Mont Blanc, Grenoble Inp, IMEP-LAHC, Grenoble, 38000, France
[c]IPVF, EDF R&D 18, boulevard Thomas Gobert, 91120 Palaiseau, France
[d]EDF ENR Photowatt, 33 rue Saint-Honoré 38300 Bourgoin Jallieu, France

The BRIGHTSIDE project aims to demonstrate a fast and scalable route to manufacture highly efficient (>30%) and reliable perovskite/silicon four-terminals (4T) bifacial tandem modules with low carbon footprint. This 3 years project, started in March 2023 and funded by ANR, involves different industrial (EDF ENR PWT– Photowatt, EDF R&D) and academic (CEA-INES, IPVF, IMEP-LaHC) partners having specific and complementary roles in the consortium. The c-Si substrates come from Photowatt (EDF ENR PWT) factory which provides low carbon cast mono wafers. The high efficiency c-Si bottom cell fabrication process using poly-Si/SiO_x passivated contacts layers, adapted to these substrates, is developed at CEA/LITEN (INES). Perovskite (PK) solar cells are fabricated at IPVF, involving people from EDF R&D and IPVF and focusing on industrial processes with a low environmental impact. The tandem modules will finally be assembled at Photowatt where their performances will be checked over time to assess their stability. These studies will benefit from the modelling and characterization skills of IMEP-LaHC, particularly concerning ageing mechanisms and low frequency noise analyses. The first results obtained are mainly focused on bottom cells and modules optimization, aiming to study the compatibility of cast mono wafers with a double side passivated contacts fabrication cells process (**Figure 1**). We also explored the possibility to increase the bottom module voltage output through c-Si cells cutting in different sizes and shapes (**Figure 2**).

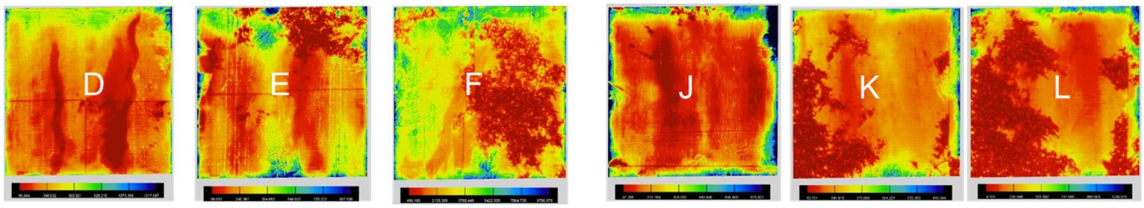

***Figure 1** : Photoluminescence imaging of n-type (D,E,F) & p-type (J, K, L) metallurgical grade cast mono wafers from Photowatt processed with double side poly/SiO_x passivated contacts for bottom cells application.*

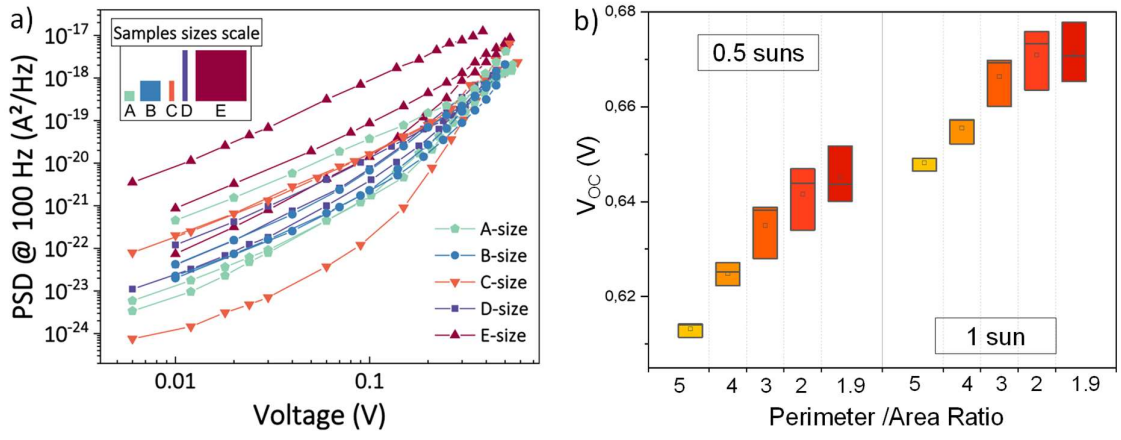

***Figure 2** : a) Values of power spectral densities, extracted at 100 Hz as a function of the applied voltage in solar cells showing different sizes and shapes (Low Frequency Noise analysis). b) Open Circuit Voltage (V_{OC}) values of cut cells measured under 0.5 and 1 sun illumination, depending on their perimeter/area ratio.*