EUROPEAN COMMISSION

HORIZON 2020 PROGRAMME
TOPIC H2020-LCE-07-2016-2017
Developing the next generation technologies of renewable electricity and heating/cooling

GA No. 727523

Next – generation interdigitated back-contacted silicon heterojunction solar cells and modules by design and process innovations

NextBase - Deliverable report

D5.2 Light management scheme allowing Jsc >42 mA/cm^2

Deliverable No.	NextBase D5.2	
Related WP	5	
Deliverable Title	Light management scheme allowing Jsc > 42 mA/cm^2 (interlinked to D4.3)	
Deliverable Date	30 March 2018	
Deliverable Type	REPORT	
Dissemination level	Confidential – member only (CO)	
Author(s)	Paul Procel, Olindo Isabella (TUD)	March 2018
Checked by	Bertrand Paviet-Salomon (CSEM)	March 2018
Reviewed by (if applicable)	WP partners	March 2018
Approved by	Kaining Ding (Jülich)	
Status	Final	29-03-2018

Disclaimer/ Acknowledgment

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727523. The information and views set out in this publication does not necessarily reflect the official opinion of the European Commission. Neither the European Union institutions and bodies nor any person acting on their behalf, may be held responsible for the use which may be made of the information contained therein.

Publishable summary

Within NextBase consortium, light management techniques were evaluated looking not only at light in-coupling at front side and rear side back reflectance but also as function of front surface passivation and bulk lifetime. Reflectance, recombination and optical absorption parasitic losses were extracted from measured or simulated reflectance and EQE spectra.

Regarding front side light management, promising optical systems are under development, for example the modulated surface texturing or the 2/3 ARC system, reducing losses below 0.32 mA/cm^2. In case of modulated surface texturing, almost perfect broad band light in-coupling is achieved thanks to nano-texturing properties. Concerning the 2/3 ARC system, a stack that includes MgF_2/SiN_x and/or SiC_x is being investigated, lowering optical losses in random textured front. As a reference, in case of single SiN_x ARC, losses increase to 0.6 mA/cm^2.

From the evaluation of rear side light management, promising approaches were identified in devices or optical systems featuring textured rear side. These approaches show losses below 0.5 mA/cm^2 when compared to their flat rear side counterparts, thus validating advantages of rear side scattering.

Through combining best front and rear light management approaches developed in the project, maximal J_{sc} = 42.64 mA/cm^2 can be achieved. Looking into recombination analysis, state-of-art chemical passivation is crucial to get J_{sc} > 42 mA/cm^2. In absence of front surface field, such a passivation quality is attainable using intrinsic a-Si:H as passivating layer, a solution that all partners in NextBase consortium use. Finally, standard bulk lifetime quality obtained in WP3 allows J_{sc} > 42 mA/cm^2.