

**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  $J_{sc} > 42 \text{ mA/cm}^2$**

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

### *Disclaimer/ Acknowledgment*



Copyright ©, all rights reserved. This document or any part thereof may not be made public or disclosed, copied or otherwise reproduced or used in any form or by any means, without prior permission in writing from the NextBase Consortium. Neither the NextBase Consortium nor any of its members, their officers, employees or agents shall be liable or responsible, in negligence or otherwise, for any loss, damage or expense whatever sustained by any person as a result of the use, in any manner or form, of any knowledge, information or data contained in this document, or due to any inaccuracy, omission or error therein contained.

All Intellectual Property Rights, know-how and information provided by and/or arising from this document, such as designs, documentation, as well as preparatory material in that regard, is and shall remain the exclusive property of the NextBase Consortium and any of its members or its licensors. Nothing contained in this document shall give, or shall be construed as giving, any right, title, ownership, interest, license or any other right in or to any IP, know-how and information.

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<sup>2</sup>. 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<sub>2</sub>/SiN<sub>x</sub> and/or SiC<sub>x</sub> is being investigated, lowering optical losses in random textured front. As a reference, in case of single SiN<sub>x</sub> ARC, losses increase to 0.6 mA/cm<sup>2</sup>.

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<sup>2</sup> 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<sup>2</sup> can be achieved. Looking into recombination analysis, state-of-art chemical passivation is crucial to get  $J_{sc} > 42$  mA/cm<sup>2</sup>. 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<sup>2</sup>.