Refined PV
Reduction of Losses by Ultra Fine Metallization and Interconnection of Photovoltaic Solar Cells

Project Duration: 07.2017 to 06.2020
Initial report submitted: 01.2018

Summary

In the last decade, major improvements in crystalline solar cells have been achieved by successively increasing emitter sheet resistance and reducing finger width and finger distance on the cell, allowing for decreased recombination, absorption, shading and resistance losses. While the reduced width could partly be compensated by a better aspect ratio of screen printed fingers, the trend to narrower fingers had to be additionally supported by an increased number of bus bars, from initially two, to firstly three, and lately also four, five or six. A further prerequisite was the reduction of specific contact resistance to high ohmic emitters. While contact resistance of actual pastes would allow for a further shrinking, screen printing faces difficulties to keep pace. And for classical soldering, more than six ribbons seem not to be feasible. Recently Utilight has demonstrated an ability of printing high aspect ratio ultra-fine finger lines, see Fig. 1 and 2. Meyer Burger has developed the Smart Wire Connection Technology (SWCT), which interconnects cells with a multitude of wires, see Fig. 3. Merging both approaches in the project will allow for a notably increased efficiency and drastically reduced silver consumption for crystalline solar cells. Utilight will develop the hardware and process for high quality printing of 15-20 µm wide finger lines with high aspect ratio suitable for mass production. ISC Konstanz will optimize the solar cell in order to take maximum advantage of ultra fine line metallisation. Due to the very narrow finger width and the intent to use emitters with even higher sheet resistance, control of contact formation will be of major importance. The optimization of the metallization layout will be performed in close conjunction with Meyer Burger, providing the bus bar free connection of the cells to a module of increased efficiency and superior reliability. The module will be built tested and qualified by Meyer Burger.

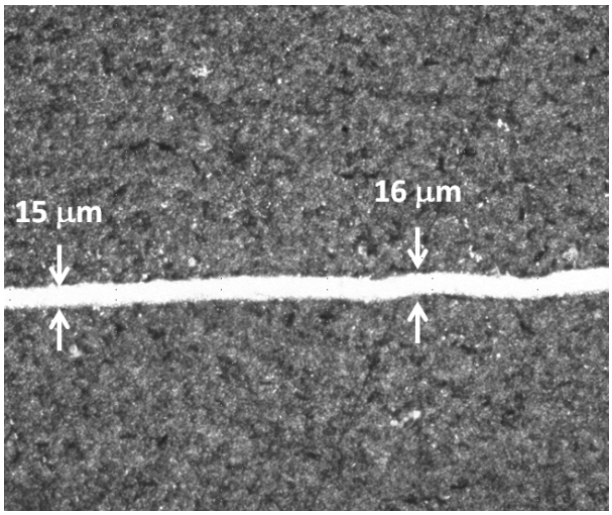

Fig. 1: Ultra-fine line of around 15-16 µm width printed by PTP.

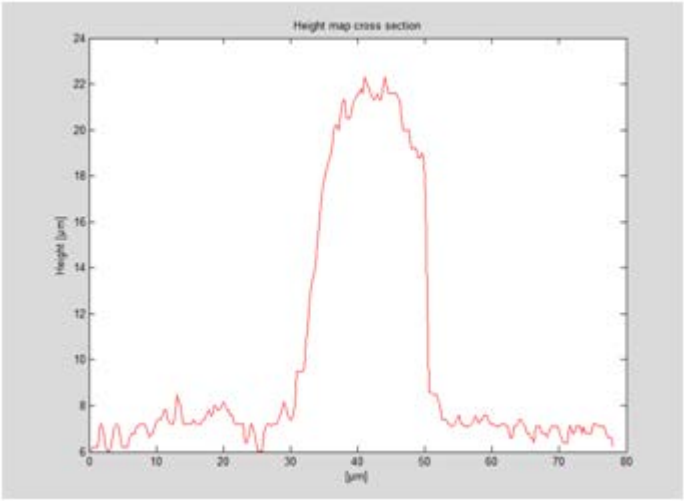

Fig. 2: Cross section of a ulta-fine line printed by PTP.

Fig. 3: Smart Wire concept developed by Meyer Burger.

Project consortium

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Participating countries and financing:

Country	**Number of organisations involved**	**Project costs in EUR**	**Public funding in EUR**
Germany	1	1'200'755	960'604
Israel	1	475'580	237'790
Switzerland	1	1'000'000	400'000
Total		*2'676'335*	*1'598'394*

Funding agencies involved and contracts

Funding Agency	**Contract N° and Title**
Projektträger Jülich (PTJ)	0324206 "Refined PV – Reduktion elektrischer Verluste durch verfeinerte Metallisierung und Verbindung photovoltaischer Solarzellen"
Ministry of Energy	216-11-034: Reduction of Losses by ultra-fine Metallization and Interconnection of Photovoltaic Solar Cells
Swiss Federal Office of Energy (SFOE)	SI/501594-01 "RefinedPV-Reduction of Losses by ultra fine Metallization and Interconnection of Photovoltaic Solar Cells