

**Crystalline silicone heterojunction  
solar cell exceeding  
26% conversion efficiency  
(designated version)**

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# Outline

- Heterojunction back contact (HJBC) solar cell

# Most high efficiency works of back contact and heterojunction cell

\*da: designated area \*ta: total area \*ap: aperture area

	$V_{oc}$ [V]	$J_{sc}$ [mA/cm <sup>2</sup> ]	FF%	Eff%	Area*[cm <sup>2</sup> ]	Cell type
Panasonic	0.740	41.8	82.7	25.6	143.7 (da)	HJBC[1]
SunPower	0.737	41.33	82.71	25.2	153.49 (ta)	IBC[2]
Kaneka	0.738	40.8	83.5	25.1	151.9 (ap)	HJ[3]
Panasonic	0.750	39.49	83.2	24.7	101.8 (ta)	HJ[4]

Highest  $J_{sc}$  obtained from by IBC type

Highest  $V_{oc}$  and FF obtained from top/rear contact heterojunction cell

**We aimed to realize best parameter by HJBC.**

[1] K. Masuko *et al.*, IEEE Journal of Photovoltaics, 4, 1433 (2014)

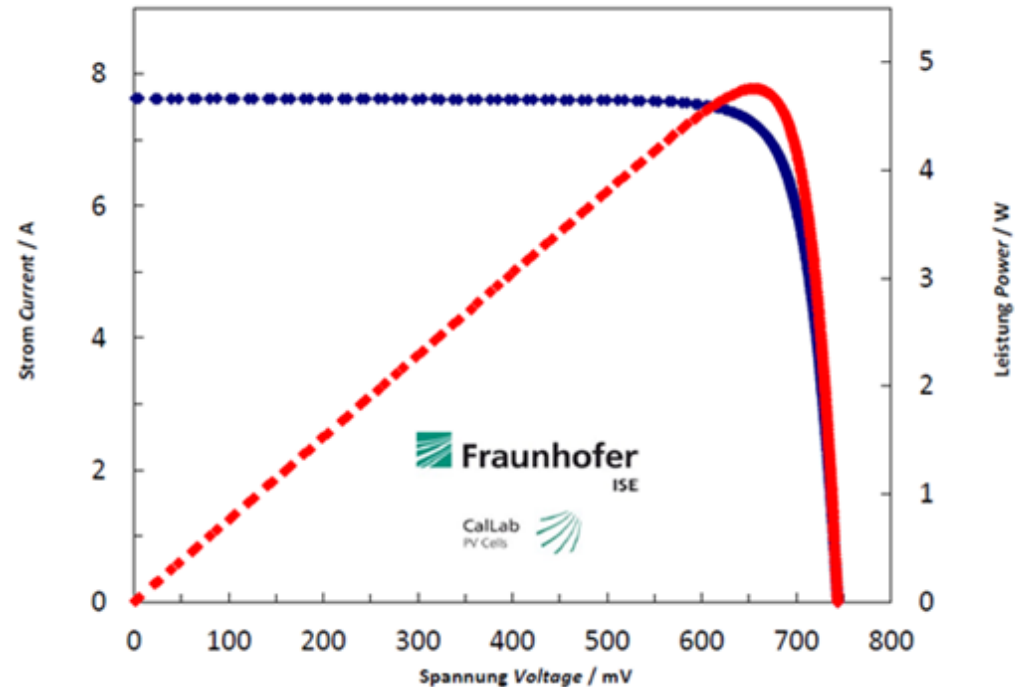
[2] R. Swanson, presentation in "A workshop on the role of theory, modeling and simulation", Purdue University, August 2–3 (2012)

[3] D. Adachi *et al.*, Applied Physics Letters, 107, 233506 (2015)

[4] M. Taguchi *et al.*, IEEE Journal of Photovoltaics, 4, 96 (2014)

# Record efficiency by HJBC cell

Area	180.43	cm <sup>2</sup>
V <sub>OC</sub>	743.8	mV
J <sub>SC</sub>	42.25	mA/cm <sup>2</sup>
FF	83.78	%
<b>Eff</b>	<b>26.33</b>	<b>%</b>



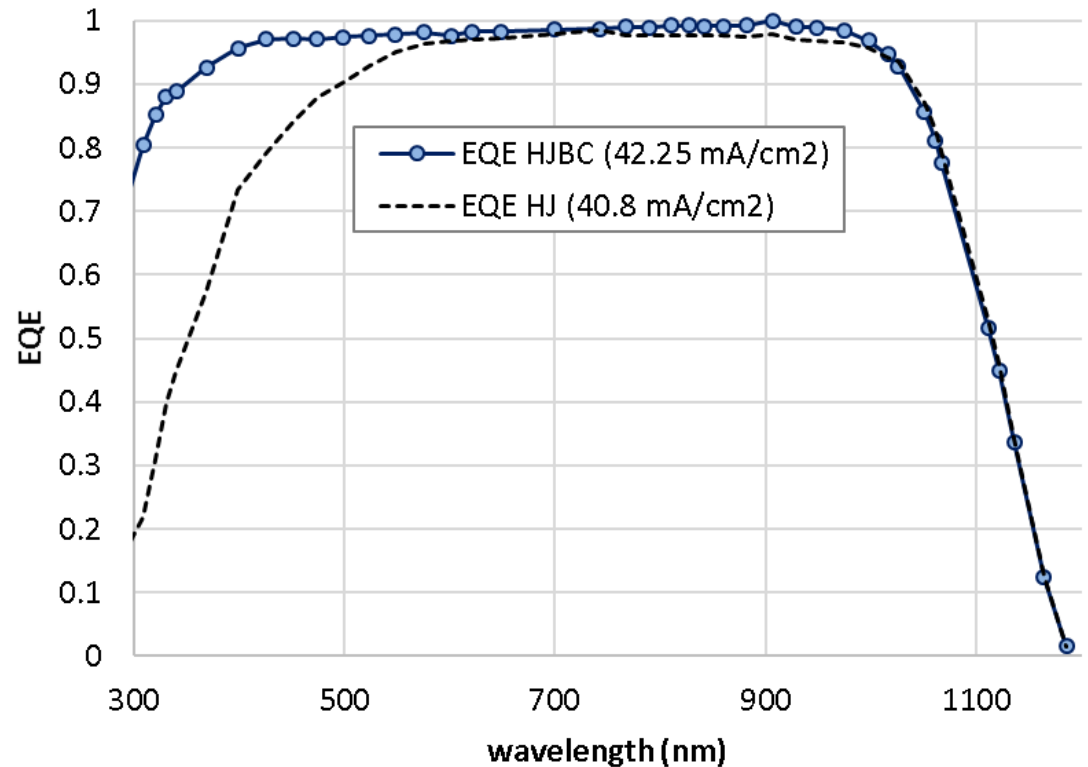
- Record efficiency\* for crystalline silicon, 26.33% (180.43 cm<sup>2</sup>)
- High FF by improved minority carrier lifetime and series resistance

\* Green\_et\_al-2016-Progress in Photovoltaics “Solar cell efficiency tables (Version 48)”

# EQE of HJBC cell

**$J_{sc}$  of 42.25 mA/cm<sup>2</sup>**

EQE of short wavelength improved due to front optics improvement compared to top/rear HJ record (25.1% Kaneka)



Sight improvement possible at long wavelength <1000 nm

# Highest VI parameter by HJBC

\*da: designated area \*ta: total area \*ap: aperture area

	$V_{oc}$ [V]	$J_{sc}$ [mA/cm <sup>2</sup> ]	FF%	Eff%	Area*[cm <sup>2</sup> ]	Cell type
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Kaneka	0.738	40.8	83.5	25.1	151.9 (ap)	HJ[3]
Panasonic	0.750	39.49	83.2	24.7	101.8 (ta)	HJ[4]
Kaneka	0.744	42.25	83.78	26.33	180.43 (da)	HJBC

High Voc, Jsc and FF was obtained by excellent PECVD passivation process and structure design of HJBC.

# Summary

- Record efficiency for Si cell of 26.33% was achieved by HJBC applying Kaneka's thin film & heterojunction technology.

## ACKNOWLEDGEMENT

**This work was supported in part by the New Energy and Industrial Technology Development Organization (NEDO) under the Ministry of Economy, Trade and Industry of Japan.**

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