Atomic layer deposition passivation for high-efficiency i-PERC silicon solar cells

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SoLayTec InPassion LAB (PDT) tool for deposition of spatial ALD Al2O3.

At this week's European Photovoltaic Solar Energy Conference and Exhibition (27th EUPVSEC, 24/08-28/08), imec, RENA and SoLayTec present thin (165µm), large area (156x156mm2) i-PERC-type Silicon solar cells with ALD (atomic layer deposition) passivation achieving a cell efficiency of 19.6% without selective emitter using an industrial screen printing process flow.

The solar cell manufacturing has been performed within imec's solar cell pilot line using RENA in-line lab equipment for the rear-side polishing and emitter removal steps, and the SoLayTec in-line spatial ALD process development tool (InPassion LAB) for the ALD-Al2O3 deposition. Within imec's i-PERC process flow, a conversion efficiency of 19.6% with an open circuit voltage Voc of 665mV has been delivered for the best cell, with an average of 19.4% for the small series batch. "These results indicate that spatial ALD-Al2O3 can offer excellent passivation without suffering from front-side parasitic deposition;" explains Dr. Aude Rothschild, Senior scientist and responsible for the Al2O3 passivation development in imec's PV department. "The excellent passivation level obtained with the technology allow for even higher efficiencies so that further improvement of solar cell performance is expected in the near future. We are aiming at +20% efficiency in the coming months."

Franck Delahaye, product manager solar at RENA: "This excellent cell result shows the maturity of RENA's InPolish for rear-side polishing and InOxSide for junction isolation for next generation cell concepts as i-PERC".

Roger Görtzen, Co-founder and manager marketing and sales at SoLayTec:"The excellent rear-side passivation results show the properties of SoLayTec's ALD Al2O3 process. The lab process is scalable to volume production. Together with the low TMAl consumption, it results in the lowest cost of ownership. This is the first choice passivation layer for high efficiency and thin p-type PERC silicon solar cells."

The results were achieved within imec's silicon solar cell industrial affiliation program (IIAP), a multi-partner R&D program that explores and develops advanced process technologies aiming a sharp reduction in silicon use, whilst increasing cell efficiency and hence further lowering

substantially the cost per Watt peak.

Provided by IMEC