Assessing The Potential for Rear-Junction p-type PERC/TOPCon Hybrid Solar Cells

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PERC-cells dominate commercial photovoltaic production with the main challenger, commonly known as TOPCon (tunnel-oxide-polysilicon-contact), which offers higher cell performance but at higher cost. Our group works on development of a highly-promising low-cost and high-efficiency silicon cell technology, Rear-Junction p-type PERC/TOPCon Hybrid Solar Cells (dubbed RJ-PERP). The hybrid is essentially a bifacial p-type PERC cell "flipped-over", with the diffused n-type selective-emitter, now on the rear, upgraded to the n-type "polysilicon-on-oxide" contact used on n-type TOPCon rear-surfaces. By capturing the best features of both technologies, this approach provides higher performance than either, while avoiding key contributors to higher TOPCon costs, specifically n-type wafers, Ag for both polarity contacts, boron diffusion(s) and top-junction shunting by polysilicon wrap-around. Recent credible 3D simulations by ISHF suggest 1.0% and 0.32% (absolute) improvement in cell efficiency beyond PERC and TOPCon, respectively, at costs substantially below both.

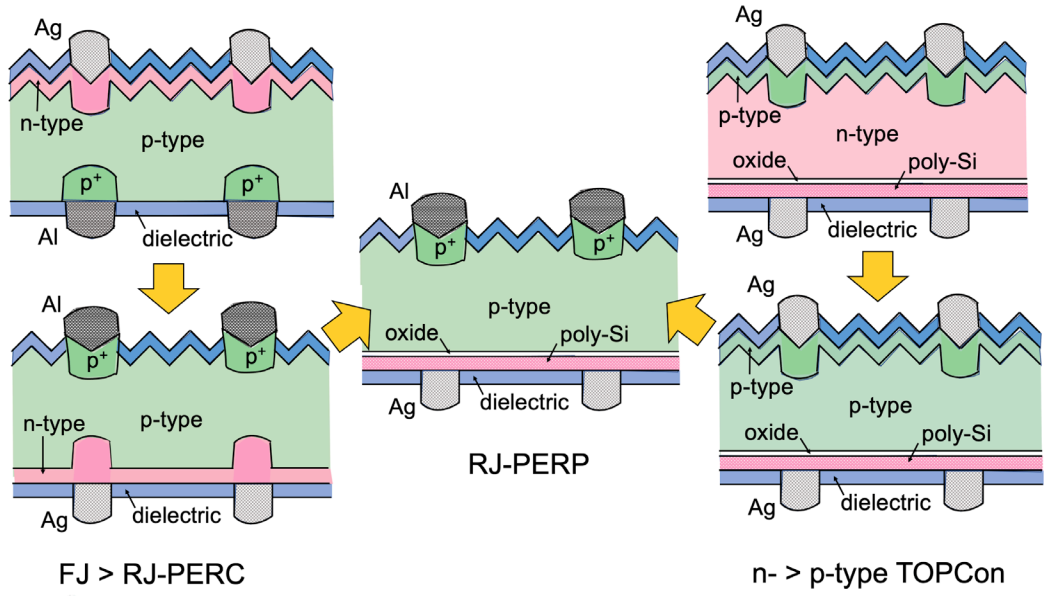

Fig.1: p-type RJ-PERC and p-type RJ-TOPCon shown as “intermediate structures” to RJ-PERP.

This project involves close collaboration with multiple PV manufacturers, that these industry partners will provide samples of devices with the “intermediate structures”, requiring minimal departure from established sequences. One is a rear-junction (RJ) PERC structure based on our partners' established bifacial PERC sequences, where the wafer is flipped-over for junction diffusion, dielectric deposition and contact screening steps; the second is a p-type RJ-TOPCon device, based on our partners' TOPCon lines, using Ga-doped wafers rather than P-doped. The student will work on characterising the performance of both “intermediate structures”, and collaborating with industry partners to further improve the design. The student will gain understanding of present capabilities of solar cell manufacturing and learn necessary processing/characterisation techniques for successful RJ-PERP implementation.