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Research and Development Scenarios of Interdigitated Back Contact Cells

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Abstract Photovoltaic is an important area of research in the energy crises period. So scientist and engineers of different laboratories and industries are involved in the development activates in the area of solar photovoltaic technology. Main thrusts of reaserch are improvement of solar cells efficiencies and production cost. It has been already established that improvement of solar cell efficacies and cost, n-type silicon is one of the key solution. Out of the different solar cell technological research, Interdigitated Back Contact cell research is one of the thrust areas of solar technology research.

The prime drive to move n-type c-Si cell is, its high minority carrier lifetime, no light-induced attenuation (LID), good low-light effect, low temperature coefficient, is expecting towards the theoretical highest efficiency of c-Si solar cells. Moreover, another drive is the decreasing price gap between n-type and p-type wafers. In order to keep the race for efficiency improvement, the existing back Surface Field (BSF) technology manufacturers started since 2015 upgrading their existing lines to PERC by adding two new equipment parts in the process (cheap solution). PERC structure is a natural progression from the standard BSF cell architecture, which suffers from some inherent limitations. However, this has also a limitation in terms of cell efficiency, which can get to around 23-24% maximum on the industrial level. Meanwhile, manufacturers will have to consider upgrading again n-PERC to TOPCon. As for IBC, it has many production processes, and thus the difficulties and costs are far higher than other technologies. Consequently, HJT and TOPCon are expected to be the two major n-type technologies in the coming years.

Interdigitated Back Contact (IBC) is one of the most complicated ways to produce solar panels. However, due to its effect on increasing the “efficiency” of the modules, it reduces the final product price and therefore, it has recently become popular. The product is still in the R&D phase and on the way to the market. IBC as the name suggests places the contacts in the rear side of the cell instead of the front side. This allows it to have higher efficiency due to a decrease in shading on the front side of the cell. These all result in an increase of the absorption capacity of IBC solar cells. In addition, solar panels produced by IBC technology, inactive areas, the spaces between cells, have diminished to near zero increasing the cell-to-module (CTM) ratio. IBC solar panels are highly-efficient with high power output. The power output of a module is the sum of the powers of all the individual cells in the module multiplied by the CTM ratio. IBC is highly valued in areas where higher current values are needed and the land is priceless such as big cities.

My lecture mainly focused on the review of different research and development activities of Interdigitated Back Contact cells.

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