Area: Crystalline and Thin Film Silicon PV

22.0% EFFICIENCY BIPERC WITH 17.5% BACK BASED ON INDUSTRIAL PROCESS

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Passivated emitter and rear contact (PERC) solar cells are dominating the market expansions of new solar cell production lines worldwide due to the introduction of rear passivation layer stack that increases the conversion efficiency. The passivation layer at the back did not just improve the conversion efficiency but it also give the possibility to use the back side to generate photocurrent with good bifaciality potential around 80% by changing the aluminum metallization from full area to designed finger grid similar to that of front Ag design allowing light to pass through from the back too, known as BiPERC or PERC+ solar cells which can be used in glass-to-glass bifacial solar modules.

In this paper, Longi latest R&D progress of BiPERC cell production will be presented. We realized 22.0% BiPERC front and 17.5% back efficiencies using PERC solar cell industrial processes.

Compared to normal PERC, BiPERC front EFF is decreased because of lower infrared absorption, lower Al finger conductivity and back paste corrosion. To improve the back efficiency while avoiding front EFF loss, the reflection of back stack SiNx/AlOx layer, the Al paste conductivity and printing line shape are optimized. On polished back surface, the optimized AlO_x/SiN_x dielectric thicknesses are thinner if compared to standard PERC solar cells. Due to the thinner passivation dielectric, normal Al paste and rear Ag paste resulted in poor PL images and therefore, the back silver and aluminum glass frits were adjusted to minimize the corrosion of the passivation layer to avoid front efficiency deterioration. Another improvement is realized by using proper Al paste with high conductivity and suitable thixotropic agent. With such paste, 175 micro/35um high finger lines are aliened and printed above the laser opening with the help of camera alignment. On the finished cells, advanced hydrogenation process is applied for anti-LID process resulting in stable final BiPERC cell front efficiency of 22.0% and 17.0% back efficiency tested on black chunk. One special advantage for BiPERC cell is its excellent LID performance of 0.5% relative loss if compared to 1.0% LID of conventional PERC solar cells which were processed in the same firing condition and treated similarly with advanced hydrogenation process.