

High efficiency HJT solar cells: Innovative silicon based PV technology for reducing energy generation costs in solar plants

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Today, silicon is the mainstream commercial technology in the photovoltaic market. The last years have seen huge cost reductions, which have favored large-scale PV expansion. The PV market, with a volume of about 100GWp of modules manufactured in 2017, is dominated by multicrystalline-Si (mc-Si) and monocrystalline-Si (c-Si). Though characterized by limited innovation, such technologies take many advantages from mature manufacturing processes, standardized materials and scale economy. To compete in a tough market PV manufacturers are more and more focusing on technologies able to reduce energy cost, leveraging on high efficiency solar cells, module durability and higher average energy generation. In such a context, the innovative hydrogenated amorphous Si / crystalline Si heterojunction technology (Si - HJT) is very important since it exhibits several fundamental characteristics allowing PV modules to generate more energy for longer time. Such properties have remarkable effects on the reduction of the levelized cost of energy (LCOE), which is the relevant parameter of PV installations. Si - HJT cells are intrinsically bifacial and can be fabricated with a quite simple industrial process flow at low temperatures (<200°C), thus enabling the use of thinner silicon wafers and facilitating the implementation of emerging materials, which are typically less compatible with high temperature processes. Therefore, the technology roadmap of silicon heterojunction solar cells can rely on the development of several innovations, such as efficient selective contacts and nanotechnology solutions for improving transparent contacts performances and light trapping in the absorber material. This work will report the most recent research and industrial developments for the Si - HJT solar cells, describing the technology roadmap as well as the expected advantages with respect to conventional technologies.