

P5 CAST-MONO

CSI Solar's cell technology is in constant evolution to reach higher efficiencies enabling module with higher power ratings at a competitive price. This is inline with the global market demand for higher power modules to enable lower LCOE.

In 2017 P4 (poly PERC) was introduced, and now our polycrystalline offering has a new option called P5 (also known in the PV industry as "cast mono" or "mono-like").

In this document, we will describe how P5 is manufactured and its main differences compared to P4 and mono PERC modules.

Background

The constant push of the market to increase module efficiencies at the same time as keeping competitive prices has been the driver of using cost-effective manufacturing processes specific to polycrystalline cells to reach almost comparable underlying structures as that of monocrystalline.

P5 cells are made of wafers using what is known as "cast mono" material. This material is produced in furnaces similar to those for poly-crystalline silicon, which means that P5 has low content of O₂ in the material, reducing LID in comparison to mono PERC.

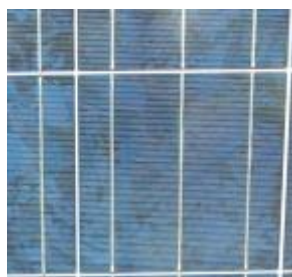
The homogeneous crystal development is achieved by means of using, at the bottom of the furnace, seeds of monocrystalline material that act as a starting point for the crystal orientation of the new block of cast-mono. This enables, using manufacturing process similar to polycrystalline cells, achieving an almost monocrystalline structure, as the orientation of the silicon crystals is controlled, compared to the random orientation of the polycrystalline material.

The process will generate small crystal dislocation areas in P5 cells, visible in the wafers as line, small dots or polygons of different reflectivity, and therefore a different color.

Visual difference: P5 vs. conventional polycrystalline

Convention polycrystalline cells are characterized by a random pattern of different tones of blue, that are caused by the different orientation of the different crystals, making the border grains visible.

Monocrystalline cells have a homogenous color thanks to all the silicon crystals growing perpendicular to the plane of the cell surface. Due to this there are neither differences in the blue hue nor visible border grains.



Typical appearance of a conventional polycrystalline cell.



Typical appearance of a P5 module.



P5 cells showing visible border grains.



P5 cells showing visible crystals.

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P5 cells have a rather homogenous blue hue (characteristic of monocrystalline cells), and only some cells may contain small irregular crystals in a different tone of blue, typical of the polycrystalline cells. Most cells are of a perfectly homogeneous appearance but the spots of crystals with different orientation will show a different color, being inherent to the production process. Basically, it is a monocrystalline structure with some small parts of polycrystalline, therefore the name of “mono-like”.

Why P5?

The main benefits of P5 cells are:

- Higher nominal power
- Higher efficiency
- LID degradation at the same level as conventional polycrystalline modules (P4)
- More competitive price than monocrystalline modules

P5 Reliability and Warranty

We would like to stress that this different appearance does not represent any lower performance at all, compromise reliability in any way nor represent any source of future problems, as backed by our product warranty terms.

Conclusion

P5 is a cell technology that combines modules with efficiency values very similar to those of monocrystalline PERC but with price levels of polycrystalline PERC solar modules. Since CSI Solar has a vertically integrated manufacturing capacity starting from ingots, wafer, cells, and modules, we are able to control the pricing of key production steps to offer competitive stable pricing for P5 products.

For further questions, please don't hesitate to contact us at service.emea@csisolar.com.

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