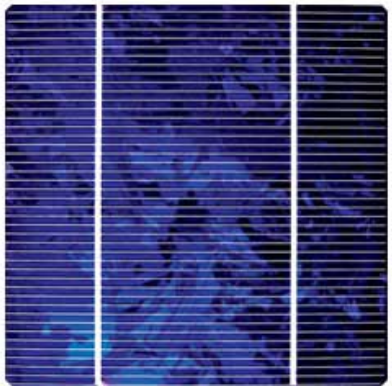
SOLAR PANEL EFFICIENCY

Monocrystalline VS Polycrystalline

ecocoast

Technical Note



MONOCRYSTALLINE **POLYCRYSTALLINE**

A brief background on silicon solar panels: A typical silicon photovoltaic (PV) solar panel is composed of a thin wafer, consisting of an ultra-thin layer of phosphorus-doped (N-type) silicon on top of a thicker layer of boron-doped (P-type) silicon. An electrical field is created near the top surface of the cell where these two materials are in contact, called the P-N junction. When sunlight strikes the surface of a PV cell, this electrical field provides momentum and direction to light-stimulated electrons, resulting in a flow of current when the solar cell is connected to an electrical load.

The two types of silicon solar panels used in marine lanterns: There are two types of solar cells, which are classified based on the types of crystals used - **Monocrystalline Silicon Cells (MSC)** and **Polycrystalline Silicon Cells (PSC).**

The **Monocrystalline Silicon Cell** is produced from pure silicon (single crystal). Pure silicon is prepared by passing a rod of impure silicon through a heated zone in the same direction several times. This process drags the impurities towards one end and is then removed.

Since the monocrystalline silicon is pure and defect-free, the efficiency of the cell is higher than a polycrystalline cell and requires less surface area to achieve a given power with a typical efficiency of 15-20%. These perform best at higher temperatures and lower light conditions. Monocrystalline cells appear mostly black.

In **Polycrystalline Silicon Cells**, liquid silicon is used as raw material and polycrystalline (also known as multicrystalline) is obtained by a solidification process. The materials contain various crystalline sizes. The resulting efficiency of this type of cell is around 5% lower than a monocrystalline cell. Typical efficiency is around 13-16%. Polycrystalline cells have a lower heat tolerance than monocrystalline cells, perform worse in high temperatures and low light conditions. Polycrystalline cells appear distinctly blue.

Monocrystalline advantages:

Higher efficiency: Approximately 5% higher than polycrystalline for a given surface area.

Operating temperature: They tend to be more efficient in warm weather. Performance drops at a lower rate as temperature increases compared to polycrystalline.

Longevity: Pure monocrystalline cells have wide spectral absorption bands, resulting in higher efficiency and longer projected life span.

Low light performance: They perform better than similarly rated polycrystalline panels in low light conditions.

Monocrystalline disadvantages:

Cost: Monocrystalline solar panels cost more than polycrystalline panels.

References

1. *Fraunhofer Institute for Solar Energy Systems ISE "Photovoltaics Report", 24 October 2019, Link*
2. *T. Saga, NPG Asia Mater. 2(3) 96–102 (2010), Link*