Seeding better efficiencies in monocrystalline silicon solar cells

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Researchers at MANA have developed a single-seed silicon cast method. Compared with conventional casting, the new method enables dramatic improvements in the crystalline quality of the silicon that are expected to improve the efficiency of silicon solar cells.

The conversion efficiency of silicon solar cells that are the mainstream of commercial photovoltaics is now going to reach 20 percent using single crystalline silicon. Increasing conversion efficiency brings higher value to solar cells. However, it is not possible to achieve such high efficiencies using conventional cast multicrystalline silicon. Furthermore, since semiconductor-grade single crystal silicon is too expensive for solar cells, there is a strong demand for the development of a third type of silicon as an alternative to multicrystalline and single-crystalline semiconductor types.

As a solution to this problem, a research team has developed the so-called single-seed cast method using a seed crystal for the silicon cast method. The researchers succeeded in producing high-quality, low impurity ingots of single crystal silicon (mono-silicon).

The new method consists of dissolving silicon feedstock inside a crucible and growing single crystalline silicon from a small seed. Notably, production costs can be reduced by this method compared with the method to produce dislocation-free single crystal silicon such as Czochralski method.

Importantly, solar cells produced using the new ingots yielded conversion efficiencies of 18.7 percent, which approach the value of 18.9 percent obtained with cells produced from semiconductor-silicon (CZ silicon) wafers.

In the future, further reductions of crystalline defects and impurities are expected to yield conversion efficiencies greater than 20 percent.

More information: Yoshiji Miyamura et al. Advantage in solar cell efficiency of high-quality seed cast mono Si ingot, *Applied Physics Express* (2015). DOI: 10.7567/APEX.8.062301

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