Microcrystalline tandem manufacturing plant with an annual production of 40 MW

Conversion Efficiency Improved by 1.5 Times by Microcrystalline Tandem-type Photovoltaic Cell

POWER SYSTEMS HEADQUARTERS
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Mitsubishi Heavy Industries, Ltd. (MHI) has been manufacturing and marketing amorphous silicon photovoltaic cells since October 2002. High-efficiency microcrystalline tandem-type photovoltaic cells, whose conversion efficiency is 1.5 times that of the amorphous silicon type, will be put on the market in 2007. The photovoltaic cell is the same size as the conventional amorphous type, but power output has been improved from 100 W to 150 W. These photovoltaic cells are manufactured in a newly built plant with an annual production volume of 40 MW.

The new plant is shown in the photograph above, and **Fig. 1** shows the microcrystalline tandem-type photovoltaic module.

As shown in **Fig. 2**, the new photovoltaic cell consists of a conventional amorphous type photovoltaic cell superimposed on a microcrystalline-Si photovoltaic cell. **Figure 3** shows an example of the spectral response of the new cell. As a microcrystalline-Si photovoltaic cell can utilize long wavelength light which is not absorbed by amorphous-Si for power generation, the use of a tandem construction with cell films stacked into two layers has improved efficiency. However, as the optical absorption coefficient of microcrystalline-Si is smaller than amorphous-Si, the i-layer of the microcrystalline photovoltaic cell, which constitutes the bottom cell, has to be over five times as thick as the amorphous i-layer. This means that the film deposition rate must be more than five times higher to achieve a production level equal to the amorphous type. Therefore, high-rate, high-quality film deposition technology is the key technology to realize a commercially viable microcrystalline tandem photovoltaic cell. To this end, we have improved the efficiency of tandem photovoltaic cells by high-rate film depositon, while developing a very-high frequency plasma film forming method suitable for microcrystalline-Si through upgrading the VHF plasma CVD which was developed for amorphous silicon.

As a result, an electrode based on the new concept was developed into a new plasma CVD. This plasma CVD is being manufactured in the new plant, attaining a fivefold increase in production capacity over the former level.

After starting production in April, the new plant will produce 30 MW during 2007 and will launch full production of 40 MW in 2008. The products will be marketed mainly in Europe where demands for photovoltaic cells are high.

The technology for the practical use of this photovoltaic cell was developed together with the New Energy and Industrial Technology Development Organization (NEDO).

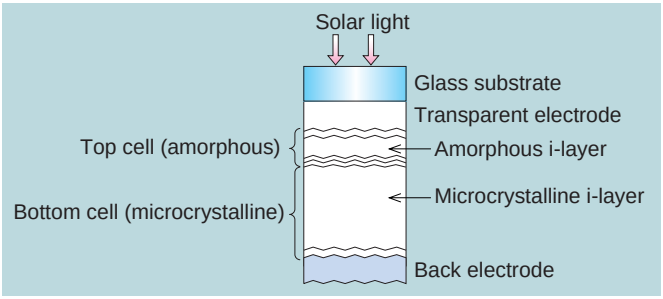

Fig. 2 Structure of microcrystalline tandem-type PV module
The film is formed by the amorphous silicon PV superimposed on microcrystalline-Si PV module.

Fig. 1 Microcrystalline tandem-type PV module (substrate 1.4m x 1.1m)
The microcrystalline tandem-type PV module has the same-sized substrate as the amorphous silicon PV module and a 1.5 times higher output.

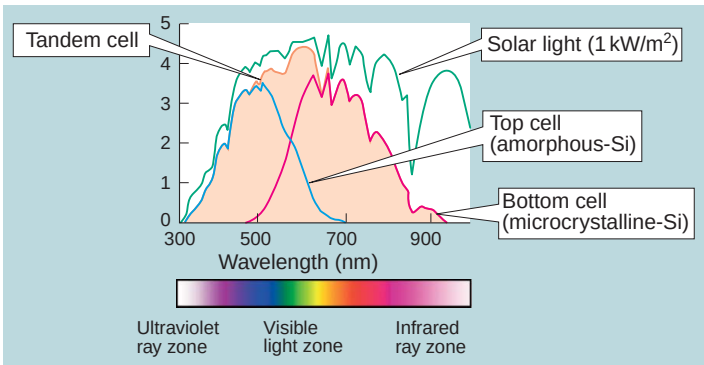

Fig. 3 Spectral response of microcrystalline-Si tandem-type PV cell
As a microcrystalline PV cell can absorb long-wavelength light which cannot be absorbed by an amorphous silicone PV cell, the quantity of light usable to generate electricity is increased, resulting in improved efficiency.