Microcrystalline High-Efficiency Tandem Solar Cell to Begin Production

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Mitsubishi Heavy Industries, Ltd. (MHI) has been manufacturing and selling amorphous solar cells for many years. Very recently, from October 2007, it also began to manufacture a new generation of microcrystalline tandem solar cells with far higher efficiency than the amorphous type.

The substrate for the tandem type is identical in size to the substrate for the amorphous type. Production plans call for cells with three power generation outputs – 130 W, 140 W and 150 W.

The microcrystalline tandem solar cell consists of a microcrystalline solar cell placed on top of a conventional amorphous solar cell, in tandem, as shown in **Fig. 1**. **Figure 2** shows an example of the spectral sensitivity of the microcrystalline tandem solar cell. The tandem cell is more efficient, as the microcrystalline cell absorbs the long-wavelength light that cannot be absorbed by amorphous silicon. But because the microcrystalline Si has a lower optical-absorption coefficient than the amorphous type, the i-layer of the microcrystalline solar cell needs to have a film thickness at least five times greater than the amorphous solar cell. In production, this means that the film-depositon rate must be fivefold faster in order to ensure the same production capacity as that attained for the amorphous type using the same device.

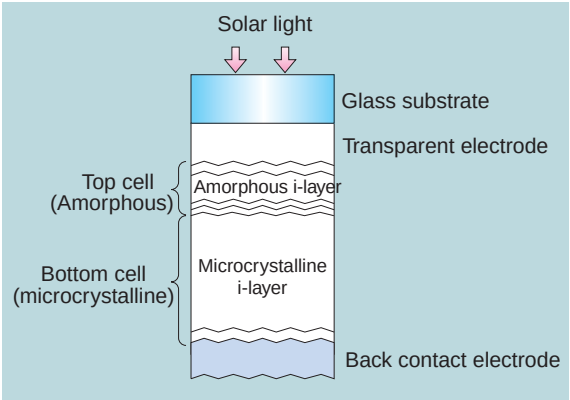

Fig. 1 Structure of the microcrystalline tandem solar cell
Tandem structure consisting of a microcrystalline solar cell placed on top of an amorphous solar cell

To accomplish this, MHI has developed a high-rate film-depostion technology for deposition microcrystalline Si films. The system is based on a VHF plasma CVD film-deposition technology developed by MHI for the amorphous solar cell. MHI will use this technology to manufacture tandem solar cells in the coming years. The new factory, shown in **Fig. 3**, will go into full production of the 40 MW microcrystalline tandem solar cells from 2008. MHI plans to sell the product widely both at home and abroad. The cells will be marketed most aggressively in Europe, where the demand for solar cells is robust.

Figure 4 shows the annual change in the amount of power generated per normal output of the microcrystalline tandem solar cell. This data were measured in central Germany. A high power generation performance is obtained compared with the crystalline types made by other companies.

The microcrystalline tandem solar cell and microcrystalline Si high-rate film-deposition technology have been developed through research entrusted to MHI by the New Energy and Industrial Technology Development Organization (NEDO).

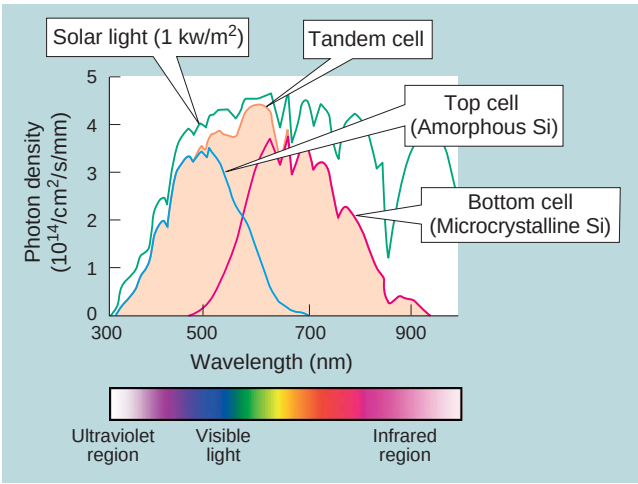

Fig. 2 Spectral sensitivity of microcrystalline tandem solar cell
Short-wavelength light is absorbed by the amorphous cell above and long-wavelength light is absorbed by the microcrystalline cell below.

Fig. 3 Microcrystalline tandem solar cell factory
Production lines in the center building produce microcrystalline tandem solar cells of 40-MW capacity each year.

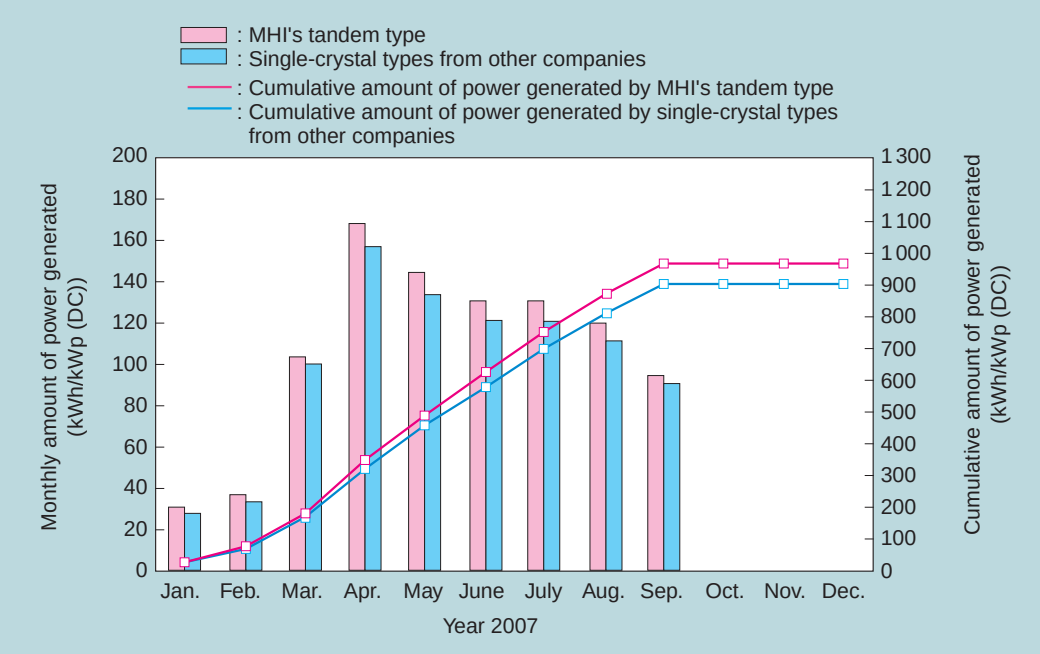

Fig. 4 Annual power generation characteristics of the microcrystalline tandem solar cell (central Germany)
The microcrystalline tandem solar cell generates abundant power with excellent power-generation characteristics.