Tandem Solar Cells in Thin Film Modules

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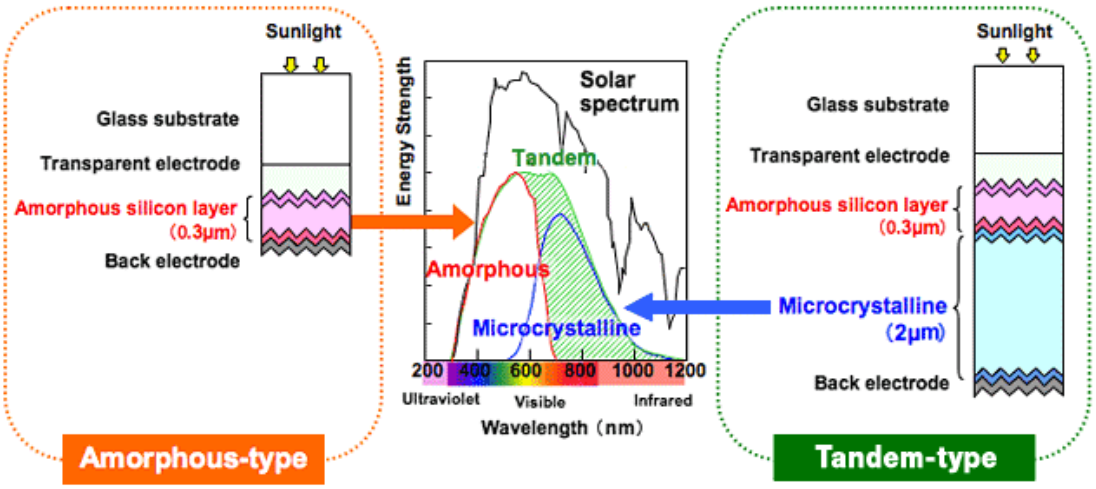
Background to Tandem Solar Cells

Tandem cells are solar cells containing several p-n junctions. This is in contrast to traditional crystalline silicon cells, which only contain one p-n junction. Compared to basic amorphous cells, they contain an extra layer of microcrystalline material, improving the spectral response (range from ultraviolet to infrared). Each junction is tuned to a specific wavelength of light in order to minimize losses. This means that as the number of junctions increase, the more efficient the cells become (87% theoretical efficiency with an infinite number of junctions).



http://www.mhi.co.jp/en/products/expand/a-si_specification_01.html

Benefits to solar system owners and manufacturers

From a production point of view, tandem cells can potentially be cheaper to manufacture as they use less silicon. But, the current price (2011) for silicon is so low that this reduction does not currently produce a significant amount of saving.

Comparing the electrical properties, modules with tandem cells tend to be arranged as many series connected cells, leading to higher voltage, and smaller current than many traditional modules. Their overall maximum power rating is generally lower than modules made from crystalline silicon cells.

Although there are improvements in efficiency over amorphous type solar cells, tandem cells are still less efficient compared to basic monocrystalline and polycrystalline silicon cells (under standard testing conditions). In order to compensate for this, more area is required, resulting in potentially longer installation times as well as mounting and labour cost.

However, tandem cells produce many benefits compared to silicon cells. They perform much better in low light conditions which will result in more energy production (kWh/kWp). This also leads to the advantage of higher performance at unfavourable tilt and orientation (east/west facing). They also have a smaller power temperature coefficient (-0.28%/C˚ compared to -0.5%/C˚), smaller voltage temperature coefficient and better performance when shaded (partly due to their vertical strips), which would be ideal for hot climates or in the case of nearby shade sources, such as narrow poles or antennae.

Note that for Mitsubishi's MT130 and other panels in this range, there are several requirements that must be followed or noted:

- The panels must be mounted vertically (because to the vertical strip layout of the cells);
- System voltage cannot exceed 600V;
- Galvanically isolated transformers must be used (can't use a transformerless inverter); and
- Grounding connections are required on negative conductors to prevent premature degradation.

Schuco micomorph tandem modules do not require grounding/earthing of the negative conductor, however, most amorphous modules will need to be grounded, such as the Schott ASI90, ASI100 and similar.