# News Release

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## SANYO Develops HIT[*1] Solar Cells with World's Highest Energy Conversion Efficiency[*2] of 23.0%[*3]

Tokyo, May 22, 2009----SANYO Electric Co., Ltd. (SANYO) announced today that it has broken its own record for the world's highest energy conversion efficiency in practical size (100 $cm^2$ or more) crystalline silicon-type solar cells, achieving a efficiency of 23.0% (until now 22.3%) at a research level for its proprietary HIT solar photovoltaic cells.

**Background**

SANYO is pushing forward with the expansion of its solar business, based on its Brand Vision 'Think GAIA', and aims to realize a clean energy society.

The increase in the solar cell conversion efficiency this time is accompanied by significant advances in lowering the production cost of the photovoltaic system and the reduction in the use of raw materials such as silicon.

This achievement by SANYO represents the first time that a photovoltaic manufacturer has broken through the 23% mark in conversion efficiency at the research-level for practical-sized solar cells, and further cements the leadership of SANYO's HIT solar cell which is renowned for its high conversion efficiency.

For now on SANYO will continue to advance its efforts into applying this research-level achievement into mass production, and promote further research into energy efficiency, as well as reductions in cost and materials.

[*1] HIT (Heterojunction with Intrinsic Thin layer) solar cell is composed of a single thin crystalline silicon wafer sandwiched by ultra-thin amorphous silicon layers. This product provides industry-leading performance and value using state-of-the-art manufacturing techniques.
[*2] As of May 22, 2009 (according to in-house surveys)
[*3] Evaluation results provided by the National Institute of Advanced Industrial Science and Technology (AIST), an energy conversion efficiency public certification body

**Overview of the elemental technology enabling the high energy conversion efficiency**

1. Improvement in the quality of heterojunction[*4] of HIT solar cell (single-crystalline silicon (c-Si) and amorphous silicon (a-Si))

The structure of the HIT solar cell is such that it has a feature that can reduce recombination loss[*5] of the electrical element (charged carrier)[*6] by surrounding the energy generation layer of single thin crystalline silicon (c-Si) with high quality ultra-thin amorphous silicon (a-Si) layers. SANYO has recently managed to improve the quality of the HIT solar cell junction through developing a technology for depositing a higher quality a-Si layer over the c-Si substrate while protecting the c-Si surface from being damaged.

The result was an increase in the open circuit voltage (Voc)[*7] from 0.725V to 0.729V.

2. Reduction of optical absorption loss

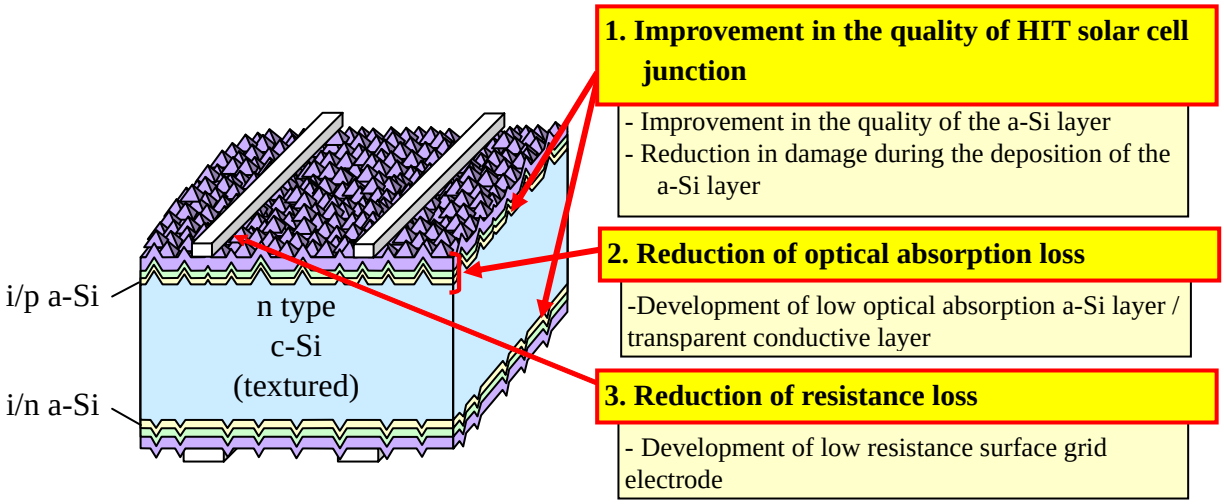
In the solar cell, sunlight that hits its surface needs to be guided to the c-Si, the energy generation layer, with the smallest possible absorption loss. As for the HIT solar cell, reduction of optical

absorption loss in the a-Si layer, which covers the front and rear surfaces of the c-Si, and the transparent conductive layer was a challenge. Absorption of short-wavelength solar radiation by the a-Si layer and that of long-wavelength solar radiation by the transparent conductive layer were the causes of the optical absorption loss. SANYO has recently developed know-how to reduce optical absorption loss in both the a-Si layer and transparent conductive layer. As a result, the short circuit current (Isc) [*8] was improved from 39.2mA/cm$^2$ to 39.5mA/cm$^2$.

3. Reduction of resistance loss

In the solar cell, generated electric current is collected by and taken out through the surface grid electrode. SANYO has recently realized lower-resistance electrode material for use in the grid electrode and a higher-aspect ratio through improving printing technology, leading to a success in reduction of resistance loss when an electric current flows through the grid electrode. As a result, the fill factor (FF) [*9] was improved from 0.791 to 0.80.

***Schematic diagram of the elemental technology***




[*4] Heterojunction is a stacked semiconductor structure formed by heterogeneous materials. In the case of the HIT solar cell, it means the laminated structure formed by a-Si and c-Si.
[*5] Recombination loss occurs when the negative electron and positive hole (carriers) that are produced within the solar cell combine and disappear, causing a loss in the electrical current produced by the cell and hence a decrease in the overall output of the solar cell.
[*6] Charged carriers are electrical particles, consisting of electrons (negative charge) and electron holes (positive charge).
[*7] Open circuit voltage (Voc) is the maximum voltage produced by the solar cell.
[*8] The short circuit current (Isc) is the maximum current that can be produced by the solar cell.
[*9] The fill factor is the total output divided by the product of Voc and Isc (Voc x Isc)

**The characteristics of the HIT solar cell**

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| Open circuit voltage (Voc) | 0.729V |
| Short circuit current (Isc) | 3.968A (39.5mA/cm$^2$) |
| Fill factor (FF) [*9] | 80.0% |
| Cell energy conversion efficiency | 23.0% |
| Cell size | 100.4cm$^2$ |