Sharp develops world's most efficient solar cell

Using the triple-junction compound solar cell, the technology leader Sharp achieves the world's highest solar cell conversion efficiency[1] of 35.8 percent[2], for non-concentrator solar cell.

Hamburg, 27 October 2009. "The increase in efficiency with compound solar cells from a previous 31.5 to 35.8 percent is a great success and another milestone in the optimisation of solar technology", says Peter Thiele, Executive Vice President of Sharp Energy Solution Europe.

Unlike silicon-based solar cells, the most common type of solar cell in use today, the compound solar cell utilizes photo-absorption layers made from compounds consisting of two or more elements such as indium and gallium. Due to their high conversion efficiency, compound solar cells are used mainly on space satellites. Since 2000, Sharp has been advancing research and development on a triple-junction compound solar cell that achieves high conversion efficiency by stacking three photo-absorption layers.

To boost the efficiency of triple-junction compound solar cells, it is important to improve the crystallinity – that is the regularity of the atomic arrangement – in each photo-absorption layer. It is also crucial that the solar cell be composed of materials that can maximize the effective use of solar energy. Germanium (Ge) is used as the bottom layer with conventional cells, since it is easy to handle and produces a large amount of current. But the majority of this current is lost without effectively being converted into electrical energy. This problem is solved by the use of indium gallium arsenide (InGaAs), since this material converts light into electricity with a very high degree of efficiency. But the process of manufacturing high-grade with high crystallinity is very complex.

Sharp has now succeeded in forming an InGaAs layer with high crystallinity by using its proprietary technology for forming layers. As a result, the amount of wasted current has been minimized, and the conversion efficiency, which had been 31.5 percent in Sharp's previous cells, has been successfully increased to 35.8 percent. Sharp achieved this breakthrough as part of a research and development initiative promoted by Japan's New Energy and Industrial Technology Development Organization (NEDO)[3] on the theme of "R&D on Innovative Solar Cells".

[1] As of October 22, 2009, for non-concentrator solar cells at the research level (based on Sharp survey).
[2] Conversion efficiency confirmed by the National Institute of Advanced Industrial Science and Technology (AIST; one of the organizations around the world that officially certifies energy conversion efficiency measurements in solar cells) in September 2009. (Cell surface: approx. 1 cm^2)
[3] The New Energy and Industrial Technology Development Organization (NEDO) is Japan's public management organization for promoting research and development as well as for disseminating industrial, energy, and environmental technologies.

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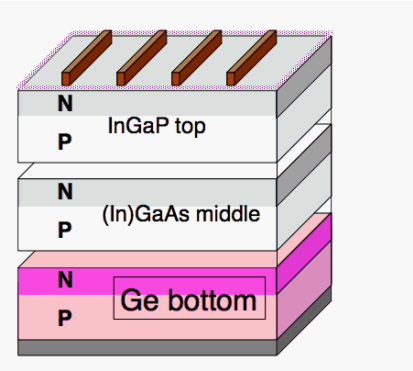
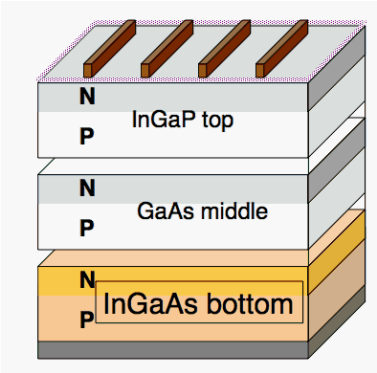
Sharp will build on this success in order to continue to improve solar cell conversion efficiency and make further advances in the technology in the future. Sharp can look back on half a century of experience in photovoltaics: Since the first development of solar cells in 1959, Sharp's experience and dedication have led to innovation after innovation. With its mono and polycrystalline solar modules, thin-film solar modules, and compound solar cells, Sharp has a variety of photovoltaic technologies in its portfolio.

Conventional Cell Structure



InGaP: Indium Gallium Phosphide
(In)GaAs: (Indium) Gallium Arsenide
Ge: Germanium

New Cell Structure



InGaP: Indium Gallium Phosphide
GaAs: Gallium Arsenide
InGaAs: Indium Gallium Arsenide

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History of Sharp Compound Solar Cell Development

1967 Development begins of solar cells for space applications using single-crystal silicon.

1976 Launch of operational Japanese satellite, “Ume,” equipped with Sharp solar cells for space applications (single-crystal silicon solar cell).

2000 Research and development begin on triple-junction compound solar cell to further improve efficiency, reduce weight, and increase durability of solar cells for space applications.

2001 Participation in research and development on NEDO’s photovoltaic power generation themes.

2002 Triple-junction compound solar cell gains certification from the Japan Aerospace Exploration Agency (JAXA).

2003 Conversion efficiency of 31.5% is achieved (at the research level) for triple-junction compound solar cell.

2004 Launch of small scientific satellite, “Reimei,” equipped with Sharp triple-junction compound solar cells.

2007 Conversion efficiency of 40.0% achieved (at the research level) for a triple-junction compound solar cell (concentrator type, at 1,100 times concentrated sunlight).

2009 Launch of Greenhouse gases Observing SATellite (GOSAT), “Ibuki”, equipped with Sharp triple-junction compound solar cells.

2009 Conversion efficiency of 35.8% is achieved (at the research level) for a triple-junction compound solar cell based on research and development efforts that are part of NEDO’s “R&D on Innovative Solar Cells” program.

Reprint free of charge, please forward a copy.

Please visit http://www.sharp.eu for further information.

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