

Spherical Surface Gives Sphelar Cell More Efficiency, Flexibility

In mid-2006, Kyosemi Corp. plans to begin full-scale mass production of its Sphelar spherical micro solar cell at its Eniwa Operation in Eniwa City, Hokkaido, Japan. While existing planar solar cells can take light only from their elevation surface, the Sphelar cell allows light to reach its cells from all directions because it has a spherical surface, providing a high level of photoelectric conversion efficiency. Since the Sphelar cell is especially strong and durable and can also be used even for curves and other flexible forms, the manufacturer expects the new product to meet a wide range of demands. The product will first find use as a power source for mobile phones.

Kyosemi will begin full-scale mass production of Sphelar cells using a 14m free-fall tube with a diameter of 30cm. This tube has been installed at the company's Eniwa Operation.

Currently, the solar cells are wired manually using paste. However, as full-scale mass production begins, an automatic wiring machine now under development will be completed. Thus, a fully automated production system covering all processes will be established.



Josuke Nakata, President

Microgravity and Surface Tension

The company uses conditions of microgravity to form the Sphelar cells from molten silicon. Surface tension causes the silicon to take on a nearly perfect spherical shape. Due to segregation effects gained during the solidification process, single crystal silicon with a purity of 99.9999 percent can be obtained. The pn junctions are created using an n-plus diffusion process. Silver paste is used to attach electrodes. The product is finished with a coat of reflection film.

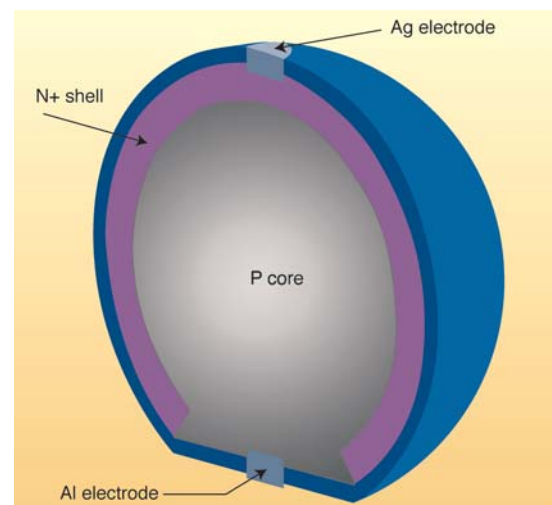
The Sphelar cell uses single-crystal silicon, which provides an especially high level of photoelectric conversion efficiency and costs less than other materials. Other materials, such as gallium arsenide, can also be used to produce the solar cell. The Sphelar cell is designed so that the electrodes on its surface are as far away from each other as possible. This enables the cell to receive light three-dimensionally.

Flexible Shapes

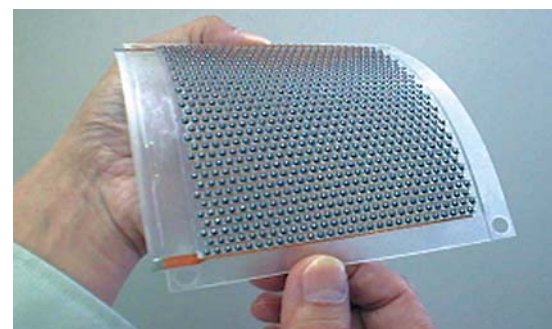
The cells are wired so that they can be easily connected, enabling the creation of modules in many different shapes.

If a Sphelar cell is encapsulated in acrylic resin, it can be turned into Flexible Sphelar sheet, a thin solar cell module whose shape can flexibly be changed into, say, a crescent or a curved form.

A module made with a series of Sphelar cells connected in parallel on silicone resin achieves a photoelectric conversion efficiency of 19 percent. Kyosemi reckons that it will be able to raise the photoelectric conversion efficiency to about 24 percent to 25 percent within five years by, for example, increasing the purity and quality



Sphelar cross section view



Sphelar flexible module

of single-crystal silicon and optimizing its shape.

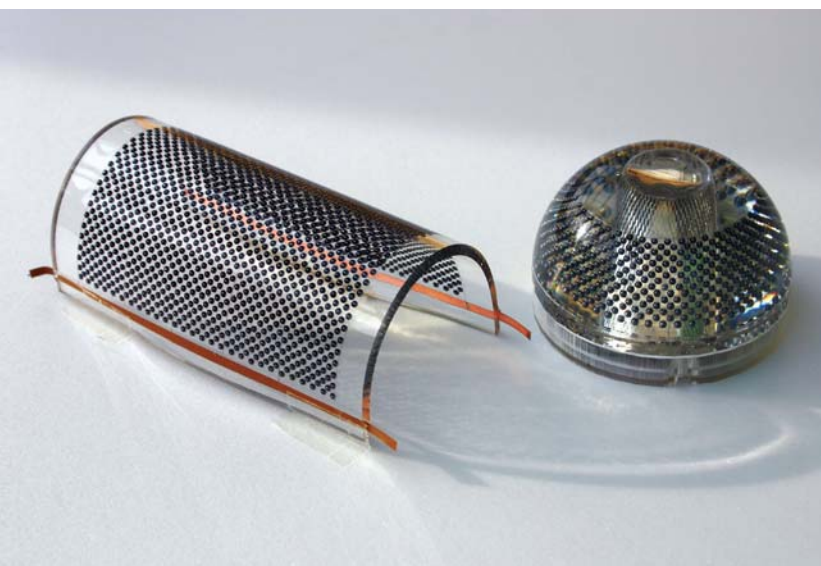
The manufacturer expects that Sphelar cells will be used for applications ranging from power sources installed on windows, skylights, and other parts of houses, to power sources for automobiles and other means of transportation. At Expo 2005 in Aichi, Japan, Kyosemi demonstrated a kind of Sphelar device. The cells in this device provided power to voice cards, which enabled visitors to hear, as they walked, about the highlights of the Show & Walk display, created by Laurie Anderson in the Japanese Garden. The cells were also used for receiving information signals driving a public address system.

At its Eniwa Operation, established in 1992, Kyosemi began to develop Sphelar technology as its new business project nine years ago. In 1998, the company opened the Microgravity Utilization Laboratory within the plant and has since stepped up the development of Sphelar cells as well as advanced optical semiconductor devices used for optical communication. With subsidies from the New Energy and Industrial Technology Development Organization (NEDO), Kyosemi continued to conduct tests for commercializing Sphelar cells until 2003. The company has also filed about 30 patent applications, including basic patents for semi-spherical Sphelar cells in 1994 and spherical Sphelar cells in 1996.

JEI



Eniwa operation in Eniwa City, Hokkaido



Flexible see-through Sphelar sheet and dome-style Sphelar module