# Ultrasonic Welding Plays Key Role in Photovoltaic Cell Assembly

*Welding method helps create solar cell arrays*

**BY JANET DEVINE**

As concerns about global warming and rising energy prices drive more businesses and consumers to consider alternative forms of energy production, ultrasonic welding is playing a key role in the manufacture of the solar cells that make up solar panels.

A solar, or photovoltaic, cell contains materials that produce small amounts of electric current when exposed to light. The ultrasonic welding process attaches aluminum conductors to treated glass so that interconnects between photovoltaic cells can create an array with sufficient voltage and current to provide a practical source of electrical power.

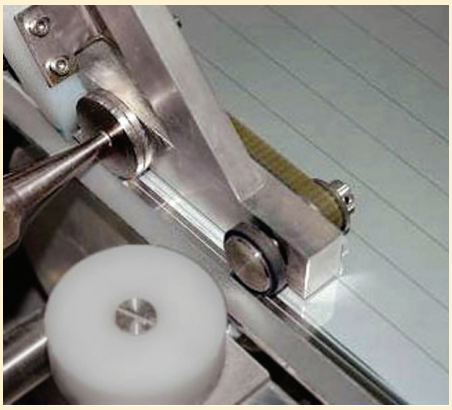

*Fig. 1 — The ultrasonic welding process attaches aluminum conductors to treated glass so that interconnects between photovoltaic cells can create an array with sufficient voltage and current to provide a practical source of electrical power.*

*Fig. 2 — For manufacturers of solar cells, as well as aluminum and copper foil processors, ultrasonic welding offers the fastest and highest quality method of welding.*

## Photovoltaic Cells

In photovoltaic cells, a thin semiconductor wafer — usually composed of silicon — is treated to form an electric field that is positive on one side and negative on the other. When exposed to sunlight, the semiconductor material releases electrons from the atoms that make up its structure, producing an electric current.

In order to produce usable amounts of electrical energy, photovoltaic cells are connected and mounted in a support frame to create a photovoltaic module. Multiple modules can then be wired together and encapsulated, usually behind glass, to form an array. The larger the area of the array, the more electrical energy. Ultrasonic welding produces a low-resistance joint and minimizes the loss of electrical energy when modules are connected.

## Benefits of Ultrasonic Welding in Photovoltaic Cell Manufacturing

To connect modules, a thin layer of metal is deposited on the glass. Then, an ultrasonic seam welding machine attaches a strip of aluminum foil to the metal layer on the glass, permitting electrical interconnections to carry enough energy for practical use — Fig. 1. The bond is produced through the momentary application of mechanical vibratory energy under pressure. The ultrasonic seam welding machine operates at high frequency with low pressure and amplitude to securely attach the aluminum strip to the metal without cracking the glass.

Ultrasonic welding provides a number of benefits for manufacturers of photovoltaic cells. The bonds created during welding have essentially the same strength and structure as their base materials. Bonds are achieved without melting and without excessive heat, fluxes, filler metals, tapes, or other consumables, making the welding process neat, clean, and economical. Additionally, ultrasonic welding is faster than other welding methods, does not distort materials, and generally requires minimal operating and training costs.

Sonobond Ultrasonics' MS-5010B Ultrasonic Foil Splicer™ is used by numerous photovoltaic cell manufacturers, including Bangkok Solar, of Thailand; New Jersey-based Energy Photovoltaics, Inc. (EPV); and EnerGoSolar, of Hungary. Additionally, the welding machine is incorporated into equipment manufactured by EPV, and Kraft Electronics, Inc., and Kraft Project Ltd., both of Hungary.

## Ultrasonic Seam Welding Machine

Applicable to numerous aluminum and copper foil processes, the ultrasonic seam welding machine is also used in most aluminum foil mills in the United States and elsewhere, replacing a taping method. It consists of a power supply with solid-state frequency converter, a welding head, and a rotating disk that traverses the foil at speeds up to 15 ft/min (4.6 m/min), although welding rates vary depending on the thickness and type of alloy being joined. Aluminum foils up to 0.006 in. (0.15 mm) thick can be joined. Since seam welds have metallurgical and dimensional characteristics similar to the original materials, rerolling, laminating, and printing processes are facilitated.

## Universal Recognition

For manufacturers of solar cells, as well as aluminum and copper foil processors, ultrasonic welding offers the fastest and highest quality method of welding — Fig. 2. Without requiring additional consumables or costly and extensive operator training, ultrasonic welding is also the most efficient assembly choice. As the need and demand for alternative sources of energy increase in the near future, recognition of the benefits of ultrasonic welding among producers is likely to continue to grow.◆

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