

Systems engineering for solar absorbers

The Swiss company Sunlaser plays a special role in the European solar thermal industry. It has brought forward laser welding as a production method for solar absorbers and, along with this technology, an increase in absorber sheets made from aluminium – against considerable resistance from some quarters.



Sunlaser produces welding systems in which a carousel transports the absorbers into the laser welding chamber.



At the Spanish collector manufacturer Hucu, a robot charges the Sunlaser welding unit.

Outside, it is cool on this 9th November 2005. Inside, however, in the Solar Information Centre in Freiburg, Southern Germany, the debate is hot. In front of the rows of seats filled with the assembled solar experts, Stefan Brändle demands that the German Fraunhofer Institute for Solar Energy Systems, the host of the solar thermal energy symposium, officially withdraws its report about heat shock tests on laser-welded aluminium absorbers. "It is not the tested product that has given rise to the poor results, but an unsuitable choice of material and the testing conditions," explains the managing director of the Swiss company Sunlaser AG from Niederuzwil. He is referring to tests that were conducted by the scientists from Freiburg on behalf of the European Copper Institute during which welding points on an aluminium absorber had burst off.

Production systems engineering instead of own production

Several months earlier, the 15 page paper with the bad results had been handed out to individual participants at the OTTI symposium on solar thermal energy in Bad Staffelstein, Germany. Brändle, who had started the production of aluminium absorbers in 2003, explained in Freiburg that it had taken him a great deal of effort to regain his customers' confidence during the weeks that followed the publication of the Fraunhofer report. He presented to the symposium participants the results of temperature resistance investigations which had been carried out by the Swiss testing laboratory in Rapperswil on an aluminium absorber from his production. "In these tests, it has demonstrated its suitability for application," emphasised Brändle.

Meanwhile, the temperature in the industry has returned to normal again. Laser welding technology and the utilisation of aluminium as an absorber material have become established. Brändle, however, has stopped his own production and is now active in the sales and marketing of turnkey laser welding units. Since 2006, he has focussed on making this technology available worldwide through his newly founded company Sunlaser Consulting GmbH in Bichwil/Switzerland – and he has been successful. In 2007, he delivered two turnkey production units. One went to Austria, to the company Sun Master Energiesysteme GmbH in Kirchdorf/Krems, the other to Germany, to the company Solvis GmbH & Co KG in Braunschweig.

For the North German collector manufacturer, it was already the second unit after the company had taken over the production line and the OEM customers from Sunlaser two years ago. Inside the two laser portal systems, a laser head is hidden in a protective box and moves along the absorbers. At a welding speed of 15 m/min, the laser portal systems produce large-scale absorbers that are up to 6 m long and 1.40 m wide. A cassette change system on two levels carries the absorbers into the welding chamber. In the case of the five units that have recently been delivered, among others to the company Hucu Solar Espana S.L. in Antequera/Málaga, Spain, and to the company Nobel Xilinakis D. & Co in Aharnes, Greece, a carousel device turns the absorbers in a welding chamber.

A welding method for aluminium absorbers

Companies the world over have already ordered further laser welding units. "In fact, the development has proceeded much faster than planned," says Brändle, who is additionally working as a consultant for Alanod Aluminium Veredlung GmbH & Co KG in Ennepetal, Germany. The company supplies selective aluminium band for absorber production. In cooperation with Alanod, Brändle has made the material, which is called Mirotherm, widely known in the sector. "Sunlaser has developed the welding procedure that is required for the processing of Mirotherm. We wanted to bring the production method to the market and to create acceptance for the

new material." With its laser welding facility, Sunlaser produced 120,000 m² of absorber area in 2005 alone, for about 20 customers, primarily in Europe. In order to be able to grow further with the market, Brändle would have had to invest again. He chose another path, sold the system to Solvis and from then onward focussed on selling the production method to other manufacturers.

The technology is considered ground-breaking for various reasons: It joins the absorber tubes to the absorber sheet without any visible welding seam on the surface, the joint withstands the high temperatures of highly efficient, modern flat plate collectors, and handling the material combination aluminium/copper is relatively trouble-free with this technique. Especially the latter point makes laser-based production attractive. Those who use aluminium as the material for the absorber sheets can save costs because the raw material is cheaper than copper. At a price advantage of 6 to 7 €/m², the investment for a laser welding system, which is more expensive than a conventional ultrasonic welding machine, can pay off after only a few years. "From 50,000 m² of produced absorber area per year upwards, the purchase is profitable," says Brändle.

Sunlaser focuses on full aluminium absorbers

The manufacturing systems are built by Geiser Tech AG in Otelfingen, Switzerland. The mechanical engineering company is in charge of development, production and order processing. Its staff members assemble the structure using profile systems from the German Minitec Maschinenbau GmbH & Co KG, for which Geiser Tech is the Swiss representation. Subsequently, they integrate the electronic and pneumatic components as well as the laser device. They are well versed in laser welding technology. After Brändle had sold his own production facilities and had agreed on cooperating with Geiser Tech AG, the mechanical engineering company took over his production team. "A large part of our success can be attributed to the fact that the key members of staff from the production department of Sunlaser not only pursue the further development of the system technology at Geiser Tech AG today, but can also fall back on a wealth of experience from their own production period, and thus have a very clear understanding of our customers' requirements and know how to implement them," explains Brändle. "We not only have the necessary understanding of systems engineering, but also of practical application."

In order to allow collector manufacturers to produce at even lower costs in the future, Brändle is managing a project that deals with the development of a full aluminium absorber. Up to now, the solar fluid has flowed through copper tubes, even in the case of aluminium absorbers. In the future, it is planned to replace these with aluminium tubes. At the trade fair Intersolar 2008 in Munich, the company Standard-Metallwerke GmbH from Werl in Germany, which is participating in the project, presented a tube made from a corrosion-resistant special aluminium alloy called S-Life Solar. Labora-



A technician from Minitec, Switzerland, checks the control system of the absorber welding unit.

Photos (5): Sunlaser



View into the laser welding chamber

tory tests for corrosion resistance with various solar fluids have already been conducted, because aluminium has higher requirements on corrosion protection than copper. Special inhibitors are needed in the solar fluids to block any potential corrosion processes. At high temperatures, however, the chemical compounds can break down and thus become ineffective. According to Brändle, suppliers of solar fluids are now developing inhibitors that are also able to withstand the high temperatures arising in the case of stagnation. "The other possible solution is to avoid stagnation occurring, so that the glycol is not overstrained," he explains. This, he adds, is an issue for the system providers.

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Further information:

www.minitec.ch
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The laser head is mounted.