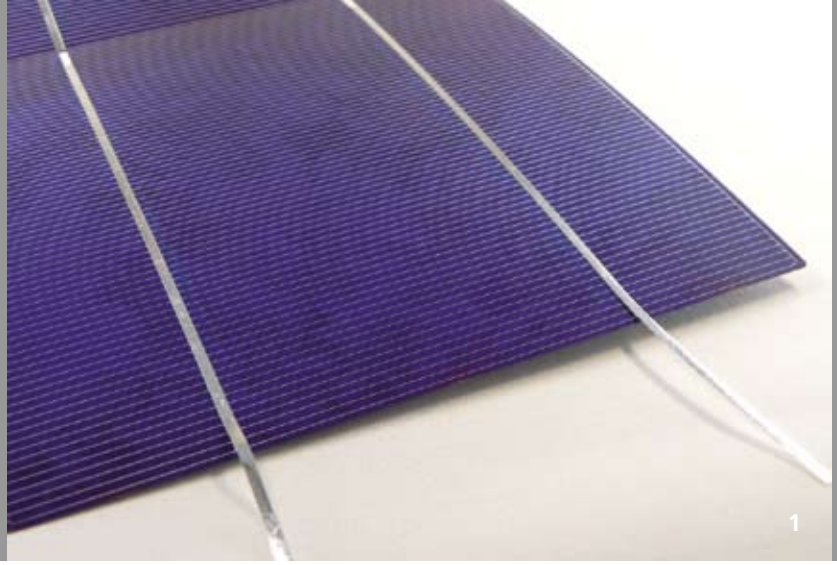

LASER SOLDERING SOLAR CELLS

Task

The requirements upon the service life of photovoltaic modules and their production quality related to this have increased continuously in the last few years. At the same time, the production costs have had to be lowered by reducing the wafer thickness to below 150 µm and by raising process cycles. A key process in module production is the cell contact, by which the metal cell interconnectors are soldered onto the solar cell. The goal here is to minimize the mechanical and thermal load while the cell interconnectors are joined, to avoid cell breakage caused by induced stress. In the course of this, the process time should remain under three seconds.

Method

Thanks to its lower energy input, laser soldering has great potential to fulfill the demands placed upon it when compared to conventional processes. For the radiation of the cell interconnectors, a process approach has been chosen which uses a laser scanner as well as fixed optics with linear beam forming. The integration of a pyrometric measuring system with a galvometer scanner enables the temperature distribution to be identified in the joining zone in order to make an individual energy input possible. In the course of optimizing the process parameters, such as laser power, feed speed and processing strategy, the cause for arising microcracks was analyzed. Through the beam forming with fixed optics, the entire joining zone is simultaneously heated. At the same time, thermal imaging cameras were used to test the process for processing errors.

Result

When linear fixed optics are used, the cell interconnector can be joined over the entire length in a time down to 0.2 s. The galvanometer scanner enables process times in the range of 1 - 2 s and creates contacts with peeling forces of up to 6 N due to distortion-minimized processing strategies. Crack formation in the contacting process can be prevented by minimal energy input.

Applications

This laser bonding technology is used to contact conventional crystalline silicon solar cells. Thanks to its geometrical freedom during the scanning processing, it is possible to expand the applications to back-side contact solar cells with punctual contacts. Potential further applications are possible in bonding technology in the electronics sector.

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1 Solar cell with joined cell interconnectors.