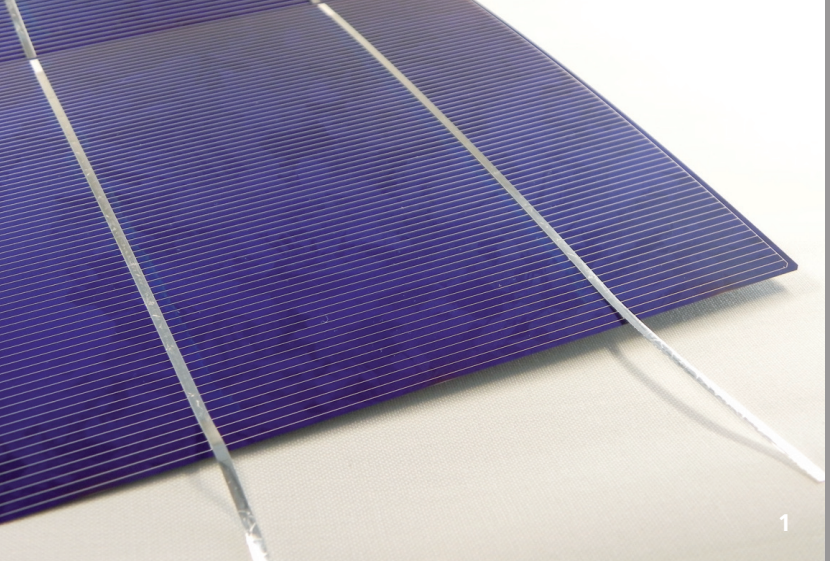

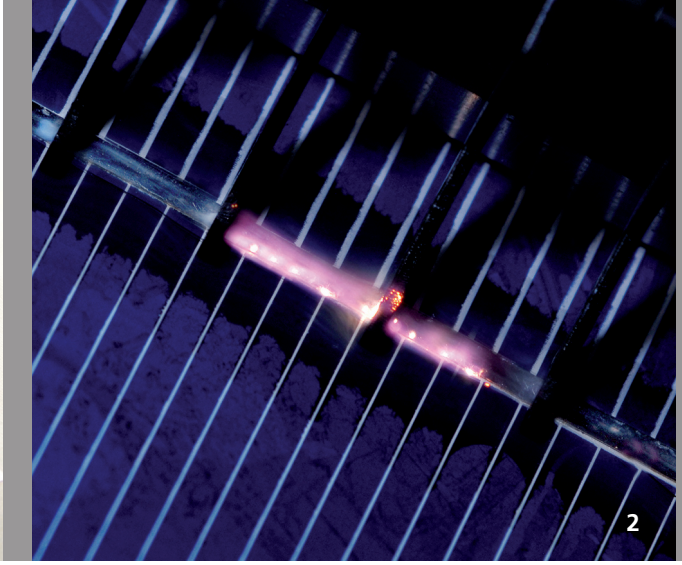

LASER SOLDERING IN PHOTOVOLTAICS

Task

The technical requirements for solar cells have increased constantly in the past few years regarding their life cycle and the required quality of the manufacturing process. At the same time, production costs have to be reduced by using thinner wafers and a lower process cycle time. A key process in the production of photovoltaic modules is the interconnection of the cells. In this process, the solar cells are interconnected by using laser soldering to attach metallic interconnectors.
The aim of the laser soldering is to minimize the thermo mechanical stress induced by the joining process and, hence, to reduce discard caused by cell breakage. In addition, the joining process must be done in a process time of less than 3 s.

Method

Compared to conventional processes, the laser soldering process holds the highest potential to fulfill the requirements above due to its low energy deposition. By applying a galvanometer scanner with pyrometric sensor systems, researchers at the Fraunhofer ILT are able to identify the temperature distribution in the joining zone. This information can be used during the process to control and regulate the deposited amount of energy. During the optimization of the process parameters e.g. laser output power, feed rate and motion pattern, the cause for process-induced micro cracks is analyzed. The application of a fixed optic allows the complete joining zone to be heated quasi-simultaneously, which is checked for process failures with a thermal camera.

Result

The application of a fixed optic allows the interconnectors to be joined over the complete length in a process time of 1 s. The galvanometer scanner enables process times of 1 - 2 s and interconnections to be made with a peeling strength of up to 6 N through distortion-minimized process strategies. The crack development in the joining process can be hampered by minimal energy deposition.

Applications

The laser soldering technology is used to create interconnections of crystalline, silicon based solar cells. This application can be extended to innovative back contact cells with punctual joining zones thanks to the geometrical freedom of a scanning system. Further applications of the joining technology are possible in the electronic industry, e.g. SMT (Surface Mounted Technology).

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1 Solar cell with joined interconnector.

2 Laser soldering process.

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