



## LASER JOINING FOR BATTERY PACKS

### Task

When battery packs are produced, the individual battery cells are always joined in order to create higher voltages and higher capacities. Thus, joining cells is a key step, one which needs reliable connections and robust processes with a high demand for automation.

Fraunhofer ILT has developed a process whereby the modules of a battery pack are built out of small-format cylindrical cells of the type 18650. On account of their metal housing, these cells offer possibilities for direct cooling. By means of laser micro welding, both poles of the cell are contacted on the upper side, and the cells are switched in parallel into units (blocks) that act as individual cells for the battery management system (provided by Fraunhofer ISE) and the overall system. To directly cool the individual cells internally, one block is provided with PCM slurry (provided by Fraunhofer UMSICHT) without additional heat conducting structures inside the block.

### Method

Due to the material combination – copper on nickel-plated steel and the process requirements (seam width, weld depth) – simple laser welding strategies are not sufficient to reach high process capability and stability. The approach chosen in this application is spatial power modulation where the global beam feed is superposed with an oscillating movement, making it possible to weld on the rounded edges of the battery can and allowing both terminals to be contacted from the upper side. Furthermore, this technique allows for welding without damaging the cell by controlling the weld depth also for different battery cell designs and materials. The low energy input can also be used to weld metal, which is on top of thermally sensitive materials, e. g. plastics.

### Applications

This method is applicable for all hard-case battery cells and can also be adjusted for pouch-bag cells. Fraunhofer ILT develops customized processes, like the process solutions described here, which can be transferred by contractual development projects.

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1 Cross section of connection at the negative terminal on the top side of the can.

2 Battery block with laser-welded joints between 18650 cells and collector on the bottom side of the can.