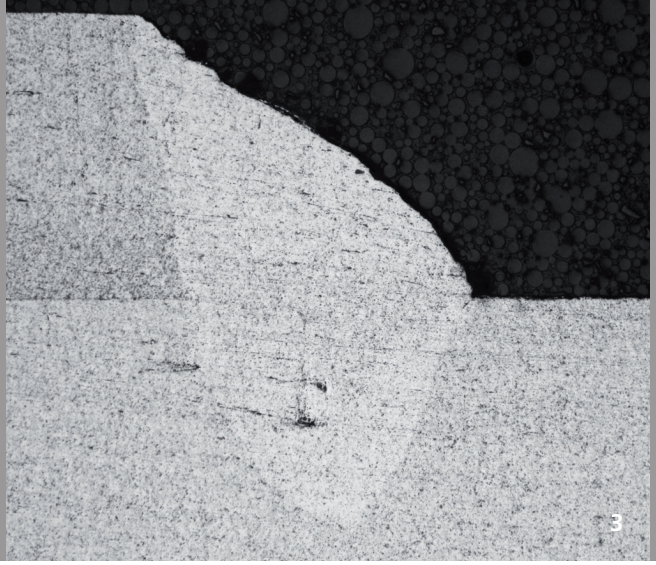

LASER-BEAM WELDING OF LITHIUM-ION BATTERY CELLS

Task

Electric mobility is dependent on highly stable and reproducible electrical connections to the lithium-ion batteries cells used in this sector. As part of a process study, reliable welds should be tested on prismatic lithium-ion cells. Lithium-ion battery cells were installed in a fixed housing made out of aluminum. The aluminum poles which exit the housing were either screwed or welded in place. Since aluminum forms an electrically insulating oxide layer in air, a consistently good electrical contact between the two aluminum poles can only be ensured by a welded connection if no other additional measures are taken. The temperature rise in the cell due to the welding may reach a maximum of 120 °C during the welding process.

Method

To generate the connection, the welding process uses local power modulation in the form of circular oscillating movement superimposed on a linear feed movement. The parameters oscillation frequency and amplitude thus expand the design freedom of the weld seam considerably. The process allows a constant weld and connection width. When the power is modulated spatially, the melt pool can be positively influenced and the temperature gradient controlled in the melt pool.

Result

The increase in process stability through local power modulation leads to a uniform weld penetration depth and connection width in an overlapping fillet weld configuration. The contact pole of aluminum 1050 (d = 1 mm) is welded on the cell pole in aluminum 3003 (d = 6 mm). The measured temperature in the cell pole was < 60 °C. The sealed battery modules were then tested on a battery test bench manufactured by FEV GmbH. This demonstrated that the joints have very low electrical contact resistance and exhibit a homogeneous temperature distribution under current load.

Applications

This process can be applied primarily in the automotive industry, mobile machinery, stationary energy storage and recreational vehicles.

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3 Micrograph.

4 Lithium-ion cell.