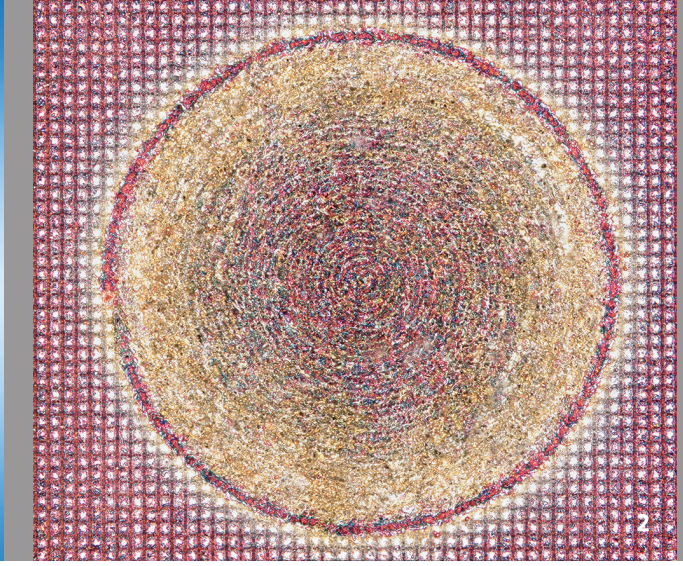

MICROWELDING WITH SHORT PULSE LASER BEAM SOURCES

Task

Joining high-current connectors made of copper or aluminum with large cross-sections pose a special challenge in joining technology. They are increasingly used in power electronics and contacted to thermally and mechanically sensitive substrates (e.g. battery cells and printed circuit boards). It is essential to precisely control the welding depth and energy input with minimum component stress. The use of nanosecond beam sources provides a novel solution to better control the energy input and to contact dissimilar materials.

Method

A nanosecond pulsed fiber laser is mainly used where material needs to be ablated, such as for laser drilling, engraving, cutting and laser structuring. Fiber lasers operated in continuous wave (CW) mode are generally used for contacting copper and aluminum connectors. In order to investigate the suitability of a pulsed laser beam source for welding, Fraunhofer ILT is defining the process limits and investigated samples made out of dissimilar materials in terms of various properties, such as contact resistance and mechanical load capacity. For benchmarking purposes, a fiber laser operated in continuous mode is used to produce samples for comparison.

Results

The laser beam source described here was integrated into a typical setup for laser welding and used for welding copper connectors that were up to 300 µm thick. Welding depths and seams with comparable quality to conventional laser beam welding could be demonstrated.

Applications

Welding with a nanosecond pulsed fiber laser can be applied in various areas of power electronics and battery technology. The nanosecond laser is particularly important where several processes (including structuring and welding) have to run in parallel. In addition, this laser beam source allows for greater flexibility when welding high-gloss metals.

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1 Positive pole contact with a copper connector without burn-through.

2 Spiral blind weld.

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