Laser beam soldering with 450 nm visible wavelength

In industry, lasers in the infrared wavelength range (808–940 nm) are commonly used as a standard for laser beam soldering of electronic components and component groups. In this wavelength range, the solder in the solid state is absorbed by approx. 30 to 50 percent, a fact that limits the achievable efficiency of the production process. In the BlueSold research project, Fraunhofer ILT has researched and developed a laser manufacturing process for laser-beam soldering with a wavelength of 450 nm (blue) over the past two years.

More efficiency through the use of blue wavelengths

To reach a cost-effective and industrial solution, Fraunhofer ILT and Mergenthaler GmbH have developed a specially designed laser beam source that makes it possible to precisely match the laser beam properties to the required soldering process. When the blue wavelength is used, the degree of absorption in the solid material state can be increased to 40 to 60 percent.

For process development, the partners investigated methods using high-speed cameras and additional in-situ X-rays at the Deutsches Elektronen-Synchrotron DESY. In this way, the properties of various solders could be tested as could the solders' suitability for use with the innovative laser beam source. The project partners mainly focused on improving the internal quality of the solder joint as well as the melting and wetting properties on the PCBs used.

Higher productivity through parallelization

Laser beam soldering using a 450 nm wavelength can be carried out faster and more energy-efficiently due to the increased absorption. In future, this fact will be used in the SoLaVi project to apply the laser beam to the workpiece using a spatial light modulator (SLM). With the help of an SLM, the laser beam can be split into individual partial beams with pinpoint accuracy in order to process several solder joints simultaneously. This significantly increases how well the laser beam at 450 nm wavelength is absorbed so that more efficient soldering processes can be developed.

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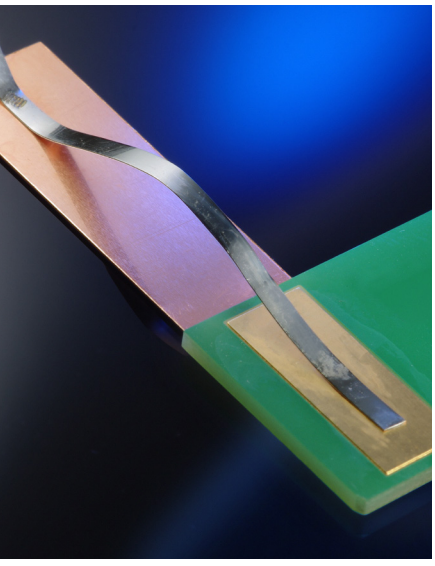

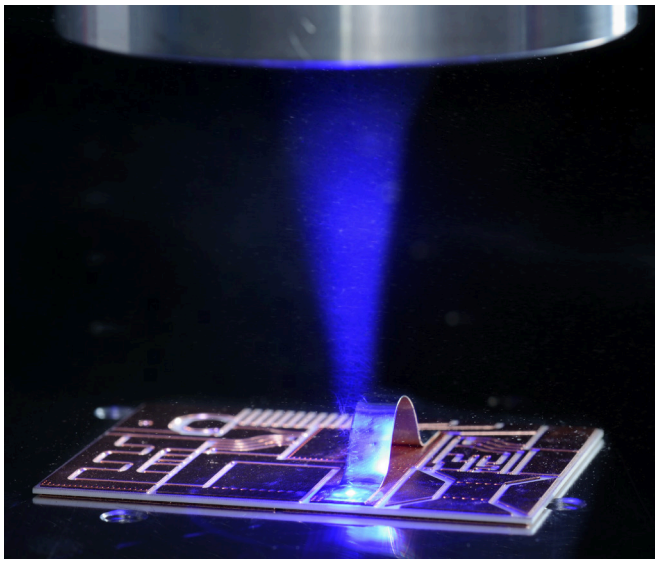

1 Laser-beam soldering.
2 High-speed image of a laser-beam soldering process.