



METALLIZATION OF CERAMICS THROUGH PROCESS-ADAPTED MATERIAL DESIGN

Task

Materials innovations often succeed by combining dissimilar materials intelligently. Their very different thermophysical properties, however, present special challenges when, for example, metallic and ceramic materials are combined, such as in electronic and optical applications. The soldering technology currently in use is limited by the temperature range – when soldering partner is melted, the ceramic material can be damaged – and by the complexity of the necessary vacuum technology. In the LaMeta project, Fraunhofer ILT and its partner Euromat GmbH are developing new soldering materials especially designed for metallization with laser radiation. They can be used to reduce the temperature needed in the process by up to 200 °C and to replace vacuum furnace treatment by selective remelting with laser radiation.

Method

The project partners have considered the composition of the solder, the application technique and the laser process to produce firmly adhering metallic layers with a thickness of several 10 µm on Si- or W-based ceramics. Ag-based active solders are added with various micro- and nanoadditives to trigger chemical reactions with the ceramic. For the application, they are printed or sprayed in the form of pastes or inks. Material

design and laser process parameters are adapted to each other in an iterative process. The functionality of the metallization is tested by soldering LEDs and joining honing tools to the produced coating.

Results

Initial silver layers with nanoadditives could be applied to tungsten carbide with thicknesses of $11 \pm 2 \mu\text{m}$ without cracks by remelting the silver layer spread on it. Current challenges are improving the homogeneity of the coating application and achieving required values with regard to conductivity, adhesion and thermal stability.

Applications

In addition to the applications mentioned above, the process could also be used in the areas of sensor technology, electronics and optics.

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1 Silver layer on tungsten carbide.