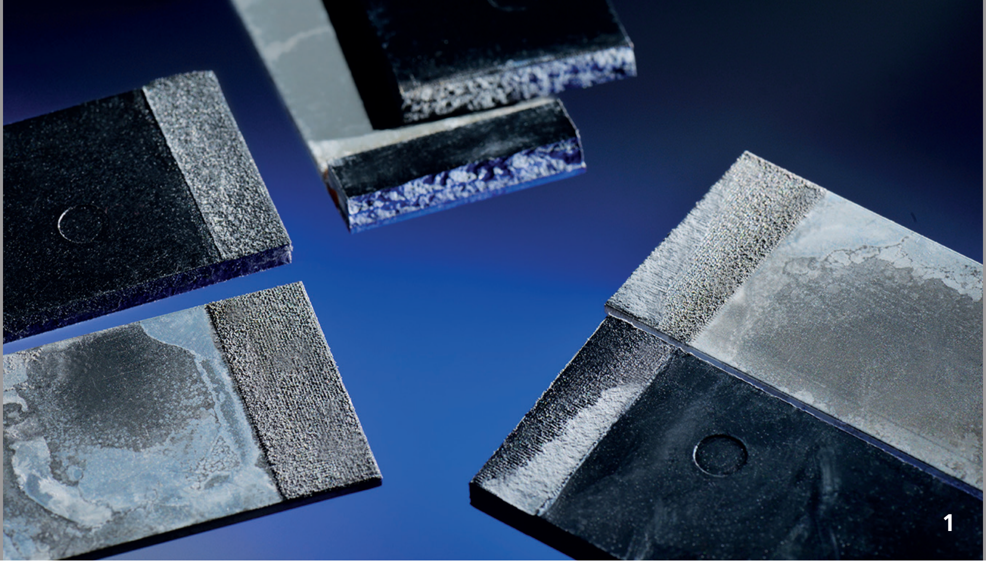

Subject to alterations in specifications and other technical information. 06/2020.

AGEING BEHAVIOR OF THERMALLY JOINED PLASTIC-METAL HYBRID COMPOUNDS

Task

Multi-material design opens up new ways of optimizing weight since it employs different materials adapted to local loads. However, joining technology, especially for plastics and metals, faces a particular challenge as the materials are physically and chemically dissimilar. In addition, hybrid joints are subjected to high stress during use because the materials have different properties, such as thermal expansion and corrosive infiltration. The ageing behavior of such compounds is, therefore, of crucial importance for the long-term stability of a component that consists of them.

Method

Fraunhofer ILT has developed a process chain in which laser radiation is used to create microstructures in the metallic joining partner. In the subsequent thermal joining process, the plastic is melted and bonds with the microstructures. So that long-term stability can be better understood, hybrid joints of different metals (aluminum alloys, steel) with polypropylene are subjected to climatic change and corrosion tests. Lap shear tests are then used to determine the strength before and after aging.

Results

The results of the lap shear test before and after the climatic change tests, with up to 30 cycles between -40 °C and 80 °C, show no significant decrease in the bond strength of the hybrid joints. Likewise, the corrosion climate change tests do not impair the lap shear strength in any detectable manner. This testing thus confirms that the process can compete with other joining methods for plastic-metal hybrid connections in a variety of applications.

Applications

Thanks to the good long-term stability of the hybrid connections under a wide range of environmental conditions, the laser-based joining process is particularly suitable for applications in automotive engineering or the aerospace industry.

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1 Fractured surfaces of the hybrid connection after corrosion tests.

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