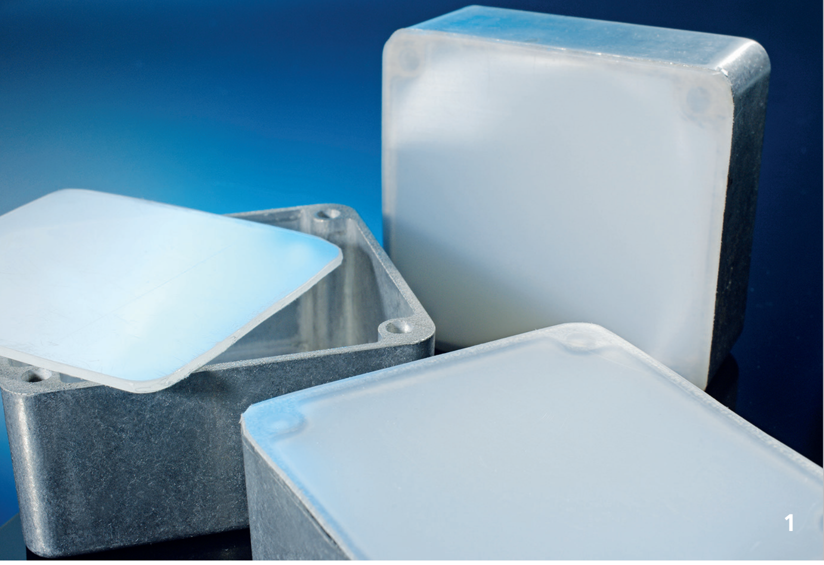

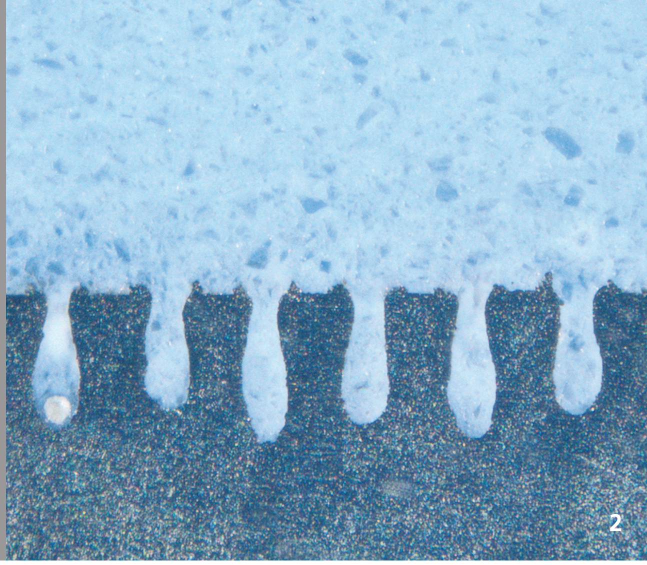

REUSABLE PLASTIC-METAL HYBRID JOINT

Task

Joining dissimilar materials poses major challenges for almost all sectors of the manufacturing industry. By combining the use of different materials in a hybrid compound, such as plastics with metals, manufacturers can not only add functional enhancements, but also save weight. While plastics are particularly light, inexpensive and easy to shape, metals can be subjected to significantly higher mechanical loads thanks to their mechanical properties. However, a direct material bond between the two materials has so far failed due to their chemical and physical differences. A connection by positive locking or the use of filler materials is, therefore, necessary. However, a material-to-material bond is difficult to undo after joining, making it difficult to separate the two components by type or to replace a component for repair.

Method

Fraunhofer ILT has developed a process chain for joining plastic to metal in which laser radiation is first used to generate microstructures in the metallic joining partner. In the subsequent laser joining process, the plastic is plasticized and positively bonded by allowing it to claw into the microstructures. This connection can be easily released again with local heating, so that an assembly can be separated by type or a part can easily be exchanged.

1 Reusable electronics housing made of die-cast aluminum with PA6 plastic cover.

2 Cross-section of a die-cast aluminum alloy.

Results

The tensile shear connection investigated is made of die-cast aluminum and a polycarbonate (Makrolon©). The joint strength measured immediately after the joining process is approx. 18.4 MPa. The measured strength value corresponds to the range of a structural adhesive bond. After the bond was loosened by mechanical testing, polycarbonate was rejoined to the structured metal and subsequently tested. The strength of the joint was measured, reaching 18.8 MPa, proving that it was possible to rejoin the structured metal samples without a loss of strength.

Applications

Hybrid components combine the specific advantages of their different materials, resulting in lightweight and rigid components with additional functions at the same time. The laser-based joint can also be dissolved and rejoined several times without loss of strength. Furthermore, it offers great potential in terms of sustainability and reusability. The approach presented here is particularly suitable for the aerospace and automotive industries.

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