



T-JOINT CONNECTION OUT OF PLASTIC AND METAL

Task

Particularly in the automotive industry, the combination of dissimilar materials presents manufacturing engineering with major challenges. Notably, the adapted use of plastic and metal opens up further potential for weight savings. While plastics are characterized by their low weight, low price and almost unlimited shape, metals can withstand significantly higher mechanical stresses due to their mechanical properties. Directly and firmly bonding the two materials together fails, however, on account of the chemical and physical dissimilarity of plastic and metal. To create such a connection, a positive locking fit or the use of additional materials is, therefore, required.

Method

At Fraunhofer ILT, a process chain has been developed to connect plastic with metal, in which microstructures are generated in the metallic bonding partner by means of laser radiation. In the subsequent laser joining process, the plastic is plasticized and interlocked into the microstructure through a clawing mechanism. In the specific case of a T-joint connection, an incident laser angle is used to structure the metal component, thus generating larger undercuts that can withstand higher tensile loads.

Result

The generated T-joint connection consists of a micro-alloyed steel and a short glass-fiber reinforced polyamide. In comparison to vertical structuring, a 45° incident angle increases the tensile strength of the T-joints by 30 percent. At an incident structuring angle of less than 45°, the sample breaks at a load of 18 MPa; in comparison, the vertically structured sample, however, already fails at 14 MPa. If this strength is applied to the load-bearing cross-section – i.e. the structure width* structure length*structure quantity – the base material strength of the plastic material is reached.

Applications

By using hybrid combinations of components, the ILT engineers can take advantage of the material-specific characteristics of different materials, making it possible to generate simultaneously light and rigid components. For this reason, the two-step method presented here is especially appropriate for the aerospace and automotive industry.

The work presented here was financed within the EU-funded joint project »PM-Join«.

Contacts

Dipl.-Wirt.Ing. Christoph Engelmann
Telephone +49 241 8906-217
christoph.engelmann@ilt.fraunhofer.de

Dr. Alexander Olowinsky
Telephone +49 241 8906-491
alexander.olowinsky@ilt.fraunhofer.de

- 2 Cross-section of a T-joint structured with a 45° incident angle.
- 3 T-joint of a metal-plastic connection.