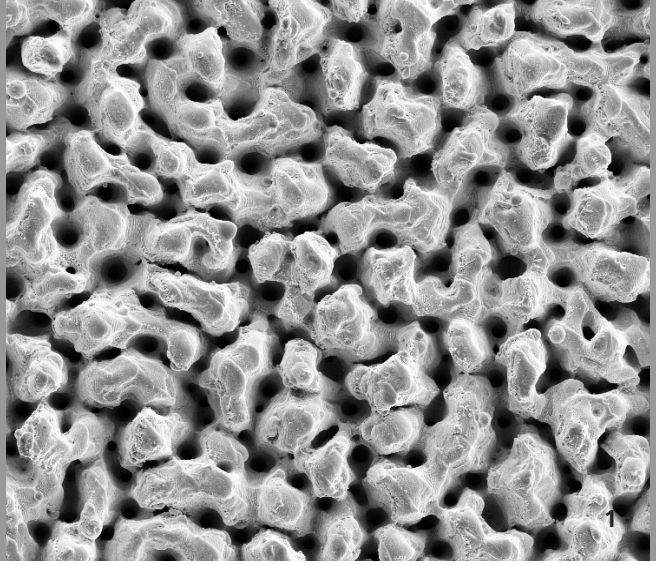
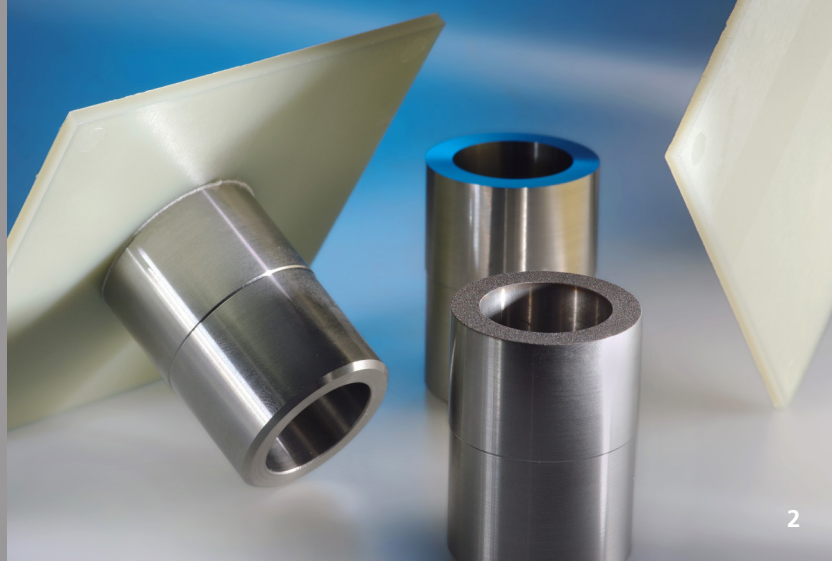


1



2

USING ULTRAFAST LASERS TO GENERATE PLASTIC-METAL HYBRIDS THROUGH MICRO- AND NANOSTRUCTURING

Task

The production of plastic-metal hybrid components is a central issue in lightweight automotive construction. For this purpose, reinforced plastic components are the key technology, but often require metallic reinforcements and hybrid joints to transmit high loads. Today, these plastic-metal compounds are usually glued. In order to achieve short process cycles and low production costs, the industry needs fast and capable inline joining processes that can be integrated into the manufacturing process of the components and ensure high bond strengths.

Method

Today, metals and plastics can already be connected thanks to a positive-locking fit in the structured metal surface. Fraunhofer ILT has developed a new process chain that generates, in addition to the positive-locking bonded joint, a specific adhesion between plastic and metal and creates a lasting and adhesive-free connection. To this end, ultrafast laser radiation is used to generate a combination of micro- and nanostructures in the metallic joining partner. These structures make it possible to transfer force via the mechanical interlocking connection and create high adhesion over a nanostructured surface within the microstructure. In the following joining process, the heat from the metallic joining partner softens the plastic, which flows into the microstructures and results in a strong and durable connection.

Results

High power ultrafast lasers can be used to generate high static structures with an extremely high structural density. These structures make it possible to produce nearly isotropic joints between plastic and metal. The tensile shear strengths that can be achieved, depending on the plastic used, are approx. 25 MPa. The necessary micro- and nanostructures are generated through full-area ablation of the surface.

Applications

Due to the large potential for lightweight hybrid connection, the new process is especially suitable for the aerospace and automotive industry. The results were achieved within the »HyBriLight« project, conducted on behalf of the Federal Ministry of Education and Research (BMBF), grant number 13N12718.

Contacts

Kira van der Straeten M.Sc.
Telephone +49 241 8906-158
kira.van.der.straeten@ilt.fraunhofer.de

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

1 Microstructure on stainless steel (1.4301).

2 Test specimens made of steel and PA6.6/GF25.