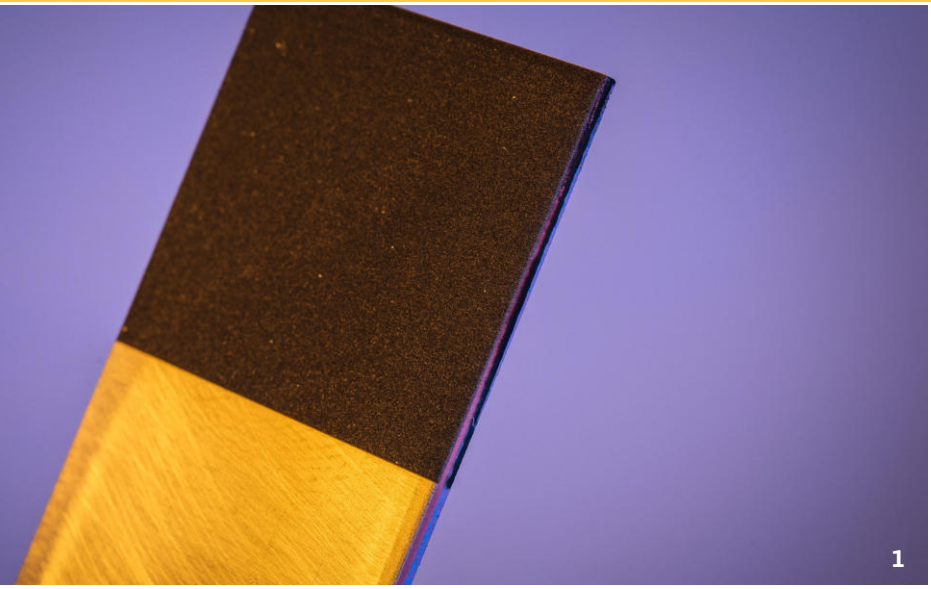

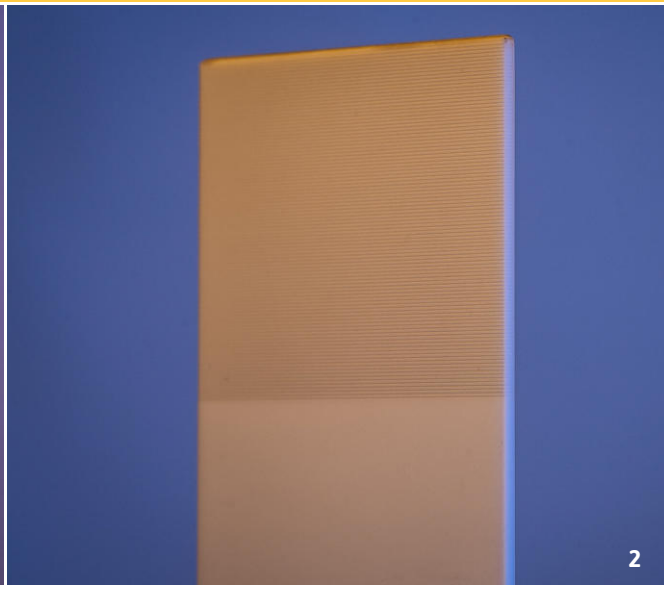

Roughening of metal and ceramic surfaces for the optimisation of fusion processes

PULSAR PHOTONICS APPLICATIONS

BETTER CONNECTION OF JOIN PARTNERS BY USING MICROSTRUCTURES WITH UNDERCUTS

With the use of ever increasing material diversity in electronical and medical products as well as in the automative engineering, fusion processes of unequal materials (e.g. metal-plastic, metal-ceramic) are getting more and more important. Typical fusion processes that are used in this sector are bonding or thermal procedures like laser welding. The qualtity and the capacity of the fusion point are critically depending on the surface characteristics of the join partners.
Therefore, a roughening or a focused microstructuring of the surface can increase the contact area of the join partners. With ablative laser processes it is also possible to produce structures with undercuts that lead to a particularly high mechanical strength of the adhesive bond or the welded connection.

EFFECTIVE MICROSTRUCTURING OF SENSITIVE COMPONENTS BY USP PROCESSING

Laser structuring with an ultrashort pulse laser is particularly suitable for join partners with a high thermal sensitivity. With thermal penetration depths in the range of a few micrometers an USP laser structuring allows to roughen the contact area without damaging the deeper layers of the material.

Depending on the material, several structure types are possible:
A deterministic structuring with for example a ditch or pattern structure increases the contact surface efficiently and provides a better bonding with the join partner for the glue.
By adjusting the laser beam to the workpiece, oblique drillings can be included by special procedures, which lead to a better grip of the fusion.
For metalic materials, in particular steels, aluminium or titanium, a statistical structure can be used. These so called Cone-like-protrusions (CLPs) are created during the USP processing by a self assembly effect. It results in a hierarchical structure in the range of micrometers superimposed by nanostructures. In addition to an approximately fivefold to tenfold increase of the surface, these CLP structures have undercuts. For example in the thermal fusion process with plastic, the liquid plastic can flow into these undercuts of the metalic surface, harden there and from a fixed anchor point. This effect can also be used effectively with adhesive bonds.

Figure 1: Roughening of a metallic surface by Cone-like-protrusions

Figure 2: Roughening of a ceramic surface by cross hatching

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