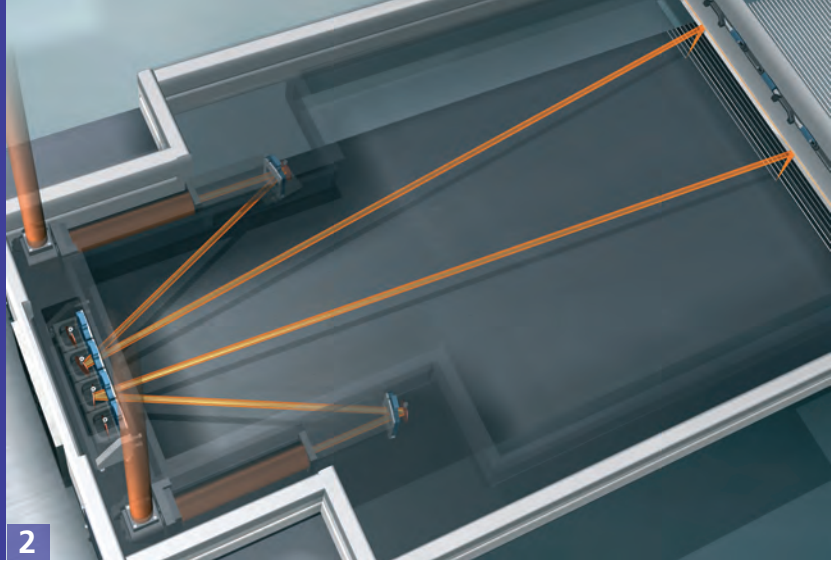


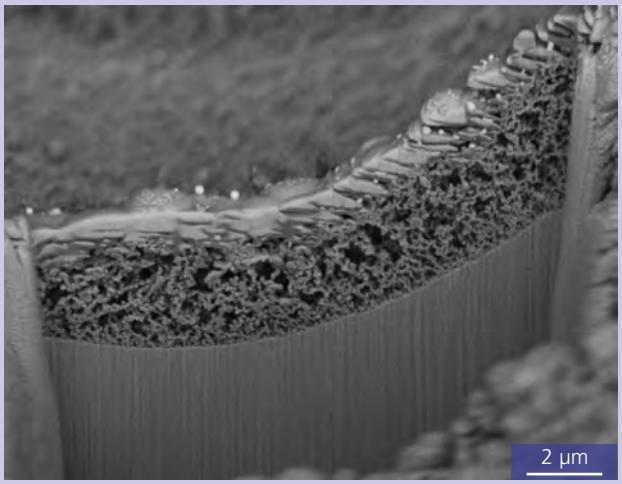
2

LASER STRUCTURES FOR A CLEAN ENVIRONMENT

The Fraunhofer IWS has developed a laser structuring technique for adhesive bonding of metal surfaces with fiber-reinforced plastics, which is able to replace the chemical pre-treatment bath. The laser beam cleans and structures aluminum sheets and generates a thicker artificial oxide layer. The test results show good adhesive strength and corrosion resistance.

Composite laminates made of metal and fiber-reinforced plastics are lightweight materials with great future potential. In comparison with pure metals, these materials do not only save weight, but also enhance burn-through and impact characteristics, and – due to the delayed crack propagation – improve fatigue parameters. The production has so far been very time-intensive and critical in terms of ecology; the aluminum sheets pass through chemical baths for cleaning and pre-treatment. The Fraunhofer IWS approach aims at economical manufacturing and intends to pre-treat the surfaces to be adhesively bondable by means of a laser beam. For material ablation, pulsed laser systems have been used up to now. However, in this process, the challenge was to structure surfaces of several square meters.

Focused Ion Beam (FIB) – section of the aluminum oxide layer



For this purpose, the IWS team employed a powerful continuous wave solid state laser and remote technology. Focusing the laser beams precisely and providing quick spot movements at the same time enables reproducible material removal. To achieve high productivity, the laser spot moves line-wise at maximally 300 meter per second over the surface. Thus, the Fraunhofer IWS engineers achieved current surface rates of one square meter per minute. The approximately 10 micrometer structure depth achieved on the aluminum surfaces provides optimal adhesion to the adhesive film. The research team verified that the native porous oxide layer was removed and a homogeneous boundary layer with clearly enhanced corrosion protection properties was formed. Consequently, the team could work without chemical sheet pre-treatment.

2 Principle of high-speed beam deflection by means of scanner technology.

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