



## EHLA/TS DUAL-LAYER SYSTEM FOR CORROSION AND WEAR PROTECTION

### Task

Instead of manufacturing components completely from a high-performance material, a company can reduce costs by making them with less expensive materials and coating them at critical zones with the stronger material. Extreme high-speed laser material deposition (EHLA) – developed by Fraunhofer ILT – can be used to produce corrosion protection layers in the thickness range of 50–250 µm with metallurgical bonding. Thermal spraying (TS) is suitable, among other things, for processing hard spray materials such as ceramics to improve wear protection. The two-layer system, consisting of an EHLA and a TS layer, combines the advantages of both processes and, thus, offers effective corrosion- and wear protection. Within the framework of KERAMIK, a project of the German Welding Society (DVS), suitable process strategies have been developed to achieve the greatest possible adhesion of the TS wear protection layer to the EHLA corrosion protection layer. The work is being carried out in cooperation with the Surface Engineering Institute (IOT) of RWTH Aachen University.

### Method

Fraunhofer ILT is investigating different process strategies for the production of the thinnest possible, corrosion-resistant EHLA layers with a rough surface. To test this, it applies an EHLA layer to a test part, then, without further processing, IOT

applies a TS layer on top of it. For the EHLA layer, the powder materials 316 L and IN 625 have been investigated and for the TS layer, the materials  $\text{Al}_2\text{O}_3/\text{TiO}_2$  and  $\text{Cr}_3\text{C}_2/\text{NiCr}$ . The EHLA/TS-layer composite was tested for corrosion resistance in a salt spray test (DIN EN ISO 9227). The adhesive tensile strength of the TS layer on the EHLA layer was tested by means of the adhesive tensile test PAT (DIN EN 582).

### Results

By developing suitable process strategies, the partners could produce EHLA coatings of 316 L and IN 625 with 50–250 µm layer thickness on S355 substrates; these coatings passed the corrosion test. The roughness could be adjusted in the range of  $R_z = 40\text{--}80\ \mu\text{m}$  by metallurgically bonded adhesions of powder particles or powder particle agglomerates on the EHLA layer surface. Furthermore, the adhesive tensile strength of the TS layer  $\text{Al}_2\text{O}_3/\text{TiO}_2$  could be increased by 70–80 percent. TS coatings made of  $\text{Cr}_3\text{C}_2/\text{NiCr}$  have such a high adhesive tensile strength that the measuring equipment failed.

### Applications

The two-layer system EHLA/TS is particularly suitable for applying corrosion and wear protection on rotationally symmetrical, heavy-duty components such as hydraulic cylinders for the offshore sector.

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1 EHLA process.

2 Cross-section of the EHLA/TS layer system,

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