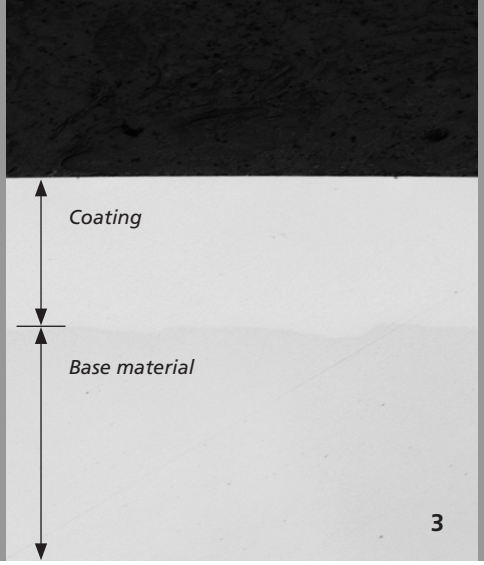

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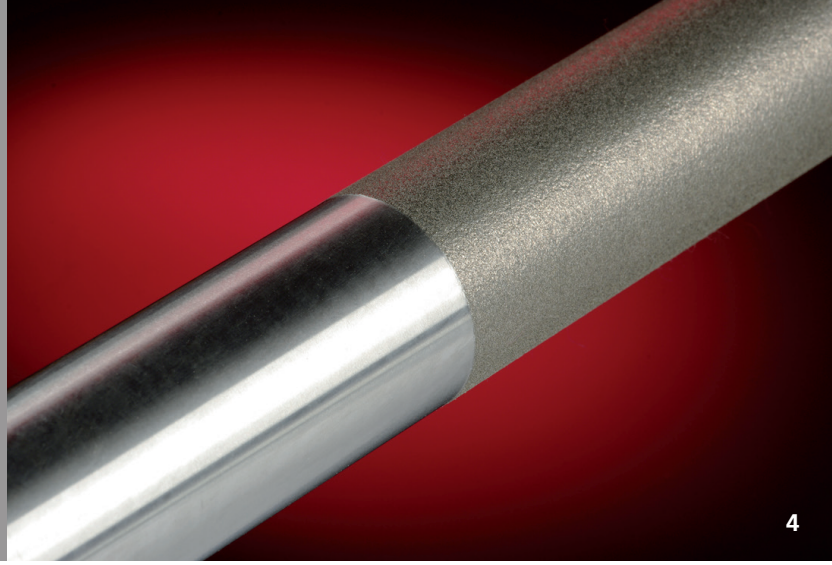

4

COATING OF HYRAULIC CYLINDERS WITH HIGH-SPEED LASER MATERIAL DEPOSITION

Task

To date, electrochemically produced chromium coatings have been mainly used to protect high-quality hydraulic cylinders against wear and corrosion. Since substances harmful to both health and environment are used in the production process, research into alternative coating methods is becoming increasingly important from an ecological and economic point of view. In the field of wear and corrosion protection, Laser Material Deposition (LMD) has only been able to establish itself for individual applications. With LMD, high quality, pore-free and crack-free layers with metallurgical bonding and low dilution can be produced from a wide range of materials. Typical layer thicknesses (> 500 µm), however, are often too large for wear and corrosion protection, and the surface rates achievable – in the range 10 - 40 cm²/min – significantly too low for large-area coatings.

Method

In this context, Fraunhofer ILT is developing high-speed Laser Material Deposition (HS-LMD) as a new version of LMD to produce coatings in the layer thickness range of 10 - 300 µm and surface rates of > 50 cm²/min. The approach consists in significantly increasing the achievable process speed of LMD such that the powdered filler material is already heated by the laser beam to a temperature close to its melting point before it is fed into the melt pool. Since the loss of the heat flow is reduced by the temperature equalization between the powder particles and the melt pool, the time needed to melt the powder is reduced in the melt pool. This, in turn, reduces the time necessary for the layer to form.

Result

With HS-LMD, a pore- and crack-free wear and corrosion protection layer (Stellite 6), approx. 150 µm thick, has successfully been applied to a piston rod at a surface rate of approx. 50 cm²/min. The hardness of the coating is about 600 HV0.3.

Applications

HS-LMD is currently being developed for the coating of rotationally symmetrical components to protect against corrosion as well as against abrasive and adhesive wear. The high feed rates of 10 - 500 m/min needed for this can be achieved by rotating the components.

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3 Cross section of a coating with Stellite 6, layer thickness approx. 150 µm.

4 Piston rod coated with high-speed Laser Material Deposition and subsequently finished.