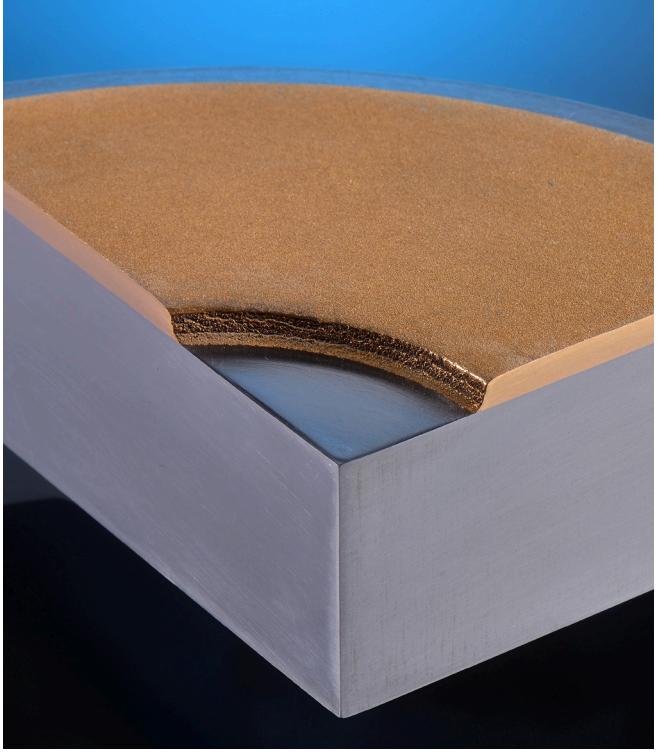

1 Plate segment with CuSn10 layer.
2 CuSn10 EHLA process.

Production of lead-free plain bearing layers using EHLA

In mechanical engineering, plain bearings are among the most frequently used bearing types. Their functional surfaces are usually separated from each other by a thin film of oil. Common materials for the sliding layers are bronze or white metal alloys, such as those used for piston drums in high-performance axial piston pumps. Here, lead bronze is cast oversized onto the relevant surfaces of the steel base bodies in an energy-intensive process. Since the scaled component needs to be reworked, there is a considerable loss of raw material. Lead is also highly harmful to health and is subject to restrictions in accordance with EU Regulation 2015/628 (REACH). The industry is therefore striving to replace lead bronze with lead-free plain bearing materials and to sustainably redesign the entire production process chain. Along with the companies ADMOS Gleitlager and Rosswag GmbH, Fraunhofer ILT is developing an energy-efficient production process chain to apply lead-free sliding material with extreme high-speed laser material deposition (EHLA) using the example of piston drums.

Advantages of using EHLA

EHLA is particularly advantageous for this application as it is an economical, environmentally friendly and resource-saving process for the production of fused metallurgically bonded coatings. As part of the project, different lead-free bronze alloys are atomized into powder material and processed using EHLA. By varying the process parameters, Fraunhofer ILT welded layers onto C45R plates, analyzed them metallographically and carried out hardness measurements. On the basis of selected parameter sets, samples are produced and tested for the bond strength tests according to Chalmers.

EHLA layers with higher adhesive strength

The CuSn10 alloy can be used to produce firmly adhering, crack-free and virtually pore-free coatings. The test results show that EHLA coatings made of CuSn10 have a bond strength that is around 37 % (375 MPa) higher than that of conventionally cast plain bearing layers. The R&D project KMU-ERBE underlying this report is being carried out on behalf of the Federal Ministry of Education and Research in cooperation with the DLR project management organization under the funding code 01LY2109A.

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