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TRIBOLOGICAL COATINGS FOR METALLIC 3D COMPONENTS

Task

A variety of individual components, especially in the machinery and automotive industry, are subject to friction and wear stress; reducing it presents great challenges. Since conventional coatings based on bonded coatings often no longer meet the industry's growing requirements, in particular with regard to temperature and wear resistance, there is a need for innovative and sustainable coating concepts and processes. Tribological coatings constitute one possibility to significantly increase the service life of the components and increase process efficiency.

Method

In cooperation with partners from the industry (ELB, Arges), Fraunhofer ILT is developing a laser process and the corresponding plant technology for coating 3D components made of light metal. First, in powder form or as a dispersion, the high-performance polymer polyetheretherketone (PEEK) is applied to the component by spraying or printing. In a subsequent method step, the PEEK layer is melted with laser radiation. Thanks to the temporally and spatially controllable energy deposition, in contrast to conventional furnace processes, the component does not need to be completely heated to temperatures above the melting temperature of PEEK (340 °C). Thus, it is possible to selectively coat temperature-sensitive components.

Results

Using the innovative laser process, Fraunhofer has produced dense and adherent PEEK coatings on aluminum components. In tribological studies, the laser-based coated test specimens show a greater wear resistance of up to a factor of 50 compared to conventional antifriction coatings; Friction coefficients < 0.1 are generated. In addition, the energy required to functionalize the layers can be reduced by up to 90 percent compared to furnace processes.

Applications

The developed process contributes significantly to increasing not only process-side energy efficiency but also a longer service life and efficiency of mechanically stressed components. The potential fields of application include primarily mechanically stressed metal components in the machinery and automotive sector (e.g. pistons or bearing shells). The R&D project »TriboLas3D« underlying this report is being carried out on behalf of the Federal Ministry of Education and Research BMBF under grant number 01LY1601A-C.

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3 Tribological analysis of the coated specimens.

4 Selective laser processing.