



LASER-BASED PRODUCTION OF POLYMER MULTIFUNCTIONAL COATINGS FOR LIGHTWEIGHT CONSTRUCTION

Task

Replacing conventional materials by lightweight alloys continues to be an increasing trend in the automotive and aerospace industries, but the requirements for corrosion, friction and wear protection often exceed the performance of these lightweight materials. These requirements can be met if the surface is suitably modified. Coatings based on high-performance polymers such as polyetheretherketone (PEEK) have great potential to fulfil the necessary requirements thanks to their excellent properties: high temperature resistance and effective corrosion and wear protection. However, conventional oven-based processing of microparticulate PEEK coatings at temperatures above 340 °C is not suitable for many temperature-sensitive substrate materials, as both the coating and the substrate are heated to the same temperature.

Method

Fraunhofer ILT has developed a laser-based melting process including plant technology that makes it possible to apply adhesive and dense PEEK coatings onto lightweight components. By additivating the powder, the institute can increase the performance of the coating in terms of corrosion protection,

- 1 PEEK layer on an aluminum engine piston.
- 2 Multi-layer system consisting of corrosion protection, wear protection and sacrificial layer on a laser-pretreated metal surface.

wear protection and lubricant film formation. The individual layers can be applied on top of each other with print or spray processes and laser post-treatment, producing discrete multilayer systems with application-adapted properties.

Results

The laser-based process presented here can be used to produce adhesive and dense PEEK multilayer systems on aluminum and magnesium, but also on hardened steel. The system shown in Figure 2 – consisting of a corrosion protection layer, wear protection layer and sacrificial layer – does not exhibit any intermixing of the individual layers. Investigations of the coating system using a pin-on-disc tribometer show significantly longer lifetimes than those of conventional bonded coatings.

Applications

The technology can be used for all components in general mechanical engineering that are in constant frictional contact with other components. The coatings produced are particularly relevant for lightweight components, e.g. in the automotive and aerospace industries.

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