



LASER-BASED PRODUCTION OF POLYMERIC CORROSION PROTECTION COATINGS

Task

As the global consumption of energy and materials continues to increase, sustainable anti-corrosion strategies are beginning to play an increasingly important role. In particular, in the field of renewable energy generation, such as wind power and solar thermal power, the construction of new plants often involves exploiting areas with a high corrosive potential. In this case, the use of high-temperature resistant thermoplastics such as polyetheretherketone (PEEK) as a coating material represents a promising alternative to conventional anticorrosion coatings. A particular challenge results from the use of temperature sensitive steels with annealing temperatures in the range of 180 - 200 °C as base material to be coated.

Method

The steel substrates to be coated are first pre-treated by means of pulsed laser radiation. The induced formation of a thin oxide layer is used to promote adhesion between the substrate steel and polymer. The PEEK powder (\varnothing 5 - 20 μ m) is then applied to the substrate as a dispersion by spraying or a knife-coating. Thereafter, the dispersion is heated by means of IR laser radiation above the melting temperature of 340 °C. In the molten state, the layer densifies and the base material adheres to the substrate. Thanks to the short interaction times of the laser procedure, when compared to a furnace process, the thermal load on the temperature-sensitive base material is reduced, thus preventing a functionally relevant influence on the coated component.

Result

By means of the proposed laser-based process, adherent and dense PEEK layers can be produced on steel substrates. In climate change tests, these layers already exhibit good corrosion protection. Since the annealing temperature in the base material is still exceeded, future studies will focus on reducing the thermal load even further.

Applications

For the most part, these layers can be used for high-precision components in the renewable energy, in particular, in the field of solar thermal power plants, offshore wind turbines and tidal power plants.

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- 3 PEEK-coated steel substrate, rear: initial state (right) and after laser treatment (left), front: laser-based front (right) and after (left) functionalization.
- 4 Offshore wind farm, Baltic Sea, © BWE / C. Hinsch.