



VCSEL-BASED LACQUER CURING IN AN INLINE PROCESS

Task

Increasing demands on wear protection and corrosion resistance, low friction and high hardness often exceed the limits of current state of the art base materials. Hence, thin films are applied onto the base material to ensure reliable and enduring performance. For the thermal post-treatment, which is often necessary after coating, laser-based solutions offer advantages over conventional methods, in particular with regard to local and temporal control of the temperature profile both in the workpiece and in the coating. Thanks to Vertical Cavity Surface Emitting Lasers (VCSEL), it is possible to individually adjust the intensity distributions according to the application.

Method

Currently, Fraunhofer ILT is using a VCSEL module with a maximum output power of 2.2 kW, a beam exit area of 40 x 55 mm² and a total of twelve individually controllable emitter rows to dry and cure thermosetting lacquers on stainless steel substrates. The intensity profile is calculated in advance and the material feed rate adjusted individually so that the lacquer cures as quickly as possible, without damaging the coating or the substrate material.

Results

Application-adapted intensity distributions of VCSEL modules make the hot curing of lacquers and the drying of wet-applied pastes possible in dynamic continuous processes, providing uniform processing quality of the coating; this shows that the process is inline capable. Both the wear coefficient and the hardness of the layers can be improved over conventional methods and the duration of the post-treatment can be reduced by a factor of 100 compared to furnace methods.

Applications

The VCSEL-based functionalization is particularly suitable for thin, large-area applied layers, which are to be dried or cured by the application of heat. Application fields are, among others, wear and corrosion protection, tribology and electronics.

The R&D project underlying this report is being carried out on behalf of the Federal Ministry of Education and Research BMBF under grant number 13N13476.

Contact

Susanne Wollgarten M.Sc.
Telephone +49 241 8906-372
susanne.wollgarten@ilt.fraunhofer.de

Dr. Jochen Stollenwerk
Telephone +49 241 8906-411
jochen.stollenwerk@ilt.fraunhofer.de

3 Dynamically moved VCSEL module during lacquer curing (side view).