Biomimetic laser engineering of functional surfaces – From prediction to commercialisation

Tim Kunze

Fraunhofer Institute for Material and Beam Technlogy IWS, Winterbergstr. 28, 01277 Dresden, Germany

tim.kunze@iws.fraunhofer.de

Functional laser texturing has risen in recent years to be a very powerful tool for tailoring the surface properties of parts and components. The design of the fabricated surface textures often follows a biomimetic approach motivated by well-defined surface patterns with micro- and nanometer features. As a result, self-cleaning surfaces with an improved wettability, efficient engine components with optimised tribological properties as well as functional implants with increased biocompatibility are achievable today. The industrialisation of functional laser surface texturing necessitates an efficient production of these high-resolution surface features, which still represents one of the greatest technical challenges today. The compatibility of process speed and feature resolution represents today's gordic knot in the field of laser-based surface functionalisation. In this context, Direct Laser Interference Patterning (DLIP) is identified as an outstanding technology for the efficient fabrication of tailored surface structures.

The talk gives an overview about the most recent cutting-edge developments in the field of laser surface functionalisation using industry-ready and DLIP solutions developed at Fraunhofer IWS. This includes the next-generation of DLIP optical modules with advanced beam shaping enabling processing speeds of 2 – 5 m²/min as well as novel approaches to achieve extremely wear-resistant surface textures. Most recent advances in functional laser surface texturing are demonstrated through applications examples in the field of anti-icing of aircraft surfaces, enhanced biocompatibility of implants and the next generation of electrical connectors. Furthermore, approaches for the prediction of surface properties are outlined in order to reduce the development time for industrial applications.