Multi-Scale Laser Surface Texturing for Low Ice-Friction Contacts

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Recent developments in sliding on ice identified that the ice-friction coefficient is influenced by the topography within the contact area. This opens the door to design surfaces with different contact feature sizes and shapes in order to tailor and control sliding on ice functionality. Moreover, enhanced ice-friction performance by the reduction of the ice-friction coefficient in metal/ice contacts would be a welcomed innovation with great potential in modern surface engineering. In this context, the development of a clean, flexible and environmentally friendly laser-based surface texturing technology for production of multi-scale surface textures consisting of microscopic features within a range from 200 nm to 100 µm scale level is proposed. The laser-made surface features were tested in terms of wettability and ice-friction and further functionally enhanced with the ultimate goal to achieve low ice-friction and anti-icing performance.

Experimental and computational results will be displayed in form of a poster presentation. The results indicate that the implementation of novel laser-based surface texturing technology based on Direct Laser Writing (DLW) and Direct Laser Interference Patterning (DLIP) was successfully applied for the energy-efficient production of multi-scale surface textures. In this context, a texture catalog, consisting of more than 60 different single and multi-scale surfaces was generated (see Figure 1). The fabricated surfaces displayed enhanced wettability with self-cleaning characteristic and long-term stability. The ice-friction of the generated surface features were evaluated using an ice-tribometer and a novel measurement technology based on nano-indentation. The candidate surface features for low ice-friction and anti-icing performance were scaled-up and successfully transferred to large areas up to 300 x 300 mm². At last, the first functional parts were equipped with single- and multi-scale periodic surface textures.

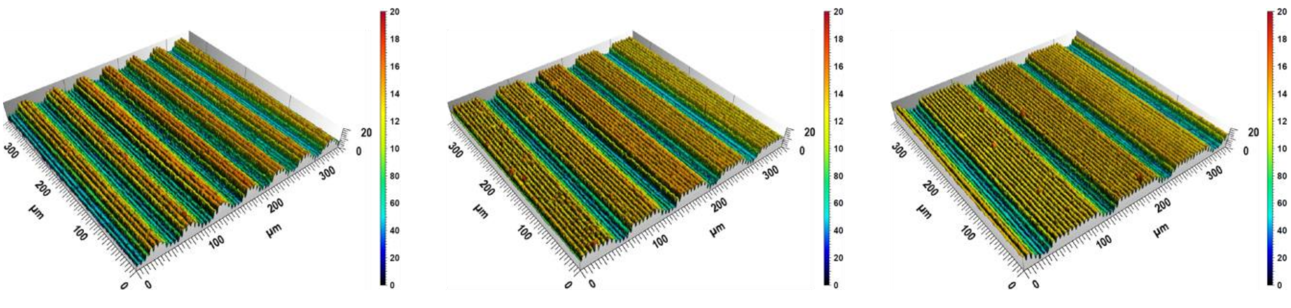

Figure 1. Exemplary 3D topography images of multi-scale periodic microstructures consisting of linear DLIP textures with fixed structure period of 6 µm and underlying trench-shaped DLW structures with varying trench spacing.