XTribology

AC²T - Austrian Excellence Center for Tribology

Top location	Wiener Neustadt (NÖ)
Additional location	
Thematic focus	Tribologie

Success story short version

Laser modified surfaces in tribological systems

Modifications of the lubricant dynamics and the materials and coating properties of tribological systems through surface treatments using laser ablation represents an interesting alternative in order to decrease the friction and improve the wear properties of tribological systems. The investigations for lubricated friction contacts have shown that the surface textures consisting of ripples combined with the use of an anti-friction-coating provided the lowest coefficient of friction.

Success story long version

Increasing cost pressures and rising global environmental awareness requires further improvements and optimizations of constructive solutions, which are characterized by an energy efficient performance. One possibility to reach this target of reducing the friction coefficient lies on surface texturing. Within this research project, the manufacturing of such surface textures along with the characterization of their tribological behaviours were investigated through tribological tests.

The production of such surface textures were carried out with an ultra-short pulse laser. Mirror-polished disc shaped 42CrMo4 samples were used as test specimens and the counter bodies consisted of polished 100Cr6 convex cylinders, both of them also used as reference samples for the tribological analysis. The effects of the channel structures with a selected texture ratio as well as nanostructured ripples, respectively, with respect to their friction behaviour were studied. Examples of the investigated surface textures are shown in Figures 1 and 2. For the lubricated friction contacts, the channel structures produced on steel discs tested against anti-friction coated cylinders did not improve the coefficient of friction in comparison to the benchmark. However, for the same test conditions, the ripple structured steel discs showed a significant reduction of the coefficient of friction in comparison to the benchmark, without influencing negatively the wear behavior. In comparison to the benchmark, a reduction of the coefficient of friction of approximately 25 % has been observed by using such ripple structures.

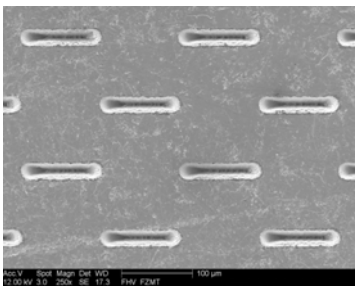

Fig.1: Channel structures on 42CrMo4 discs

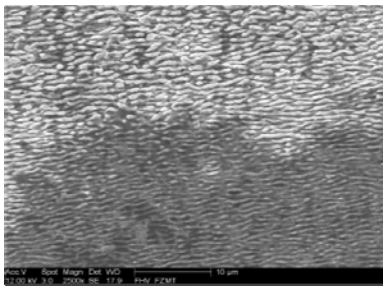

Fig.2: Nanostructured ripples (period ~700 nm) on 42CrMo4 discs

Impact and effects

The tribological optimization of component surfaces by a targeted application of ripple textures in combination with the use of an anti-friction coating in lubricated friction contacts may enable a reduction of energy loss, a possible usage of low power drives and/or uniform and smoother displacements (decrease of speed fluctuations) of moving parts such as bearings, transmission parts and sliding surfaces, for example such as in devices equipped with axial pistons. The uniqueness of producing such ripple textures on surfaces using an ultra-short pulse laser along with the excellent and promising tribological test results of these ripple textures were the driving reasons for the deposition of a patent in fall 2013.

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