Title

German research team offers collaboration in femtosecond laser micromachining and surface functionalization for tribological applications

For cooperation in a European Research project

Horizon Europe Call e.g.

HORIZON-CL4-2023-TWIN-TRANSITION-01-02: High-precision OR complex

Short summary

A German research team develops femtosecond laser micromachining and surface functionalization techniques for engineering, medical, and marine applications. Special know-how is available for designing and evaluating surface textures to develop sliding surfaces with lower wear and friction. The team is looking for industry and research partners to build up a consortium to a Horizon Europe CL4 Topic or to any other EU funded project.

Full description

The research group at university, located in North Eastern Germany, provides expertise in developing superhydrophobic/hydrophilic, anti-reflective, anti-icing, anti-fouling, anti-adhesive, and self-cleaning surfaces. Functionalized surfaces offer altered surface topography (roughness), crystallography, and chemistry affecting biological response (anti-bacterial surfaces, tailoring cell adhesion, etc.), corrosion, and electrical properties. Furthermore, femtosecond laser micromachining can perform high precision, high quality, and burr-free cutting, drilling, and engraving processes on solid materials. The team has know-how in realization of tailored topographic/morphological, chemical, and crystallographic surface properties, e.g. for biomimetic surfaces. Using laser scanning strategies, a wide range of laser-inscribed and self-organized nano- and microstructures (including hierarchical) structures can be formed on solid materials. Since 2015, the team has been developing customized surface designs for tribological applications using tribological analysis methods (e.g. Ball-on-Disk, Ring-on-Disk, Pin-on-Disk) and self-developed setups in order to evaluate the performance of textured surfaces. Furthermore, comprehensive setups like wetting analyses, optical evaluations like confocal laser scanning microscopy (CLSM), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), particle size measurement systems) are available. The suitability of the surface texturing has been studied up to long-term running. In order to transfer know how om EU level the resarch team is looking for partners from mechanical engineering or health sector to build up a consortium and to apply for European funding (Horizon Europe, Eurostars, M.Era-net are possible). The department's sustainability strategy is in line with the United Nations Global Goals and in particular with the protection of reducing CO2 emissions through friction-reducing surface texturing.

Advantages and innovations

Laser surface texturing can improve the overall tribological behavior of contact partners. Friction can especially be reduced in the boundary and in the mixed lubrication regime compared to unstructured surfaces. Long-term running tests show that the service life of sliding surfaces can be increased significantly related to conventional shaped surfaces. Firstly, laser-inscribed microstructures can change the wetting properties of a surface due to complex chemical and topographic modifications. Secondly, the topographic modification enables the surface to act as a particle trap in dry or boundary lubrication and minimizes

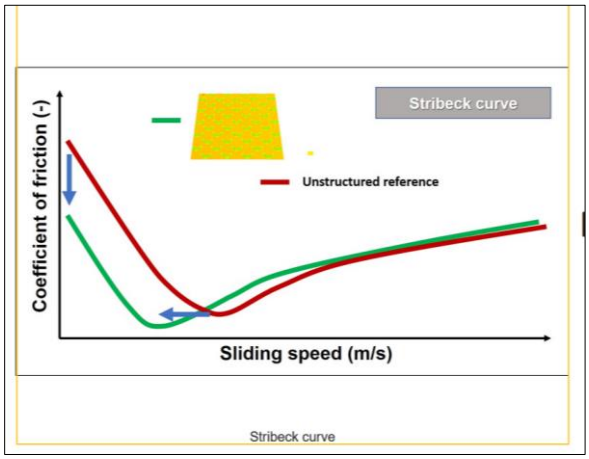
third-body wear. Thirdly, applying a surface texture reduces the contact area, resulting in less surface roughness interaction and reducing stiction in boundary or mixed lubrication. Furthermore, laser-inscribed trenches provide a secondary source for lubrication in the boundary or mixed regime. Finally, microstructures can offer an additional hydrodynamic lift resulting in an enforced load-carrying capacity at mixed and hydrodynamic lubrication. If desired, however, friction can be increased by surface texturing, for example for tribo-electric nanogenerators (TENGS).

Technical Specification or Expertise Sought

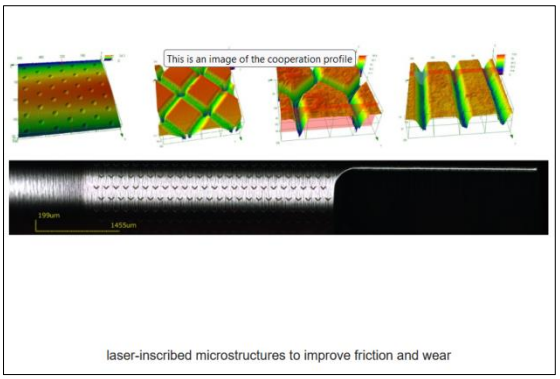
Needs to develop laser surface texturing to industrial processes

Expected role of a partner

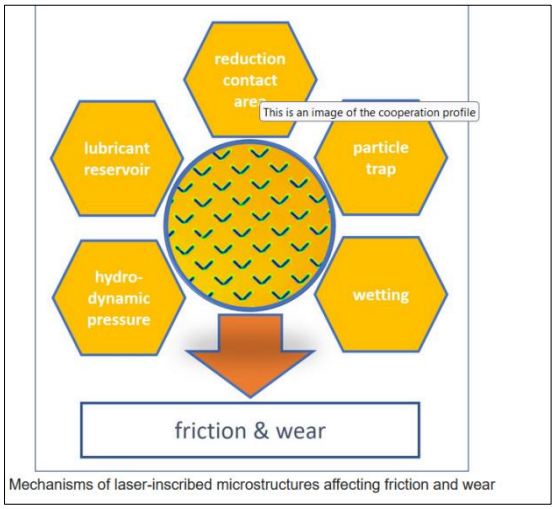
The department is searching for research institutions and companies to transfer laser surface texturing to industrial processes founded by EU projects. If desired, 3D-processing of complex parts should be developed by the partners.



Stribeck curve



laser-inscribed microstructures to improve friction and wear



Mechanisms of laser-inscribed microstructures affecting friction and wear