SERVICES and MEASUREMENTS

- Friction measurements of various materials variations in loads, contact condition, movement, atmosphere and temperature.
- Nano-scale friction measurements (AFM-LFM).
- Measurements of wear of materials under a range of contact conditions on macro and nano scale.
- Roughness and surface topography measurements with contact, non-contact and optical methods with resolutions on macro and nano scale in 2D and 3D.
- Surface characterisation with a 3D optical profilometer with nanoscale resolution.
- Detailed statistical and parameter-based topography and surface roughness analysis.
- Hardness, microhardness and nanohardness measurements.
- Measurements of surface and subsurface stresses.
- Determination of oil viscosity at specific temperatures.
- TAN, TBN and water content in oil. Determining lubricant aging
- Wear particle analysis in oils and greases.
- Determination of load-bearing properties of oils for gear drives and pitting resistance.
- Measurements of contact angles, surface energy and surface tension and wettability of solid/liquid interfaces and their adsorption properties.
- Measurements of the thickness of boundary lubricant films during tribological operation (in-situ).
- The analysis and properties of boundary surface films (ex-situ).
- Scanning electron microscopy (SEM) and qualitative chemical surface analysis (EDS).
- Atomic force microscopy (AFM), scanning tunneling microscopy (STM), adhesion measurements.
- Nanomechanical characterisation of surfaces, surface layers and films.
- Analysis of contact conditions, stresses, deformations, contact temperatures and other contact specific of analyse.

IN FOCUS

TRIBOS – Joint European Master in Tribology of Surfaces and Interfaces.

TINT is the coordinator of the prestigious Erasmus Mundus second-cycle European study programme on surface and contact tribology. It is the first comprehensive programme of its kind in Europe, bringing together the knowledge and experience of four established complementary groups from the University of Ljubljana (SI), the University of Leeds (UK), the Coimbra University (PT) and the University of Lulea (SE). www.master-tribos.eu

Lubrication Science (Wiley) – the only specialised journal with a scientific impact factor (SCI) on the subject of lubricants. After two decades, the Lubrication Science editorial board was moved from Imperial College London to TINT, University of Ljubljana in 2012. http://onlinelibrary.wiley.com

STLE Fellow – Prof. Kalin was named a Fellow of the Society of Tribologists and Lubrication Engineers (2012) due to his achievements and contributions in tribology and lubrication science, thereby joining the group of 150 fellows who have been awarded the title since 1973.

University of Ljubljana Faculty of Mechanical Engineering



CONTACT

Laboratory for Tribology and Interface Nanotechnology

University of Ljubljana Faculty of Mechanical Engineering

Bogišičeva 8 1000 Ljubljana Slovenia

tel.: +386 1 4771 460 fax: +386 1 4771 469

info@tint.fs.uni-lj.si www.tint.fs.uni-lj.si

Tint

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ENGINEERING SOLUTIONS in tribology and surface nanotechnologies

LABORATORY FOR TRIBOLOGY AND INTERFACE NANOTECHNOLOGY (TINT), with nearly 20 experts, is acclaimed in Slovenia and abroad for its studies and technological solutions in the fields of surface nanotechnologies, boundary lubrication and tribochemistry, the development of functional surfaces and contact engineering and controlling mechanisms of friction and wear in systems with traditional and unconventional materials on the nano and macro scale.

WITH ONE OF THE LEADING ROLES IN ENVIROMENT-FRIENDLY, GREEN LUBRICATION TECHNOLOGIES we ensure a comprehensive and efficient sustainable approach to the most complex tribological problems in engineering systems.



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Laboratory for Tribology and Interface Nanotechnology

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KNOWLEDGE, EXPERIENCE, STATE-OF-THE-ART METHODS and EQUIPMENT

INNOVATIVE SOLUTIONS FOR:

- Developing tribologically adapted mechanical systems;
- Developing functional surfaces and optimising topography and contact properties;
- The analysis and optimisation of contacts and surfaces on the macro and nano scale;
- The application and characteristics of protective and self-lubricat ing surface coatings and materials;
- The application of lubricants and additives to ensure formation of boundary and hydrodynamic lubricating films;
- Synergistic interactions between lubricants and materials;
- The analysis and optimisation of rheological and physicochemical properties of lubricants for specific purposes;
- Developing tribological systems for super-low or super-high friction;
- Creating conditions for protective boundary surface films;
- The application of nanomaterials in tribology;
- The analysis of free surface energies, wettability and spreading;
- The use of nanotechnologies to improve tribological properties;
- The optimisation of adsorption between solids and liquids;
- Comprehensive tribological solutions for reducing environmental emissions (green technologies);
- Biotribology.

CONSULTING

CONSULTING SERVICES IN THE FOLLOWING AREAS:

- Preventing wear and damages to mechanical systems;
- Lowering energy losses due to friction;
- Solutions for controlling friction (high or low) in mechanical systems;
- Selection and optimisation of materials, coatings, surface treatment and topography for tribologically efficient systems under lubricated or non-lubricated conditions;
- Application-specific selection of lubricants and additives;
- Evaluating lubrication quality and solutions related to lubrication and lubricants;
- Adsorption and wettability between solid and liquid surfaces;
- Comprehensive macro and nano scale contact engineering;
- Design and optimisation for solutions for tribologically efficient mechanical systems;
- Terotechnology and solutions in maintenance and technical diagnostics.

CUSTOM DEVELOPMENT



TEROTECHNOLOGY – ecologically and economically sound technical solutions

FROM DESIGN TO PROCUREMENT, ASSEMBLY AND OPERATION, MAINTENANCE, DISASSEMBLY AND RECYCLING

Ensuring a reliable and predictable condition of machines during production and control over maintenance as well as comprehensive planning of cost-effective system management.







SELECTED PROJECTS

2020 INTERFACE - NANOSCALE TAILORING OF TRIBOLOGICAL INTERFACES FOR REDUCED ENVIRONMENTAL IMPACT

During operation of internal combustion engines, tribochemical interactions occur between lubricant additives and surfaces, resulting in a tribochemical boundary film. The project involves advanced analysis and design of this boundary interface layer; by using diamond-like carbon coatings and next-generation low-SAPS additives we aim to meet the increasingly challenging European environmental protection goals, fuel efficiency and simultaneous wear resistance.

Partners: Volvo Technology Corporation, SKF, Lubrizol Ltd., Sulzer DLC Coating NV, University of Leeds, Coimbra University, Jožef Stefan Institute, Groningen University.



IDSPS - INTEGRATED DIAGNOSTIC SYSTEM FOR MECHANICAL DRIVES

The aim of the project was to develop a functionally complete and cost-effective prototype called the Diagnostic and Prognostic Processor (DPP), a device designed for a real-time monitoring of mechanical drives. The innovative components of the system enable detection, evaluation and localisation of damages in real time, the prediction of the service life of a device, insensitivity to outside influences and various operation regimes, an easy introduction and integration into the process information system.

Partners: Jožef Stefan Institute, VTT Manufacturing Technology, University of Cranfield, UTIA Institute of Information Theory and Automation.

MINILUBES - MECHANISMS OF INTERACTIONS IN NANO-SCALE OF NOVEL IONIC LUBRICANTS WITH FUNCTIONAL SURFACES

A global comprehensive approach to understanding of the mechanisms of ionic liquids for their application as of lubricant for friction and waer reduction and the basis for addition of nanoparticles. The evaluation of lubricants and materials involves determining the physicochemical properties of the materials, including artificial aging and mechanical testing as well as tribological analysis. Friction and wear properties are complemented by a comprehensive surface characterisation with emphasis on tribochemical boundary films. The parameters from these studies are used in modelling nano-scale tribological processes and the molecular design of new ionic liquids.

Partners: GKN Sintermetal S.p.A., AC2T, Fundacion Tekniker, University of Gdansk, Cardiff University, Laboratoire de Thermodynamique des Solutions et des Polymères, Martin-Luther-Universität Halle-Wittenberg, Institutul de Chimie Macromoleculara "Petru Poni", Universitat de Vigo.

MoS₂ NANOPARTICLES AS ADDITIVES IN LUBRICANTS AND LOW-FRICTION MATERIALS

The project studies an innovative physical lubrication principle by using MoS2 nanoparticles as oil additives. It focuses on a systematic analysis and explanation the fundamental tribological mechanisms in boundary lubrication with MoS2 nanotubes and determination of the decisive parameters. Due to the physical lubrication principle, independent from the tribochemical reactions with the surfaces, this concept is also suitable for inert surfaces (e.g. DLC coatings), while at the same time it reduces the environmental impact (emissions) by abandoning chemical reactions of the additives.

Partners: Jožef Stefan Institute, Université Blaise Pascal, Weizmann Institute of Science.