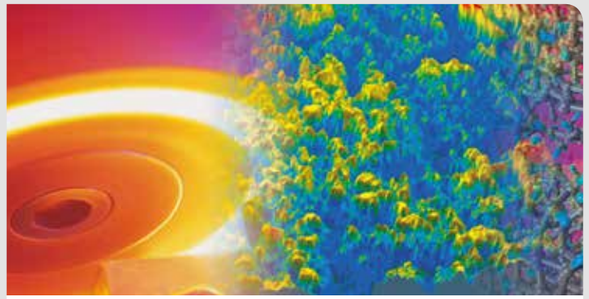

FORMS OF COOPERATION

Bilateral projects
We carry out contract research and development for industry and cooperate with companies on research and development into tribological systems.

Joint publicly funded projects
Together with industrial and scientific partners, we carry out publically-funded research projects as a partner and coordinator.

Further education, lectures and seminars
We organize scientific events on the topic of tribology for academic and industrial audiences.

International networks
You benefit from our international network when we, for example, organize symposia and carry out the EU projects that we have applied for.

»Industry on Campus«
Interns and undergraduates learn about the world of research and development as well as getting to know potential employers through industrial projects. The MicroTribology Center µTC offers companies the option of carrying out complex projects in-house.

Doctorates
We offer and supervise doctoral work in the field of fundamental research and application-related tribology issues.

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Fraunhofer KIT Karlsruhe Institute of Technology

MICROTRIBOLOGY CENTER µTC

TRIBO-DESIGN

ANALYZING, CHARACTERIZING, MODELING AND OPTIMIZING FRICTIONAL CONTACTS

MICROTRIBOLOGY CENTER µTC –
a cooperation between Fraunhofer and KIT

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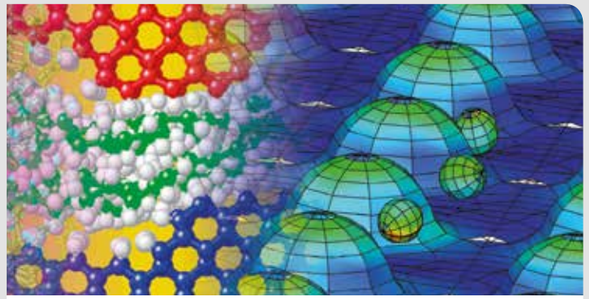

The MicroTribology Center µTC uses experimental and computational methods to carry out research into frictional and wear mechanisms and develops methods of defining and varying the friction performance in technical systems.

The MicroTribology Center µTC offers comprehensive advice and support on current tribology issues. Around 100 employees from the fields of engineering and natural sciences work on tribological issues at the facilities in Pfinztal, Karlsruhe and Freiburg. Services include the multidisciplinary physical analysis at various length scales and relevant modeling and simulation as well as investigations into and the optimization of tribological systems.

The MicroTribology Center µTC is a joint initiative set up by the Fraunhofer Institute for Mechanics of Materials IWM in Freiburg and the Institute for Applied Materials – Reliability of Components and Systems IAM-ZBS at the Karlsruhe Institute of Technology KIT. The strength of the µTC lies in the combination of industrially relevant research, fundamental sciences and teaching. Clients profit from customized projects and the comprehensive approach to fundamental research issues.

TRIBO-ANALYSIS

We use methods based on damage mechanics and energetics in order to understand wear mechanisms. We also carry out continuous high-resolution friction and wear measurements. We quantify the effect of tribological loads on areas close to the material surface using surface physics and chemistry methods.

We investigate and optimize

- friction and wear in lubricated and unlubricated tribo-systems
- behavior of motor components during running-in
- final processing of contact surfaces

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TRIBO-SIMULATIONS

The complexity of frictional phenomena is a consequence of the multitude of length and scales involved. Computer-assisted design of tribo-systems must therefore span all scales from the atomic level to the elasto-hydrodynamics of the lubricating gap. We have a strong command of the most important tools required for multi-scale simulations involved in the design of tribo-systems.

We can perform simulations for our partners related to

- friction in tribological systems
- microstructural changes in tribo-layers
- lubricating gaps under hydrodynamic conditions
- crack formation and growth close to tribo-contacts
- deformation and the wear of micro and nano roughnesses

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TRIBO-OPTIMIZATION

The characterization and assessment of changes due to tribological contact enables us to determine acceptable operating conditions such as sliding speed, contact loads, temperatures or lubrication conditions. We determine system loads and the resulting loads at the contact point.

We develop solutions that increase the operational life and performance of

- lubricated and dry frictional systems at up to around 1000 °C
- sliding applications at up to 40 m/s relative speed
- rolling applications for different conditions
- ceramics and coatings subject to extremely high loads

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COATINGS

Diamond-like carbon layers (DLC) can make an enormous improvement to the performance and lifetime of components subject to tribological loads. With many years of experience in process and plant development behind us, we are capable of coating complex component geometries made from a wide range of materials.

We can create the following coatings:

- carbon (DLC), Si and BN based
- thicker layers and optimized surface topographies
- customized properties (hardness, contact behavior, interactions with the lubricant)

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SURFACE LAYER MODIFICATION

We have developed a patented mechanical surface treatment process for brittle materials. This process not only often significantly improves strength values close to the surface but can also be used to create structured surfaces that are beneficial for many tribological applications.

We develop processes that

- create higher internal compressive stress close to the surface to compensate for damage that otherwise reduces strength
- allow for implementation within production facilities
- improve strength values close to the surface
- increase resistance to wear

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SURFACE STRUCTURING

We develop processes for laser-assisted surface texturing or materials modification (metals, engineering ceramics, PVD thin layers etc.) and characterize their effectiveness with respect to tribology. The findings of this development process enable us to perform load-specific optimizations of the active surface area.

We work on

- the development of application-specific texturing and modifications of tribological active surfaces
- the fundamental tribological characterization of new materials and their optimization
- the further development of tribological testing techniques

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BIO-TRIBOLOGY

The means by which natural systems minimize friction and wear provide an interesting starting point for the development of new biomedical materials. Materials that are not yet in clinical use can be investigated using suitable tribological measurement set-ups: dental prosthesis material should, for example, be similarly resistant to chewing and brushing as natural teeth.

We research and improve

- the tribology of »soft matter« (e.g. hydrogels)
- the abrasiveness and polishing effect of toothpastes and prophylactic pastes (polishing pastes)
- the resistance of dental prosthesis material to wear from brushing

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ELEMENTARY MECHANISMS

During frictional process, metal surfaces are subject to complex dynamic changes that play a key role in our understanding of friction and wear properties. We aim to directly observe dynamic and topographical changes combined with friction and wear behavior in the nano-scale range.

We work on the topics of

- on-line topography measurements of lubricated metal contacts
- micro-tribology in an ultrahigh vacuum
- friction in thin metal films
- tribology lectures and seminars

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