Abstract TRIGUS

The friction and wear behavior of surfaces is significantly influenced by tribologically induced modification of the boundary surface and structure and depends on environmental conditions to a great extent. Coating of a surface allows targeted modification of these tribological properties, particularly with regard to global challenges like energy efficiency and conservation of resources.

The emphasis of this proposal is to access the essential physical and chemical processes in dry running friction contacts, which will be analyzed using homogeneous coatings of tetrahedral amorphous carbon (ta-C) and Molybdenum(IV)-disulfides (MoS_2). Both materials represent scientifically and technically relevant coating systems that undergo a characteristic change in structure and exhibit complementary properties concerning friction, wear and the influence of the atmosphere.

A heterogeneous, structured coating system of both materials opens the potential to combine very low friction (MoS_2) and highest wear resistance (ta-C) and will be investigated here for the first time. In systematic experiments the influence of coating properties, counter body material, vacuum, and atmospheric gases will be studied for homogeneous and heterogeneous coating systems.

The experimental and analytical foundation of this project is based on a new, worldwide unique experimental setup that combines a universal vacuum tribometer with a cluster tool. The cluster tool comprises Rutherford backscattering (RBS), elastic recoil detection (ERD), spectroscopic ellipsometry of reflectometry, and Raman spectroscopy. Thereby, it provides the necessary in-line instrumentation for element specific depth profiling, coating thickness, and optical and structural analysis, allowing the characterization of tribologically induced processes without breaking vacuum or exposure to ambient air.

In an unprecedented way, this proposal links tribological characterization of new coating systems in defined atmospheres with complex in-line analysis. Setup and qualification of the vacuum tribometer have been carried out as a part of a Major Research Instrumentation Program and based on a long lasting cooperation of the Institute of Manufacturing Technology at Technische Universität Dresden (TUD) and the Ion Beam Center at Helmholtz-Zentrum Dresden-Rossendorf (HZDR).