Emmy Noether Young Investigator Group:

The Emmy Noether Research Program encourages young investigators, by providing financial resources and support, to enhance their scientific and academic skills through a fast-paced independent research project. It is hoped that these young scientists will gain experience in the lab and the classroom to pursue future careers in science, research and teaching. The following work is funded through this program.

Dynamics of Sliding Metal Surfaces

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The understanding and control of friction and wear is one of the longest unsolved problems in science. Sliding surfaces are omnipresent in nature (e.g. in human knee- and hip joints), as well as in technical components of all sizes ranging from Micro-electro-mechanical systems (MEMS) up to several storey high ship engines. Even for the development of cosmetic products such as shampoo tribological problems are of importance. Furthermore, in the context of the worldwide effort to reduce energy consumption and CO_2 emissions, it is a great challenge for engineers, physicists and chemists to envision tribological schemes which are able to reduce frictional losses and material damage due to friction.

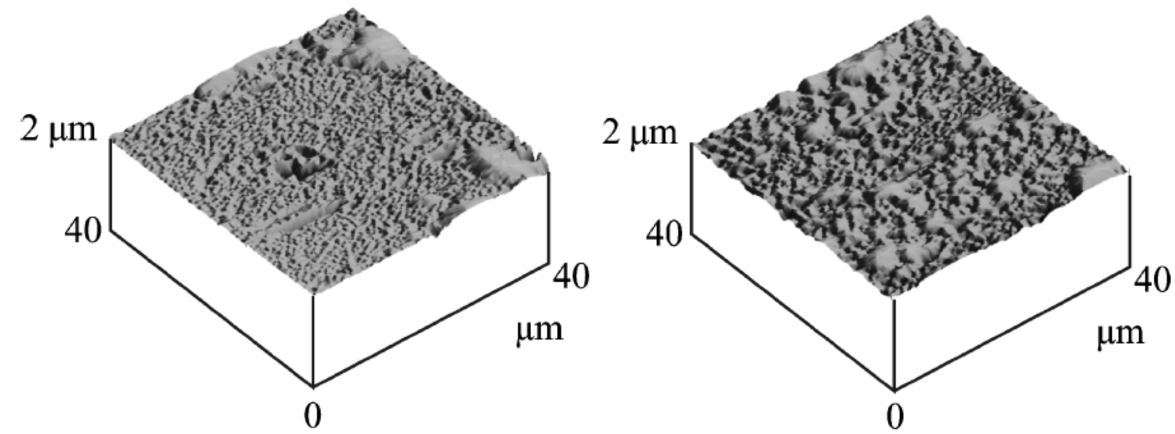

Fig. 1: Atomic force microscopy images of a grey cast iron sample after a friction experiment with 30 N (left hand side) and 90 N (right hand side) normal force. The different wavy topography features have emerged as a result of different sliding conditions. Adapted from [M. Scherge et. al., Wear 255, 395 (2003)]

Dynamical changes at the interface between two sliding objects play a key role in understanding the frictional and wear properties of macroscopic systems; nevertheless, these changes are presently only poorly understood. A key role in understanding the frictional and wear properties of macroscopic systems is played by dynamical changes at the interface between two sliding objects. Our goal is therefore to observe these dynamical changes experimentally on the nanoscale and to provide in-depth scientific (experimental) insight.

The research group, funded by the Emmy Noether Program of the German Research Foundation (DFG), started in January 2008. The first PhD student, Spyridon Korres, MSc, joined the group in April.

The first task was to design and construct a novel, highly sensitive experimental platform which will allow us to link topographical and material changes to the friction and wear behaviour of metal surfaces. Our concept combines a series of state of the art methods, such as Atomic Force Microscopy and Radio Nuclide Technique, with the latest technological breakthroughs in the field of optical microscopy.

This will enable us to gather information on the processes that take place on metal surfaces during the application of frictional loads. A further challenge is to conduct these experiments under conditions that resemble those in nature and in technical systems. Finally, in collaboration with colleagues who perform state-of-the-art simulations of tribological systems, we are confident that our research will significantly contribute to a better understanding of friction and wear within the next 4 years.

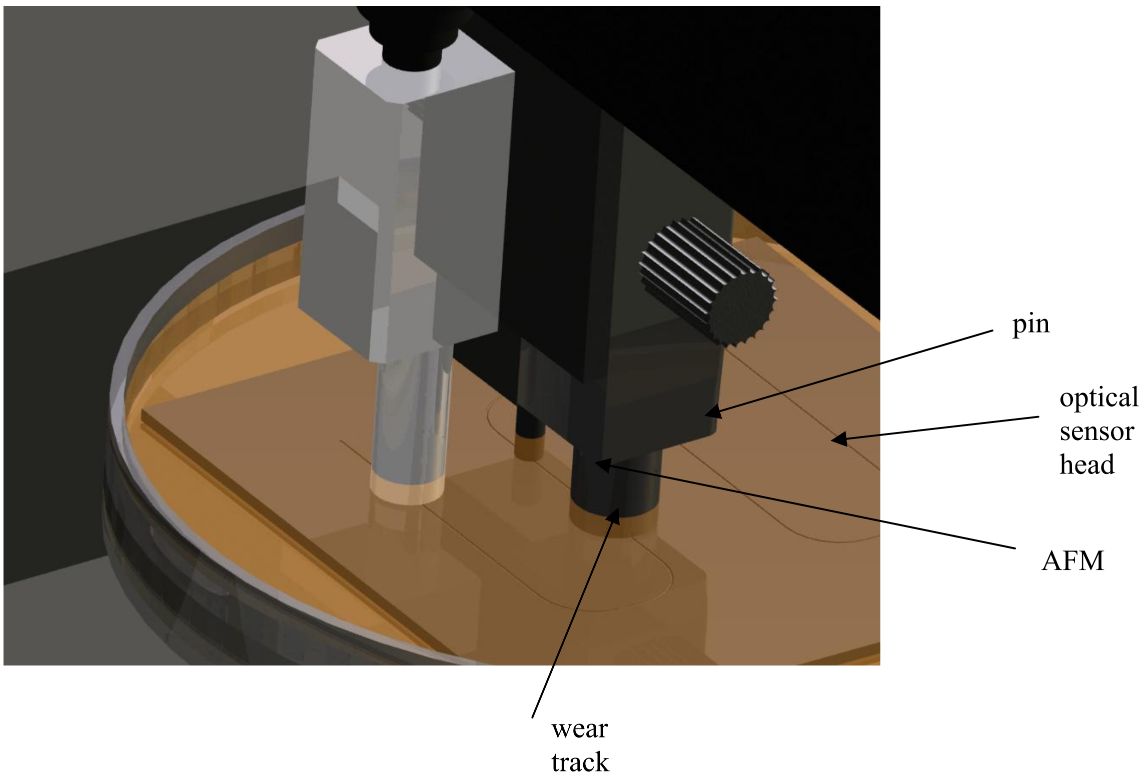

Fig. 2: CAD model of the experimental platform which is currently being set up, showing the sliding pin and an atomic force microscope (AFM) and an optical sensor