

Materials Science Aspects of the Wear of Metallic Materials

Alfons Fischer

MPI Eisenforschung

Abstract:

The challenges of technical systems subjected to friction and wear become more demanding with steadily increasing stresses. Besides safety matters, failure of tribologically loaded systems can cause tremendous maintenance costs. Because of the lack of a general wear prediction models, partly tribometer tests must be used in order to investigate wear behavior of materials in certain tribological systems; this is the more important the smaller the wear rates must be in order to achieve the so-called ultra-mild wear regimes. Any well-aimed optimizations of tribological contacts – beyond trial and error - requires a comprehensive understanding of friction and wear mechanisms. Otherwise any transferability into technical applications is not just questionable but impossible because of the wide range of applied loads, lubrication conditions, and materials microstructures. Thus, parts with different topographies and subsurface microstructures have to be investigated prior to and after tribological loading. The analyses of surface and subsurface characteristics can be performed by means of complementary microscopical techniques. The contribution shows how to link the findings to the wear behavior in order to gain information about the pathways of dissipation and transformation of frictional energy into wear and should provide some hints on how to analyze such systems for their characteristic mechanisms.

Bio:

Alfons Fischer received his Dipl.-Ing. degree in mechanical engineering from the Ruhr Universität Bochum, Germany in spring of 1980. He completed his Dr.-Ing. (Ph.D.) and Priv.-Doz. (Private Lecturer) degrees in materials science and engineering from the same university in summer of 1984 and in fall of 1992, respectively. From 1992 to 1996 he was head of quality management as well as vice-head of the center of analyses and testing of NuTech GmbH, Neumünster, Germany; a company providing laser processing technologies, materials testing, and failure analyses. Since 1996 he is full professor for materials science and engineering at the University of Duisburg-Essen in Germany from which he retired February 2019. Since 2005 he is a visiting researcher at Rush University Medical Center, Dpt. of Orthopedic Surgery, Chicago IL, USA and since March 2019 also at the Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany. His research (fundamental and applied) as well as his services (materials development and testing, failure analyses, expert reports) focus on fatigue, wear and corrosion of metals with institutional and industrial partners in mechanical, production, automotive, off-shore, tooling and biomedical engineering. He has published more than 230 papers and co-authored 5 books.