TRIBOLOGICAL PROTECTIVE LAYERS FORMED BY ADDITIVES

O. INACKER, P. BECKMANN
Natural and Medical Sciences Institute (NMI), Markwiesenstr. 55, 72770 Reutlingen, GERMANY;
e-mail: beckmann@nmi.de, inacker@nmi.de

P. OSTER
Institute for Machine Elements – Gear Research Center (FZG), 85747 Garching, GERMANY

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ABSTRACT

In practice boundary lubrication is very important for the lifetime of components. In contrast to that our knowledge about the molecular mechanisms involved is poor.

It will be shown how surface analytical methods can help to clarify physical and chemical processes at and in proximity to the material surface under boundary lubrication. Examples will be given from FZG test rig experiments with case hardened gears and FVA-reference-oil No. 3 with various additives. After the test run gear flanks were mechanically separated from the gears, oil was removed and the gear flanks were investigated with SEM, SNMS, XPS and TEM.

The results show that tribological protective layers with a thickness up to 5 nm are formed by chemical reactions of additives with the material surface. Their protective structure is governed by self assembling properties of the additives, e.g. binding at the surface and formation of micelle and inverse micelle structures. Their function is to diminish metall-metall contact and to guarantee the wetting of the material surface with oil.

Breakdown of the protective structures leads to damage of material properties at and in proximity to the material surface. The damages can be regarded as starting points of scratches, leading to the development of pittings.

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