A METHOD TO DETERMINE THE AGEING BEHAVIOUR OF LUBRICANTS FOR PRECISION MACHINERY

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ABSTRACT

A high chemical stability of the lubricant is a very important aspect especially regarding for-life lubrication in precision machinery. There the bearings are equipped with an initial lubrication during the production process with a very low quantity of the lubricant. And this small quantity has to stay there over the whole life time of the product (sometimes more than 20 years) ensuring its precise function. To guarantee, that over this long time the lubricant shows no changes in its chemical nature and its physico-chemical characteristics respectively, lubricants are optimized with anti-oxidants which should prevent the negative influences of such chemical reactions.

The prediction of the ageing behaviour of lubricants under practical conditions is very critical, due to the fact, that normally no long-term tests over many years can be undertaken in the lab. In many national and international standards methods are described to simulate the oxidation and ageing stability of lubricants. But investigations on failed parts out of practical applications showed, that there other reactions may occur than under the simulation conditions in the lab. An approach to the simulation of the effects that occur under practical conditions is therefore mandatory for a secure lubricant development and design.

The ageing stability of a lubricant depends mainly on its chemical nature and the amount of additives. Bearing materials, polymers, high temperatures, wear particles or aggressive surrounding conditions accelerate the ageing and oxidation processes within the lubricant. In order to take this circumstance into account a modified ageing test has been developed, which simulates under practice-adapted parameters the oxidation stability of lubricants in contact with bearing materials.

The presentation will give an overview over the adapted simulation method for the ageing behaviour of lubricants and the results that can be achieved. The example of different base oils, i.e. mineral oils, polyalpha-olefines, synthetic esters, polyglycols, silicon oils and perfluoropolyethers will give an impression on how broad the range of oxidation stability for lubricants used in practice is and how the influence of additives can be evaluated. A comparison of the results obtained during a failure analysis with the results derived from the laboratory simulation will proof the applicability of the results out of the tests for a life-time prediction of lubricants under practical conditions.