Achieving comparable tribological conditions in the sealing zone of a radial lip seal to investigate causes of damage

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Damage on radial lip seals (RLS) like cracks, oil carbon, extensive wear or blisters may lead to leakage and the failure of the whole sealing system. Finding the reasons for damage is challenging as during operation the actual loading of the sealing zone of radial lip seals is unknown. Using an RLS-Tribometer offers the possibility to reduce the number of unknown parameters and therefore to draw conclusions concerning the reasons for occurring damage. The RLS-Tribometer, developed at Hamburg University of Technology, uses a simplified elastomer sample to replicate the situation of the sealing zone of an RLS. In contrast to conventional RLS, the radial force between the elastomer and the shaft is adjustable and known. By measuring the friction force it is therefore possible to derive the friction coefficient.

Previous works show the dependency of the friction coefficient on the operating parameters sump temperature, radial force and circumferential speed, as well as on the time. One and the same specific combination of lubricant and elastomer does not have a constant friction coefficient over time at constant operating parameters due to wear and ageing effects in the sealing zone. At the same time, the aging effects are influenced by the temperature in the sealing zone, which depends significantly on the power loss and therefore on the loading in the sealing zone. These complex dependencies make it difficult to draw conclusions about the specific cause of damage. Two experiments that run for example with the same radial force and sump temperature, but at different speeds, have both also a different power loss and ageing. In order to achieve comparable ageing conditions the power loss in the sealing zone is controlled. Experiments with different radial forces and speeds but with the same power loss and sump temperature are run out and the occurring damage is analyzed. This procedure allows to compare experiments with different speeds and radial forces under comparable ageing effects. Furthermore, an evaluation of the ageing processes for various combinations of lubricant and elastomer can be carried out independently of the power loss in the sealing zone.

In this contribution, the capability of the RLS-Tribometer to isolate individual influencing variables on the condition of the sealing zone of an RLS is shown. The possibilities to achieve both comparable ageing and loading conditions are presented and their benefits in the investigation of damage to radial lip seals are discussed.

Keywords: Radial Lip Seal, Damage, Ageing, Controlled Power Loss

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