ANALYSIS OF THE RUNNING-IN BEHAVIOR OF A THERMALLY SPRAYED COATING

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ABSTRACT

As thermal spray coated cylinder surfaces eliminate the need for cast iron sleeves or hypereutectic AlSi alloys, these coatings are becoming the main cylinder liner technology. Moreover, it has been found that these coatings also lead to low friction and wear. The reason for improved tribological performance is believed to result from a nanocrystalline layer that forms in the sliding contact. In this paper, we use on-line wear measurement to study the dynamics of the running-in process. A pin-on-disk tribometer coupled to a radionuclide wear measurement (RNT) system was used to investigate the friction and wear behavior of wire arc spray (LDS) coatings sliding against chromium coatings under lubricated conditions. After the friction experiments, X-ray photo electron spectroscopy (XPS) and Focused Ion Beam analysis (FIB) was used to characterize the worn surfaces.

By introducing a time-dependent Stribeck plot, we analyzed running-in under constant and transient sliding conditions and observed a strong reduction of friction in the boundary lubrication regime. Wear rates of the LDS disks as well as of the chromium plated pins are ultra-low. XPS revealed carbon diffusion at room temperature in wear tracks of disks that showed a very low coefficient of friction (CoF) of 0.01, whereas this carbon diffusion could not be detected in the wear track of a disk without running-in, i.e. a final CoF of 0.12. As this is the most significant difference found between differently run-in systems, the described carbon diffusion might be relevant for the observed friction behavior.

Running-in behavior can only be discussed in terms of friction, as, even with RNT, no significant wear could be measured. The comparison of running-in under transient and constant conditions showed only minor differences in the final friction behavior.

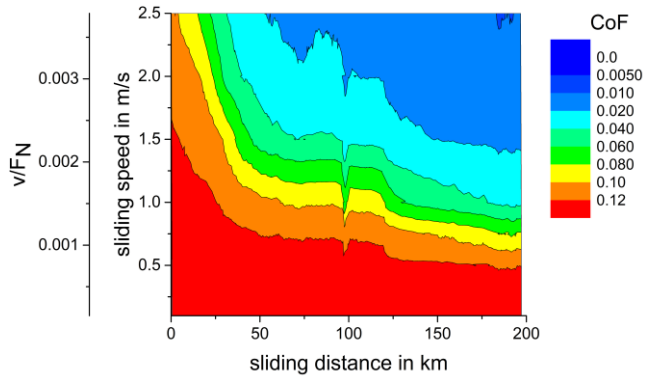

Fig.1 Stribeck map visualizing the running-in under constant load of 35 MPa and transient speeds.