

FRICITION AND WEAR BEHAVIOR OF CO-BASED ALLOYS UNDER HARSH CONDITIONS

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KEYWORDS

Experiments in tribology; wear; tribofilms and 3rd bodies, high-temperature materials

ABSTRACT

The urgent challenge of reducing CO₂ and climate-damaging emissions in the transport sector necessitates exploring alternatives, particularly in the utility vehicle domain. This study delves into the thermal management of heavy-duty commercial vehicles, focusing on flap systems crucial for emission control and wear-resistant brake systems. Employing cobalt-based materials, Tribaloy T-400 and T-800, in an oscillating friction wear tribometer with a high-temperature (HT) test chamber, the research evaluates their tribological behavior in the temperature range of 600 °C and above. The findings showcase improved tribological performance, with glaze layers forming at higher temperatures demonstrating wear-protective effects. Significantly, heat treatment at 600 °C and 800 °C emerges as a key factor influencing wear characteristics. T-800 pairings exhibit a notable reduction in wear, irrespective of the manufacturing process. Introducing the concept of "self-healing" of glaze layers through targeted transient temperature control, the study reveals potential advancements in reducing wear by up to 99 % and improving friction by up to 35 %. Considering manufacturing processes and material choices, the research provides industry-wide recommendations for optimizing real systems, emphasizing temperature, manufacturing processes, and material selection as key influencing factors.

The findings from the studies carried out can now be used to derive specific recommendations for action across all industries with the aim of optimizing state-of-the-art real systems. The focus should be on the technical usability of the influencing factors found: temperature, manufacturing process and material selection.

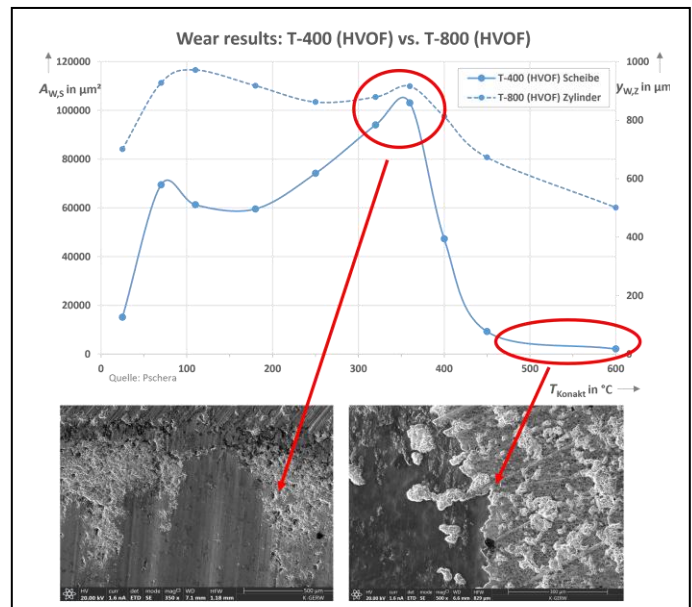


Fig.1 temperature dependency of wear behavior for T-400 and T-800 (both HVOF sprayed), SEM pictures with (T > 400 °C) and without (T < 400 °C) protective glaze layer

With increasing temperatures, oxides or oxide layers of the alloying elements of the HT materials form under the right boundary conditions. These so-called glaze layers, can have a considerable wear-protective effect and reduce friction, if they completely cover the component surfaces. Further information on the resulting oxide compounds can be found in [5].

REFERENCES

- [1] Diestelmeier J, Einhaltung von Emissionsgrenzwerten bei Wirkungsgradsteigerung, MTZ - Motortechnische Zeitschrift, 2020, 81(4), pp. 66-72. ISSN 0024-8525.
- [2] VERBAND DER AUTOMOBILINDUSTRIE E.V. Quovadis, Diesel?, p. 17, 2017.
- [3] Beau, P, Hochtemperaturtribologie Nutzfahrzeug. Internal document VW Group, 2019.
- [4] Fischer, C., Masterthesis - Untersuchung des Reibungs- und Verschleißverhaltens ausgewählter metallischer Werkstoffpaarungen bei erhöhten Temperaturen im trockenen Gleitkontakt, p.34, TH Nürnberg and MAN Truck & Bus. Nürnberg, 2018.
- [5] Wahl M, Brodyanski A, Lösch J., Kopnarski M, Loos P, Beau P, Kolmer P, Analytische Charakterisierung der Oberflächenkorrosion von Kobalt-basierten Legierungen unter (Hoch-)Temperatur-Reibbelastung: 61. Tribologie-Fachtagung; Gesellschaft für Tribologie, 2020.
- [6] DELORO WEAR SOLUTIONS GMBH. Tribaloy™ T-400 Alloy: Technical Data, 2019.
- [7] DELORO WEAR SOLUTIONS GMBH. Tribaloy™ T-800 Alloy: Technical Data, 2019.