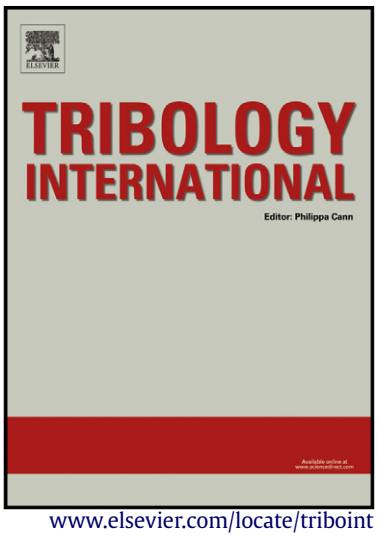

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www.elsevier.com/locate/triboint

PII: S0301-679X(14)00215-1
DOI: http://dx.doi.org/10.1016/j.triboint.2014.05.027
Reference: JTRI3350

To appear in: *Tribology International*

Received date: 5 March 2014
Revised date: 23 May 2014
Accepted date: 28 May 2014

Cite this article as: Igor Velkavrh, Florian Ausserer, Stefan Klien, Josef Brenner, Pierre Forêt, Alexander Diem, The effect of gaseous atmospheres on friction and wear of steel-steel contacts, *Tribology International,* http://dx.doi.org/10.1016/j.triboint.2014.05.027

THE EFFECT OF GASEOUS ATMOSPHERES ON FRICTION AND WEAR OF STEEL-STEEL CONTACTS

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Abstract

It is generally known that gaseous atmospheres can significantly affect the friction and wear behaviour of non-lubricated contacts; however there still exists a lack of knowledge on the subject, since the tribological behaviour and the tribochemistry of the gas-lubricated systems is highly sensitive to the selection of the operating parameters, and the results from available literature are often scattered and sometimes even contradictable. This study was focused on the identification of the friction and wear mechanisms of technical gases used at atmospheric gas-pressure in non-lubricated DIN 100Cr6 (AISI 52100) bearing steel contacts at severe operating conditions (high-frequency oscillation at high contact pressure). Argon (Ar), nitrogen (N_2) and carbon dioxide (CO_2) were used as gas atmospheres and air atmosphere was used as a reference. The gases are analysed in terms of their chemical reactivity with the steel surfaces and a correlation between the properties of different tribochemical products and the observed friction and wear mechanisms is made.

In N_2 and CO_2 atmospheres, wear was significantly lower than in air atmosphere, with a wear reduction comparable to the effect of using a liquid lubricant. In N_2 atmosphere, a slightly higher friction was measured than in air atmosphere, while in CO_2 atmosphere, friction was 60% lower than in air atmosphere. In Ar atmosphere, both friction and wear were slightly higher than in air atmosphere. With X-ray photoelectron spectroscopy (XPS) of the wear