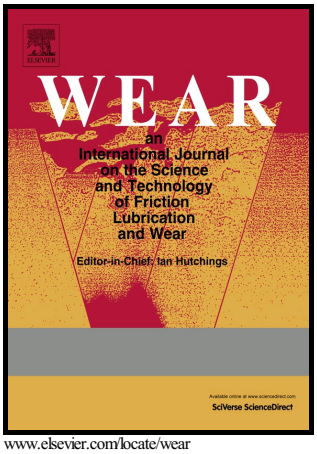

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INFLUENCE OF LUBRICANT FORMULATION ON ROLLING CONTACT FATIGUE OF GEARS – INTERACTION OF LUBRICANT ADDITIVES WITH FATIGUE CRACKS

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Abstract

The influence of lubricant additives on rolling contact fatigue crack propagation and the mechanisms responsible for the resulting micro-scale damage, was studied via experiments conducted on complete transmissions in a test cell. Bench-scale tribological tests and the exposure of steel surfaces to two different formulated lubricants were also carried out. Scanning and Transmission Electronic Microscopy observations, Electron Dispersive Energy and X-ray Photoelectron Spectroscopy analyses indicated that the sulphur present in the extreme pressure (EP) additives has a positive impact on limiting damage propagation. Thanks to TEM observations of cracks, it was demonstrated that a sulphur rich film is formed at the crack tip. This film can act as both a barrier film towards hydrogen permeation within the metal and / or as an inhibitor of oil decomposition. The latter is associated with the nascent surface's ability to limit hydrogen generation. Without such hydrogen embrittlement, crack propagation is slowed down.

Highlights:

- Lubricant additives are found to influence Rolling Contact Fatigue of gears
- Elements from lubricant additives are detected within cracks
- Sulphur is found to form a film at the crack tip and to have a positive effect on RCF
- The sulphide film formed at the crack tip seems to inhibit hydrogen embrittlement

Keywords

Rolling contact fatigue, Gears, Steel, Lubricant additives, Electron microscopy, XPS, Hydrogen Embrittlement