

## Preventing hydrogen-induced failures in bearing steel using lubricant additives

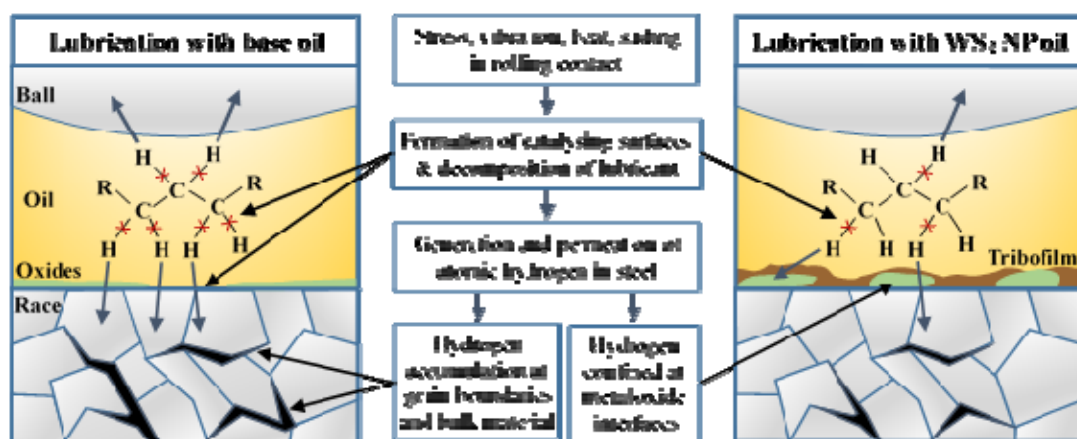
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Hydrogen is a small atom that permeates through the superficial layers of steel and uses its reducing character to modify the chemical structure. This can lead to unwanted changes of the material properties and can ultimately affect the reliability of components. Understanding the behaviour of steel components in hydrogen environments and designing new technologies capable of improving their performance and increasing their life cycle constitutes an important challenge towards a hydrogen economy, as described by the objectives of I<sup>2</sup>CNER.

This talk will give an overview of the feasibility of using lubricant additives to reduce the permeation of hydrogen into bearing steel and subsequent hydrogen embrittlement. In lubricated conditions, surface active lubricant additives such as tungsten disulphide (WS<sub>2</sub>) or zinc dialkyldithiophosphates (ZDDPs) can generate a protective tribofilm on the metal surfaces, which acts as a barrier against the permeation of hydrogen. This can reduce the negative effect of hydrogen in steel and paves the way for a clean, efficient hydrogen-based economy in the future.



**Fig. 1** Formation of a chemical tribofilm by WS<sub>2</sub>

V. B. Niste, H. Tanaka, M. Ratoi, J. Sugimura, *RSC Adv.*, 2015, **5**(51), 40678-40687.