Controlling hydrogen-induced failure of bearing steels

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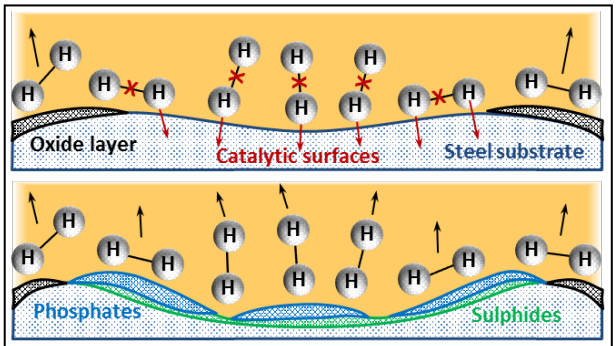
This talk will give a brief introduction to tribology and the relationship with the efforts here at I^{2}CNER to prevent hydrogen related failures. Tribology is the science of interacting surfaces in relative motion and is a relatively new field compared to other engineering disciplines. The main objective of tribology is to reduce friction/wear and prevent material failure. Reducing wear leads to a longer lifetime for components, while less friction correlates with improved efficiency.



Contact passivation using additives

With the continuous increase in bearing steel strength, a new type of failure was observed in rolling elements related to the presence of atomic hydrogen in the material. High strength steels are particularly susceptible to hydrogen embrittlement and can experience premature failure that drastically reduces their life. Lubricant additives can affect this process by creating tribofilms on the metal interface during operation.

This project investigates the impact of tribofilm generation by additives on the permeation of hydrogen in materials for various conditions. The effect of temperature, additive composition and oil polarity and chemistry on hydrogen uptake have been clarified by analysing the tribological contact. A qualitative physical and chemical description of the process was established towards the optimization of lubricated contacts.

The talk will emphasize the feasibility of using lubricant additives to reduce the permeation of hydrogen into bearing steel and subsequent hydrogen embrittlement. This can reduce the negative effect of hydrogen in steel and paves the way for a clean, efficient hydrogen-based economy in the future, as described by the objectives of I^{2}CNER.