Adapting lubricant additive reactivity to control the hydrogen embrittlement of bearing steels

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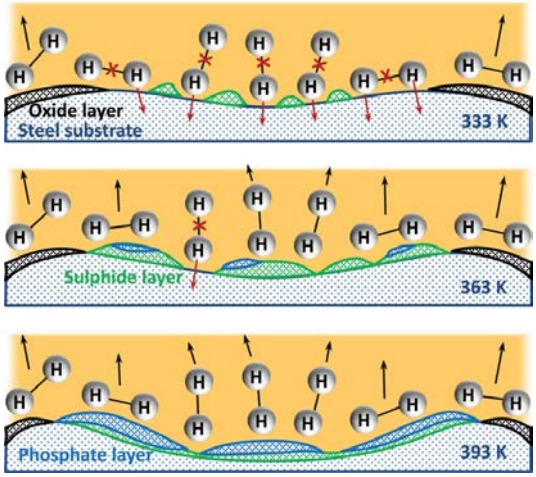
This talk will give a brief introduction to tribology and the relationship with the efforts here at I^{2}CNER to prevent hydrogen related failures. Tribology is the science of interacting surfaces in relative motion and is a relatively new field compared to other engineering disciplines. The main objective 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.

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 study investigates the effect of temperature and base oil polarity on the growth of ZDDP tribofilms, offering more knowledge regarding optimum operating conditions of rolling elements. It was found that the concentration of hydrogen in the material is related to the competition between the base oil and the additive for the wear track interface, which is responsible for atomic hydrogen production.



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.