How hydrogen influences wear and friction under tribocorrosion conditions

Anna Igual Munoz*[1], Marcin Kowalski , Ayush Khurana , and Stefano Mischler

[1]Ecole Polytechnique Fédérale de Lausanne – Switzerland

Abstract

Tribocorrosion is an established field dealing with tribological contacts in reactive environments (i.e. biological fluids, hydrogen or CO2 atmospheres, seawater, ammonia). As a consequence of the interaction between chemical and mechanical phenomena, wear mechanisms are of particular interest, especially when facing new technological challenges such as hydrogen powered economy, renewable energy sources, personalized health or electrical transportation. In this talk the current state-of-the art of tribocorrosion mechanisms of the involved phenomena and modelling will be given together with the specific application to understand which is the effect of hydrogen intake on wear and friction of carbon steel under different tribocorrosion conditions. To do that, an electrochemical hydrogen charging method was used followed by tailored tribological experiments in aqueous solutions under well controlled surface conditions (presence or absence of oxide film on the carbon steel). The electrochemical charging consisted on applying a cathodic current density of 24.3 mA/cm2 during 24 h in a 0.5 M Na2S solution at room temperature. The effect of the hydrogen intake on the material properties was identified through the measurement of the fracture energy by carrying out Charpy tests. A decrease in fracture energy from 8 J to 4 J was obtained after the hydrogen charging.
The tribocorrosion results show how the effect of hydrogen intake on friction and wear depends on the applied potential (driving force for the electrochemical reactions), in particular on the fact that the carbon steel forms a passive thin film or not.

*Speaker