Contribution ID: **7** Type: **Oral Presentation**

Understanding tribocorrosion of active steels: a combined experimental and numerical approach

Wednesday 22 October 2025 09:30 (20 minutes)

Tribocorrosion research have greatly advanced our understanding of the interplay between wear and corrosion in different materials. While considerable progress has been made in elucidating the tribocorrosion responses of passive alloys such as stainless steels, the combined effects of corrosion and mechanical wear in active steels remain less explored.
In this work, the tribo-electrochemical behaviour of active steel DC01 has been investigated under tribocorrosion conditions in a 1M NaCl solution. Potentiodynamic and potentiostatic measurements, the Scanning Vibrating Electrode Technique (SVET), and detailed surface analyses using (FE-SEM and EDX) are employed to examine how interfacial oxygen, evolving surface roughness, and oxide-layer formation governs corrosion mechanisms. To further elucidate tribocorrosion behaviour, we conducted a series of tribological tests under corrosive conditions, differentiating the contributions of corrosion, electrode agitation, and mechanical wear. Building on these experimental insights, a tribocorrosion model is proposed that integrates a Phase Field framework, capturing the time-dependent metal-electrolyte interface, ion and oxygen distribution, with a contact, friction, lubrication, and wear model to simulate surface evolution. This integrated model provides deeper insight into how time-dependent electrochemical processes, oxygen availability, and tribomechanical contact govern the tribocorrosion performance of active steels.
Our findings show that tribocorrosion in DC01 is largely controlled by corrosion and the formation of a porous oxide layer. Notably, the mechanical wear primarily enhances the electrochemical response through a stirring effect, increasing dissolved oxygen at the interface and thereby influencing the overall tribocorrosion performance.

Authors: Mr AMADOR PORRAS, Jesus (Universidad Politécnica de Madrid (UPM)); Dr IGUAL MUÑOZ, Anna (Tribology and Interfacial Chemistry Group, École Polytechnique Fédérale de Lausanne); Dr MISCHLER, Stefano (Tribology and Interfacial Chemistry Group, École Polytechnique Fédérale de Lausanne); Dr GARCÍA-LECINA, Eva (CIDETEC); Dr VARAS MÉRIDA, Fernando (Universidad Politécnica de Madrid (UPM))

Presenter: Mr AMADOR PORRAS, Jesus (Universidad Politécnica de Madrid (UPM))

Session Classification: Materials and mechanisms

Track Classification: Modelling and Simulation