Contribution ID: **24** Type: **Oral Presentation**

Elucidation of tribocorrosion and repassivation dynamics of stainless steel

Wednesday 22 October 2025 11:00 (20 minutes)

Tribochemical processes occur in various environments, where the combination of mechanical stress and chemical reactions can lead to significant changes in material properties, surface composition, roughness and technological performance. A detailed observation of chemical and mechanical tribodegradation, as well as materials repassivation are difficult to asses in-situ. Our main objectives in this work were to enable mechanistic insights into tribocorrosion and a comparison of repassivation dynamics following electrochemical and mechanical removal of an oxide. We therefore developed a new electrochemical flow cell with in-situ surface scratching combined with elemental analysis using inductively coupled plasma mass spectrometry (ICP-MS). When combined with post measurement imaging, this facilitates both qualitative and quantitative assessments of the electrochemical and mechanical removal of material, and allows a quantitative characterization of repassivation.

Experiments conducted on a stainless steel sample, Fe(82.5)Cr(17.5), demonstrated excellent reproducibility. Due to tribomechanical damaging, repassivation of damaged areas showed considerably faster first order reaction kinetics and higher dissolution rates, compared to electrochemical passivation. During the scratching process, both ions and particles were generated. While high Cr-content ($\geq$ 12%) facilitates full repassivation, low Cr-content ($<$ 12%) samples are unable to form a stable passive layer under tribocorrosive conditions. This technique is directly applicable for analyzing complex tribochemical processes, which can apply to a wide range of available engineering materials.

Authors: KALCHGRUBER, L. (TU Wien); Dr MEARS, Laura Louise Elizabeth (TU Wien)

Co-authors: HANDERKAS, H. (TU Wien); HAHN, M. (TU Wien); RESTER, M. (Berndorf Band GmbH); WEISSENSTEINER, C. (Berndor Band GmbH); VALTINER, Markus (TU Wien)

Presenter: Dr MEARS, Laura Louise Elizabeth (TU Wien)

Session Classification: Bio-tribocorrosion and related phenomena

Track Classification: Recent research topics