



Characterization of the corrosion and tribology under irradiation behaviour of a stainless steel

Bernard NORMAND¹, Philippe MARTINET², Sabrina MARCELIN², Nicolas BERERD³, Nathalie MONCOFFRE⁴, Benoit TER-OVANESSIAN², Dominique BAUX⁵

¹ *Institut National des Sciences Appliquées de Lyon, France*

² *INSA Lyon, France*

³ *Université Lyon1, France*

⁴ *IN2P3 - CNRS, France*

⁵ *CNRS-CEMTHI, France*

Progress in corrosion knowledge is increasing. It is accompanied by more accurate and multi-scale measuring tools. In addition, thanks to significant advances in elaboration processes, materials are becoming fit for purpose. Moreover, it is worth noting the efforts of the community in the field of behavioral and predictive modeling. It is now possible to assume that the main mechanisms of all types of corrosion are known and that the means of characterizing them and monitoring on site are operational. Finally, the means of prevention and repair are in the optimization phase thanks to a good knowledge of the parameters that have to be taken into account.

Nevertheless, from the point of view of the Material Science, it is clear that the materials are not designed only for corrosion, but to respond to multifunctional solicitations.

That is why it is now necessary to consider several approaches to take into account the synergistic aspects between the different requests. In the nuclear field this approach is already widely deployed with stress corrosion cracking, tribocorrosion, corrosion under irradiation.

Considering the mode of loading of the control rods, cooling circuits, to mention few examples in nuclear applications, it seems important for us to perform studies by increasing the level of complexity of the solicitations. That requires to develop new and original researches combining the electrochemical behavior taking into account tribology and irradiation effects. This solicitation mode can be entitled: Tribocorrosion under irradiation.

After having contextualized the project, the presentation will develop the process of designing the equipment adapted to this type of study, as well as the chosen methodology.

Once applied irradiation induces a shift of potential to the anodic values. Since this evolution could result from the oxydo-reduction potential of the solution or from the evolution of the passive film, electrochemical impedance spectroscopy have been performed to characterize passive film properties. The complex capacitance evaluations contributed to characterize physical criteria. Results demonstrate that radiolysis increases potential but not the film properties. Concerning tribo-electrochemistry, our preliminary experiments inform that the irradiation modifies the time constant of repassivation of the worn track, assuming as an effect of the increasing of the redox potential of the radiolysis.