A STATE-OF-THE-ART TRIBOMETER FOR REAL CONDITIONS WITH SUPERHEATED WATER (REAL CONDITIONS IN NUCLEAR ENVIRONEMENT)

B. Munteanu [a*], Y. Gachon [a], C. Larger [b], J. Champavere [b]
*bmunteanu@hef.group
[a] Institut de Recherches en Ingénierie des Surfaces, HEF Groupe,
Zi-Sud, Av. Benoît Fourneyron, 42162 Andrézieux Bouthéon Cedex, France
[b] VELAN,
90 Rue Challemel-Lacour, 69007 Lyon, France

KEYWORDS
Experiments in tribology; friction; wear; superheated water

ABSTRACT

A faithful assessment of the tribological properties of materials cannot be achieved without replicating real-world operating conditions. This is particularly crucial in key domains such as nuclear installations. In this field the implementation of regulations for worker protection from ionizing radiation has driven the development of guidelines for radiation protection. These guidelines suggest restrictions on the use of cobalt-based coatings (Stellite Gr.6) and propose alternative alloys. However, when tested on conventional tribometers, the tribological performances of these substitute coatings are notably inferior to the reference material currently employed in operational nuclear facilities (Stellite Gr.6). This performance gap raises critical concerns about the reliability and durability of components. Consequently, there is a pressing need for in-depth exploration and rigorous evaluation of the tribological properties of substitute coatings under realistic conditions, especially in the presence of superheated water.

In this context, this work aims to introduce a new home-made tribometer specifically designed to operate in super-heated water. Initially designed to investigate valves materials in nuclear installations, this tribometer can easily be adapted for use in other industrial domains such as the petroleum, gas, or chemical industries. This tribometer enables the measurement of the friction coefficient between two flat samples submerged in super-heated water (up to 230°C). This measurement is conducted using an immersed force sensor placed inside the pressurized chamber to prevent any disturbances related to unwanted friction. The capabilities of the tribometer are outlined in figure 1.

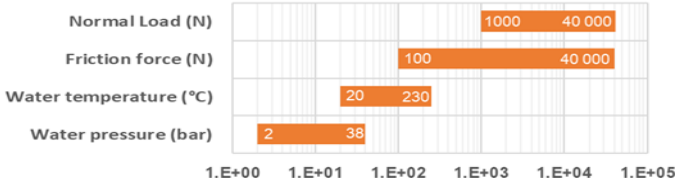

Fig.1 Capabilities of the tribometer

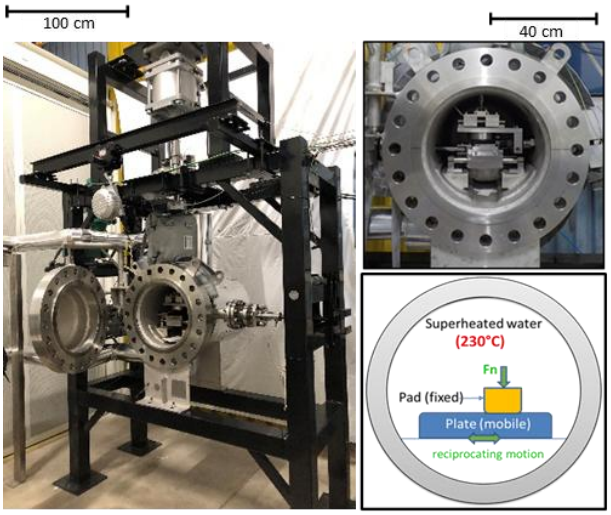

Fig. 2 Home-made tribometer in super-heated water

The preliminary results on Stellite Gr.6 reveal variations in its tribological performance under different testing conditions (water and/or temperature), with notable differences observed, particularly in water at different temperatures. The investigation of tribological properties of alternatives alloys is currently ongoing and shows promising results.

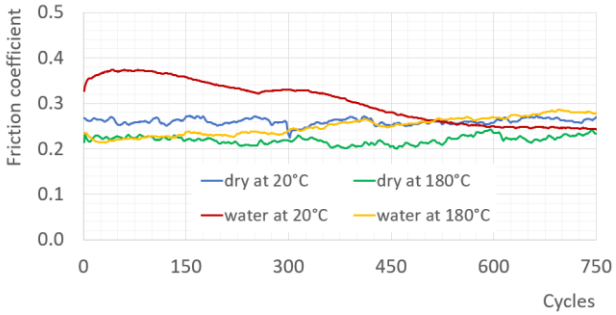

Fig. 3 Preliminary results on Stellite Gr.6 in different conditions

This reaffirms the importance of conducting tribological tests under real-world conditions. By accurately simulating environments like those found in practical settings, it will enable a more comprehensive evaluation of material performances.