**15-160**

# Effect of the Heat-Induced Corrosion on the Mechanical Behavior of Eurofer97 derived by Instrumented Indentations

I. Sacksteder[1*], J.-H. Cherville[1], T. Weingärtner[1] and V. Trouillet[1]

[1]*KIT Karlsruhe Institute of Technology, Institute for Applied Materials, P.O. Box 3640, 76021 Karlsruhe, Germany*

The 9%-Cr Eurofer97 steel remains one of the most technically matured structural materials for fusion applications. Depending on the accumulated dose and irradiation temperature, this material still exhibits embrittlement and hardening after neutron irradiation. The instrumented indentation combined with a post-processing tool has proven to be a suitable technique for the identification of the tensile behavior at room temperature of irradiated reduced-activation-ferritic-martensitic (RAFM) steels. For that reason, a new indentation testing device has been developed and will provide further characterization of RAFM and oxide-dispersion-strengthened RAFM-ODS steels at temperatures up to 650°C relevant for their operation in reactor.

In the machine concept, a vacuum chamber is integrated to the device to provide a high vacuum testing atmosphere and acts for a significant diminution of oxidation at the sample during tests performed at high temperatures. In order to ensure a proper characterization of the bulk material, heat-induced corrosion effects have to be studied in advance. In this context, one method to identify the impact of such effects on the mechanical behavior of Eurofer97 consists in carrying out indentations at room temperature on specimens previously oxidized by heating, and comparing the derived mechanical properties to those determined for non-heated specimens.

The sensitivity of Eurofer97 to oxidation under high vacuum testing conditions is investigated. The kinetics and temperature dependency to oxidation are the focus of this work. Time and temperature ranges, respectively from 1 to 3h and 250 to 550 °C are examined. The Auger-electron-spectroscopy (AES) is employed as technique to assess the thickness and content of the superficial oxide layer built on the samples after heating. AES analyses already indicate that the superficial oxide layer, which is mainly composed of Fe-oxide and Cr-oxide, grows from 8 to 80 nm between samples oxidized in normal atmosphere and those heated during 1 h at 1.10E-5 mbar. Indentations are then carried out and the indentation´s load-depth responses as well as the identified mechanical properties are compared to those obtained for the non-heated material. Further scanning electron microscopy (SEM) analyses help defining more accurately the microstructure of the indented surface after the oxidation process.

---

**Presenting Author*