Contribution ID: **799** Type: **not specified**

P.228 Chemistry and Corrosion Research and Development for Water Cooling Circuits of EU DEMO

Tuesday, 18 September 2018 11:00 (2 hours)

The European DEMO design will potentially use single phase water cooling in various components that require protection against corrosion damage. Coolant conditions will be similar to fission PWRs but with additional considerations arising from materials choices (Eurofer-97, CuCrZr), 14 MeV neutron irradiation, the presence of tritium, and strong magnetic fields. Presently, many aspects of the water chemistry and corrosion behaviour are not well defined, and several strands of work, reported here, are ongoing to address these challenges under the EUROfusion framework in collaboration with industrial partners.

The foundation of this work is a review of relevant operating experience from fission LWR plant to understand the potential for technology transfer, supported by radiolysis modelling to assess options for suppression of oxidising species under high energy neutron irradiation. This has specifically considered the interaction of water with Eurofer-97, utilised in the water-cooled lithium-lead blanket concept. High temperature water corrosion testing facilities have also been employed to expand the corrosion database, reported here an approach using micro-scale samples of structural alloys to study their susceptibility to stress corrosion cracking, and a small-scale flow cell approach for in situ corrosion measurement under changing chemistry conditions.

Consideration has also been given to the effect of intense magnetic fields on corrosion through exposure of Eurofer-97 coupons to a magnetic field intensity of 0.88 T and temperatures of 80°C. Further work is reported aimed at identifying the nature and extent of any impact on corrosion behaviour in higher temperature water.

In-vessel cooling of the divertor will use CuCrZr under lower-temperature, high flow conditions, which will lead to different considerations and the potential for flow assisted corrosion. Additionally, high, unidirectional, heat fluxes lead to a radial temperature profile and the possibility of sub-nucleate boiling. A separate test set-up, currently under construction, to expand this corrosion database is described.

Presenter: HARRINGTON, Chris (Culham Centre for Fusion Energy)

Session Classification: P2