Contribution ID: **779** Type: **not specified**

P2.208 Microstructure and mechanical property mapping of CuCrZr with complex and non-uniform thermal history

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

The divertor component is subject to some of the most extreme loading conditions in a fusion environment and the safety design window is relatively narrow. Variation in mechanical properties of the same material throughout a component is common place in practice and can be caused by both local effects of processing and joining, and local variations in thermal history, neutron flux and other environmental conditions. By their nature, divertor geometries exhibit high gradients in temperature and stress due to high heat loading and geometric discontinuities, which is readily identified by conventional engineering analysis tools such as finite element modelling. The complex conditions imposed on materials can result in spatially heterogeneous properties which are difficult to predict and remain unaccounted for in conventional structural integrity assessments.

In this work, we present the use of multiple techniques including small angle neutron scattering (SANS), Transmission Electron Microscopy (TEM), Nanoindentation (NI) and tensile testing, in order to relate variation in materials microstructure with tensile properties for CuCrZr alloys with controlled thermal history. Then we apply SANS and NI to determine the microstructural state typical of a divertor mock-up assembly, which has undergone complex heating and cooling cycles. Material property mapping is used to measure the local variation in properties throughout a component geometry, which is used to infer a variation in local stress-strain properties. It is proposed that the use of measured spatially heterogeneous material properties by these mapping techniques may provide engineers with useful insights for the design and failure analysis of components.

Presenter: SCHOOFS, Frank (UK Atomic Energy Authority)

Session Classification: P2