Contribution ID: **457** Type: **not specified**

P4.121 Testing of a high temperature radiatively cooled Li/Ta heat pipe in Magnum-PSI

Thursday, 20 September 2018 11:00 (2 hours)

In 1998 Makhankov [1] described the concept of modular exchangeable plasma facing components (PFCs) based on liquid metal heat pipes which are radiatively cooled. Here we present results from recent experiments with a lithium filled tubular heat pipe owned by Sandia National Laboratories. The tantalum envelope (~20mm diameter by ~200mm long) was heated on its side wall using a hydrogen plasma beam in Magnum-PSI. A single continuous pulse lasting ~2 hours was carried out with the active zone of the heat pipe operating at a temperature of ~1000C for the whole time with no cooling other than the Planck radiation. Target tilting was used to vary the peak surface heat flux in the range 8-14MWm2. The tilting also increased the magnetic field component normal to the return flow of lithium via the sintered niobium wick to ~1T to allow evaluation of the impact of the magnetic forces. Near infra-red thermography from two orthogonal ports was used to diagnose the surface temperature distribution. Reference pulses run on a 2mm thermally isolated molybdenum plate provided a simple target for beam power characterisation.
The heating power was gradually increased until liquid lithium escaped through a crack in the heat pipe near the beam centre [2]. The lithium loss was insufficient to affect heat removal right up to the time when the beam was switched off. The impact of the lithium leak on the plasma was benign compared to that expected from leaks in helium or water cooled PFCs. Other benefits of radiatively cooled modular PFCs are also reviewed in this presentation. Future materials and technology are discussed in [2].

[1] A.Makhankov, Fusion Engineering and Design 42 (1998) 373–379
[2] R. Nygren, SOFT 2018 “Post-test examination of a Li-Ta heat pipe exposed to H plasma in Magnum-PSI”

Part-funded by RCUK Energy Programme grant EP/P012450/1.

Presenter: Dr MATTHEWS, Guy (UKAEA-CCFE)

Session Classification: P4