



Contribution ID: 1156

Type: **not specified**

P3.109 CFD simulation of the water cooling of the DEMO first wall under high heat flux exposure

Wednesday, 19 September 2018 11:00 (2 hours)

The water-cooled lithium lead (WCLL) blanket is considered as one of the possible candidates for the EU DEMO blanket in the present EU fusion roadmap. One of the critical points of the first wall design is the maximal allowed thermal load of the Eurofer97 steel within the limiting temperature of 550 °C. Therefore, the initial reactor geometrical concept of the WCLL blanket allows a heat flux load on the plasma facing surface up to about 0.75 MW/m² only.

The effects of the design changes are evaluated using thermohydraulic three-dimensional numerical simulation. The simulation results show that the width of a blanket module and the thickness between the plasma-facing surface and the cooling channel have a significant role in the surface layer temperature gradients and limit the maximum allowable heat flux to the surface. Geometrical modifications are proposed to increase the limit heat flux under defined thermal conditions.

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Session Classification: P3