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Preliminary mechanism analysis of HyperVapotron experiment for high heat flux components

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The ITER Tokamak Cooling Water System (TCWS) is designed to provide cooling and baking for the Primary Heat Transfer Systems (PHTSs) and relevant systems including the first wall/blanket, vacuum vessel, divertor, etc. For its characters of promising to enhance the heat transfer performance and increase critical heat flux (CHF), HyperVapotron (HV) elements has been put forward as heat removal of high heat flux components in nuclear fusion research facilities.
In our study, a hypervapotron loop test facility was built to conduct some experiments of heat transfer. Phenomena of HV were observed using the techniques of planar laser induced fluorescent (PLIF) , high speed photography, particle image velocimetry (PIV), etc. According to the design of the ITER cooling water system(CWS), the flow and condition parameters were utilized: (1) CuCrZr alloy material, (2) rectangle fin with height 8mm and width 3mm , (3) inlet subcooling temperature of 298K, (4) channel flow speed of around 6ms-1, (5) maximum heat flux of around 1.5MWm-2.
The relation of the heat transfer coefficient (HTC) between rectangle fin 3mm×8mm and rectangle fin 3mm×3mm will be presented under the identical tested conditions. Furthermore, the preliminary mechanism of the heat transfer will be explained by the coupling effect of the vortex flow with air bubble in the fin pitch, and the heat transfer efficiency is extraordinary dependent on the maintain time of vortex forming between the fins.

Eligible for student paper award?

No

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