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P4.200 Evaluation of high heat removal efficiency using cooling water channel with rib structure

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A plasma-facing components (PFC) such as a first wall or a divertor are exposed to high heat flux due to high thermal radiation and high energy particles emitted from a core plasma. Various heat removal techniques had been proposed and developed to remove the high heat load of the PFC. We newly developed a high efficient cooling technique by inducing a turbulent flow in a cooling channel with the V-shaped staggered rib structure, which was originally developed to cool a target of an accelerator-based neutron source. The present work to pilot the future possibilities of the use of the structure of the water channel as a cooling system of the PFC.
The heat load experiments were performed by utilizing electron beam of 40kV in the Active Cooling Test stand 2 (ACT2) at National Institute for Fusion Science (NIFS). In the experiment, the cupper plate with nine water channels was set in a water jacket in the vacuum of the test stand and irradiated by an electron beam. The radiation thermometer and thermocouple set at the depth of 1.5 mm from surface was provided to measure the surface temperature of cupper plate. Temperature change of the cooling water was measured simultaneously. To evaluate the high heat removal performance of the "Rib channel", it compared with the simple straight channel.
As a result of the heat removal experiments, we could confirm that the V-shaped staggered rib structure cam improves the heat removal performance more than double in comparison with the simple channel structure. In addition, the surface temperature increase of the surface was 100 K when heat load of 20 MW/m2 was supplied, so the "Rib channel" structure can be applicable for the water cooling system of the PFC.

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