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Thermomechanical Assessment of the K-DEMO Divertor Target Applying CuCrZr and RAFM as Heat Sink Materials

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Divertor is one of the most challenging and important components in DEMO plants, since the enormous heat load from plasma applied onto the divertor target must cool down. In a conceptual study of the Korean fusion demonstration reactor (K-DEMO), a water-cooled divertor concept applying the tungsten monoblock type was of primary consideration. The target peak heat flux of 10 MW/m2 was set in steady state operation. To faithfully cool down the heat load, the selection of materials that the divertor is composed of is important as well as the decision of design parameters. Especially, the choice and design of the heat sink material in the divertor target are quite significant because the heat sink directly interfaced with the coolant. Reduced activation ferritic martensitic (RAFM) steel and CuCrZr have been considered the most promising candidates as the heat sink material. The preliminary designs of the high heat flux (HHF) units operating within materials' own allowable temperature were derived by accomplishing thermohydraulic analyses for RAFM and CuCrZr. Based on the designs of HHF units with a support structure, thermomechanical analyses were carried out. In mechanical analyses, the mechanical loads including the body force, the pressure caused by the coolant, the electromagnetic force were considered as well as the thermal load imported from computational fluid dynamics calculation. In this study, the structural stability of the divertor target applying RAFM and CuCrZr heat sink was accessed by performing the elasto-plastic analysis

Eligible for student paper award?

No

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