§5. Feasibly Study on Gas-Cooled High Flux Test Cell of IFMIF

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In this F.Y., temperature control performance of test pieces enclosed in capsule was estimated numerically. The key issue of this numerical study is to obtain the definite value of dimension of test facility which is planned to be constructed in next F.Y. and flow conditions of coolant and to clarify the temperature response of test piece to the beam-off scenario.

Fig. 1 shows the calculation domain used in our study which is based on the test cell design proposed IFMIF-KEP. Calculation was performed in three dimensional system by using brand-new turbulence model for flow and thermal fields. The inlet Reynolds number of flowing He coolant was in the range of 3400 to 185000, which corresponds to the inlet pressure condition ranged from 0.1MPa to 0.9MPa. Specific nuclear heating was assumed to be 5W/g for both test piece and rig wall material. Material of test piece and rig wall was SUS and that of capsule was option, DS-Cu and SUS. In spite of materials of capsule, the maximum temperature of test piece can be kept at 550K when the Reynolds number is 68000 and inlet pressure 0.5MPa and inner gap width is 0.1mm. However, in the DS-Cu case, the time required for reaching maximum temperature from the start-up is 600sec, which is 6 times that in the SUS case.

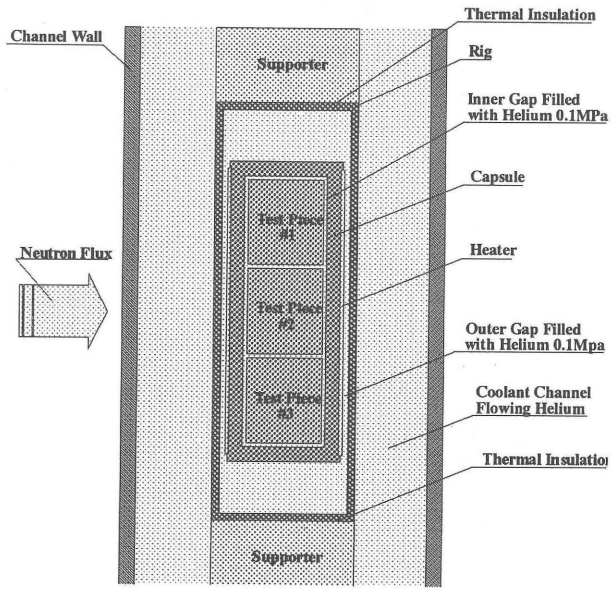

Fig 1. Calculation system

Fig. 2 shows the temperature distribution at center cross section of test piece in the case of SUS capsule. The temperature difference between maximum and minimum values is 40K Furthermore, according to the numerical results, it is cleared that the uncertainty of measured temperature of test is serious due to the temperature distribution formed in the test piece and change of inner-gap width by volumetric change of test piece.

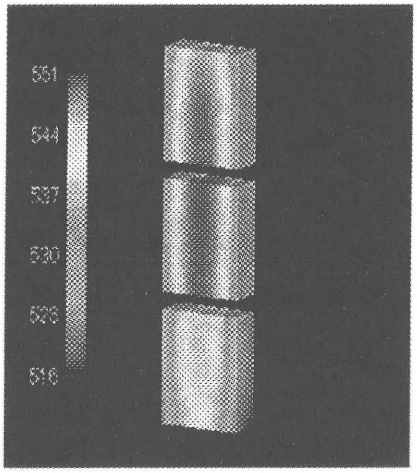

Fig. 2 Temperature distribution in the test piece

From the numerical results, it is concluded that the drastical change of design of test cell is needed in order to obtain the unformity of temperatrure of test piece, to improve the responsibility of temperature measurement of test piece, and to relieve the coolant flow condition, especially for inlet pressure value.