RECENT STATUS OF FABRICATION TECHNOLOGY DEVELOPMENT OF WATER COOLED CERAMIC BREEDER TEST BLANKET MODULE IN JAPAN

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As the primary candidate of ITER Test Blanket Module (TBM) of Japan, development of Water Cooled Ceramic Breeder (WCCB) TBM is being performed. For installation of the TBMs in ITER, it is required to certify the quality of the TBMs. To certify the quality, it is necessary to show verifications of fabrication technique, fabrication capability and the integrity of prototypical size mockup in corresponding operation condition before the delivery of the TBM to ITER. This paper overviews the recent achievements of the fabrication technology development of the WCCB TBM in Japan.

As one of the most important fabrication technologies of the WCCB TBM, Hot Isostatic Pressing (HIP) joining technology was selected to fabricate the first wall with built-in cooling channel structure made of reduced activation martensitic/ferritic steel, F82H. The HIP technology was optimized to reduce the degradation of metallurgical properties of F82H. Finally, real scale TBM first wall mockup was successfully fabricated by HIP joining. High heat flux test of the fabricated mockup showed the feasibility to with the equivalent conditions of the WCCB TBM operation. With respect to the breeder pebble box to be contained inside the blanket box, was successfully fabricated with thin wall cooling pipes and thin plate sleds by Laser welding. By using fabricated mockup, packing tests and purge gas hydraulic tests have been performed using fabricated breeder box packed with Li_2TiO_3 pebbles. With respect to the side walls with built in cooling channels were also fabricated successfully starting from thick plates of F82H. The drilling was used for forming the cooling channels and headers in the side walls. By using fabricated side wall mockup, flow distribution tests have been conducted and successfully showed the relevancy of the heat removal capability. Assembling of the first wall and side walls is one of the critical fabrication processes of the fabrication of the TBM structure. By using a F82H first wall mockup and side wall mockups, assembling process was demonstrated successfully by Electron Beam welding.

Verification of essential fabrication technologies of the WCCB TBM is showing steady progress. Based on the achievements, large scale mockup fabrication and testing will be further performed toward the start of Test Blanket Module testing program.