

Fabrication of CFC/Cu flat type Plasma Facing Components of HL-2M advanced divertor

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HL-2M is a new tokamak machine in SWIP, featuring a small angle slot (SAS) divertor and can perform advanced divertor configurations, such as snowflake and tripod. It is estimated that the wall loads on the target plates can be changed from 3 to 7 MW/m² depended on normal and snowflake or tripod divertor configurations. In order to meet the operation requirements of HL-2M tokamak machine, an active-cooling design of divertor components is considered using CFC/CuCrZr plate mockups by brazing joining. The CFC is CX-2002U from Toyo Tanso Co., Ltd. Japan, which has very high thermal conductivity in the direction of fiber weaving. High heat flux tests (1000 cycles at a heat flux of 10 MW/m²) of small scale CFC/CuCrZr mockups in EMS-60 have proven that this fabrication process is feasible.

This report will introduce the divertor components manufacturing process, including the materials preparation, brazing technology, manufacturing, overall assembly and examination. Materials preparation mainly includes CFC completes surface metallization (modified by using Cr) and subsequent pure copper casting, bending and drilling of internal waterways of CuCrZr alloy. Low temperature brazing (<700°C) technology was performed to ensure the mechanical performance of CuCrZr alloy after brazing. Many new technologies have been developed and applied to the manufacturing process to ensure the accuracy and reliability of components. A variety of non-destructive testing technique (ultrasonic and 3D ultrasonography) were applied in the inspection process to ensure the reliability of the welding interface. Positive and negative pressure helium leak detection ensure that cooling pipes do not have air tightness problems. All units have been manufactured by the optimized process and passed gas tightness and dimensional accuracy examinations, installation of the components on the HL-2M is in progress.

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