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The development of technology of Be/CuCrZr joining using induction brazing

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Beryllium was selected as the plasma facing material for the ITER First Wall. Realization of the advantages of beryllium as a plasma facing material depends on the reliability of the critical beryllium joint with the heat sink made from CuCrZr alloy. This paper considers the method of induction brazing as the technology for this critical joint.
To prevent the formation of brittle intermetallics and preservation of the material properties of the CuCrZr alloy, it leads to the need to minimize the brazing temperature and time of the brazing cycle. This paper presents the result of selection of the optimal eutectic of STEMET 1101 brazing alloy thereby reducing the temperature of the brazing to 680 oC.
Using inductor allows to heat locally the beryllium tile/CuCrZr alloy region. The fast local heating of the braze region allows to melt the Stemet whilst ensuring that the major part of the component remains at a relatively ambient temperature. This is an important feature of the induction brazing technique as it will ensure the minimum time above the transition temperature for the CuCrZr and lead to acceptable material properties. The brazing is performed in a vacuum chamber to avoid contamination and oxidization of the component.
To fix each of the beryllium tiles, a unique clamping tool was developed and applied. This tool allows for an even distribution of the clamping force across the tile and ensures adequate clamping during the complete brazing cycle. The clamping tool does not overheat, can be quickly assembled, and is reusable
Along with ultrasonic testing of brazed joints, the most important criteria for the reliability of the beryllium armor is its behavior under cyclic heat fluxes. Authors present results of ultrasonic testing of the joints, as well as the first results of the high heat flux testing of the mock-ups.

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