TECHNOLOGY FEATURES OF BRAZING OF BERYLLIUM TILES TO THE ITER FIRST WALL PANEL ELEMENTS [[1]](#footnote-1)\*)

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The First Wall Panel (FWP) of the ITER reactor is a multilayer structure with water cooling channels and is one of the most energy-intensive reactor systems. The FWP consists of a massive base made of stainless steel, to which the plasma-facing units (PFU) are fixed, connected in pairs and lined with beryllium armor tiles.

When manufacturing the PFUs, the techniques are used such as precision machining, diffusion welding using hot isostatic pressing (HIP) of 316L(N)-IG steel and CuCrZr bronze, laser and orbital welding, non-destructive (visual, penetrant, radiographic) testing of welds, brazing of beryllium tiles with subsequent ultrasonic quality control of the brazed layer. The finished PFUs are subjected to the following tests: thermal cycling tests simulating the thermal effect of plasma – 1000 loading cycles at a power of 4.7 MW/m2 for 30 seconds each, static hydraulic tests – holding at a pressure of 7.15 MPa for 30 minutes, hydraulic tests with a liquid flow to detect blocked channels, vacuum tests with tightness control at an internal helium pressure up to 4 MPa – the allowable helium leakage rate should not exceed 1 10-10 Pa m3/s at room temperature and 5 10-10 Pa m3/s at 250°C.

One of the most technologically complex operations in the PFU manufacture is the fast brazing of the beryllium tiles to the bronze heat sink layer using low-temperature amorphous copper ribbon brazing alloy developed specifically for this purpose by MIFI AMYETO LTD. Brazing is carried out in a vacuum chamber using induction heating with a copper water-cooled inductor.

During the period from 2021 to 2022, beryllium tile brazing was performed for 50 PFUs, 40 of which will be used later to manufacture a FWP full-scale prototype for qualification tests in preparation for serial production of WFPs. At the moment, the activities on the production of the FWP prototype are at the final stage. During the work execution the key issues of the brazing process were disclosed and discussed, and a plan for a further work using this technology was presented.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/E/ru/IR-Glazunov.docx) [↑](#footnote-ref-1)