DIVERTOR VERTICAL TARGET W SMALL SCALE MOCK-UPS

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- ENEA is involved in the International Thermonuclear Experimental Reactor (ITER) R&D activities. During the last years ENEA has set up and widely tested a manufacturing process, named Hot Radial Pressing (HRP), suitable for the construction of high heat flux plasma-facing components, such as the divertor targets.
- The divertor targets intercept the magnetic field lines and therefore have to remove the heat load coming from plasma via conduction and convection during the normal and transient operation as well as during the off-normal events. During normal operation the heat flux deposited onto the bottom segment is 5-10 MW/m² but the capability to remove up to 20 MW/m² during transient events of 10 seconds has also to be provided.
- This activity, performed in the frame of the EFDA contract 05-1249, was aimed at investigating the feasibility of using an alternative W grade, manufactured in the Russian Federation, for the fabrication of the divertor target components.
- Six mock-ups were manufactured by HRP in the ENEA labs using W monoblocks supplied by the Efremov Institute in St. Petersburg, Russian Federation and IG CuCrZr tubes.
- According to the technical specifications the mock-ups were examined by ultrasonic technique and after their acceptance they were delivered to the Efremov Institute TSEFEY-M e-beam facility for the thermal fatigue testing. The test consisted in 3000 cycles of 15 seconds heating and 15 seconds cooling at 10 MW/m² and finally 1000 cycles at 20 MW/m².
- After the testing the ultrasonic non-destructive examination was repeated and the results compared with the investigation performed before the testing.
- The non-destructive examination results were also compared with the evidences found by the post-testing destructive examination and a good agreement was also found.
- The microstructure changing of the W monoblock material due to the overheating of the surfaces and the copper interlayer structure modification observed in the high heat flux area are reported.
- The leakage points of the mock-ups that did not conclude the testing were localized in the middle of the monoblock while they were expected between two monoblocks.
- This paper reports the manufacturing route, the thermal fatigue testing, the pre and post non destructive examination and finally the destructive examination performed on the six monoblock small scale mock-ups.