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P3.106 Ultrasonic analysis of tungsten monoblock divertor mock-ups after high heat flux test

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In a fusion reactor, heat exhaust is one of the most challenging engineering issues, due to the high heat flux (HHF) expected on the divertor targets. The tungsten (W) monoblock design represents one of the most suitable technological solution for plasma facing components, since it has already met the ITER requirements. However, further research is required to investigate improved solutions to withstand DEMO specific loading. Among the crucial aspects, embrittlement due to neutron irradiation and component life-time estimation play a central role. For this reason, alternative W-monoblock divertor concepts have been developed and tested under HHF cycled loading, in order to assess their performance and expected lifetime under DEMO relevant heat loads and cooling conditions. To support such campaign, post-test non-destructive analyzes, such as ultrasonic test (UT), are required to quantify the damage experienced by the components. In fact, UT allows detecting defects and their location inside the material with good accuracy since it relies on the propagation of mechanical waves which is very sensitive to discontinuities.

In this contribution, a comparison between post-HHF-test UT measures of different W-monoblock concepts is presented. The baseline reference of water-cooled divertor targets (ITER-like) is compared with two other concepts, in which the interlayer between monoblocks and tube has been engineered to increase the performance of the component (Thermal break interlayer, Thin graded interlayer). For each concept, a respective mock-up is analyzed and the ultrasonic measures are reported at the depth of interest. Scans are shown to display the reflected signal amplitude and time of flight at defined depths, therefore giving insight to the shape and entity of the defect, when present. The results will be reported with particular attention to highlight the differences both in the defect morphology and in their location, in particular for defects in critical regions of the component.

Presenter: DOSE, Giacomo (Department of Industrial Engineering University of Rome Tor Vergata)

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