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New developments in the design of a helium-cooled divertor for the Europen DEMO

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The recent development of novel refractory materials for fusion applications with better ductile properties has led, in the recent years, to rethink the helium cooled divertor design under development at KIT. In particular, the availability of pipes and plates made of tungsten laminates showing very good mechanical properties over an extended temperature range has triggered a new search for concepts in which such materials can be used. As a first attempt, a divertor concept having a similar geometry with the water-cooled divertor developed for ITER was investigated both numerically and experimentally. The concept uses W slabs as armor brazed on a 15mm in diameter W-Cu laminate tube. The heat deposited on the surface of the armor is removed using a jet-impingement cooling scheme. Thus, the jets are created using a coolant distribution manifold in the form of a 6mm in diameter cartridge installed inside the W-laminate pipe. Under this configuration, the tested mock-up was able to withstand 8MW/m^2 for a total duration of 83h (100 cycles, each 5 min long) and 10MW/m^2 for more than 2h (25 cycles, each 5 min long). Taking advantage of the lessons learned with the first mock-up, a second mock-up has been developed using an improved cooling scheme, both in terms of pressure losses and in terms of jet flow distribution. The paper will give an overview on the experimental results obtained so far and discuss the further steps foreseen in the development of the present concept, including the integration into a divertor target.

Country or International Organization

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