

EFFECT OF POST WELDING HEAT TREATMENT OF THE HCPB TBM ON THE EUROFER AND LITHIUM ORTHOSILICATE PEBBLES

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The ITER Test Blanket Module (TBM) of the Helium Cooled Pebble Bed (HCPB) blanket concept has a structural box that consists of the first wall and two caps and is internally reinforced by a stiffening grid. The breeder units (BUs), including the beryllium and lithium orthosilicate pebble beds and cooling plates, are contained by the stiffening grid. The lithium orthosilicate pebbles, inside the BUs, are surrounded by cooling plates made of Eurofer. The assembly of the TBM box and BUs is based on several welding processes which require post welding heat treatments (PWHT) at high temperatures (at least 980°C). The current TBM manufacturing strategy proposes packing of the BUs with the lithium orthosilicate pebbles during the TBM box assembly; consequently the pebbles and their containing Eurofer plates will undergo the PWHT after accomplishing the required welding processes. Therefore the objective of this experimental study is to investigate the possible effects of the PWHT on both Eurofer and lithium orthosilicate pebbles and the interactions between the two materials. The test unit is a Eurofer box packed with lithium orthosilicate pebbles and Eurofer specimens. This Eurofer box and all test specimens were heat treated inside a high temperature furnace which is capable of providing the required heating and cooling rates under a controlled atmosphere of vacuum or argon. Charpy impact and tensile tests of Eurofer specimens and crush load tests of lithium orthosilicate pebbles were performed before and after the heat treatment to investigate any changes in the mechanical properties of both materials. The results of these mechanical tests are presented and compared with those of previous studies. The obtained results demonstrate that both materials did not suffer any significant degradation in their mechanical properties or chemical compatibility problems.