

Manufacture of New Set of Calorimeter Panels for the Neutral Beam Injection of ASDEX Upgrade (P3-B-416)

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The Neutral Injection of ASDEX-Upgrade employs calorimeter panels to measure the power of the neutral beam. These components are designed to safely absorb specific heat flux loads as high as 25MW/m² over a period of 10s. The currently used calorimeter panels have reached after ten years the end of their service life time and have to be replaced.

The components consist of the CuCrZr which is a precipitation hardened alloy. The selection of the manufacturing process therefore determines the final thermal and mechanical properties of the alloy. In the past these components were manufactured by a two step brazing process, at about 830°C and 730°C, respectively. This led to an overaging of the material resulting in low mechanical properties. As predicted by finite element calculations the cyclic heat flux load leads to ratcheting at the heated surface finally limiting the life time of the components.

In order to increase the service life time of the component it has therefore been decided to employ electron beam welding as the only joining technique to realise the required joints of the components. To fully characterise this manufacturing route a qualification programme has been performed, which ended in the manufacture of prototypes. These have been tested in ASEDEX Upgrade in comparison to brazed components. After successful qualification of design and processes the manufacture and testing of 100 calorimeter panels has been launched and completed recently. The used design, the results of the qualification tests, the manufacturing sequence and the applied non-destructive methods will be described in the paper.