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TOPIC: F - Plasma Facing Components

Optimization of the JET Beryllium tile profile for power handling (P2-F-489)

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The primary objective of the ITER-like wall project is to install a beryllium main wall and a tungsten divertor. From the point of view of plasma operations, the power handling properties of the new Be tiles may affect the operational space. The tiles design has to be such that it allows routine plasma operation for ITER relevant scenarios, i.e., 3-5 MA ELMy H-modes with high power input (Pin > 30 MW) for lengths of time of ~ 10 s.

Due to the constrains imposed by heat conductivity, eddy current and stress torques on a Be tile, a single Be tile must be an assembly of castellated slices [1]. From the point of view of plasma operations, the power handling properties of the new Be tiles can restrict the operational space of JET, if considerable melting of the tiles is to be avoided. This paper describes the power handling studies for the beryllium wall tiles and the optimisation of their design to achieve the operation goal described above.

The melting temperature for Be is 1289°C, corresponding to a energy limit of 60MJ/m2 for 10s [1]. For low field line angles, the power density on the toroidally facing surfaces is several times higher than the power density on the tile face requiring these to be shadowed. Furthermore the poloidally facing surfaces also have to be shadowed from assembly to assembly due to the large gap between assemblies. The tiles have been designed taking into account these limits and with a geometrical design such as to avoid exposed surfaces at high angles to the magnetic field being melted due to the expected loads. This has been achieved after detailed studies of the power handling of the various limiters and protections, including the effect of the curvature of the flux surfaces, shadowing and tolerance to misalignment.

The surface of the tiles is defined such that, when possible, there is an even distribution of power density over the entire tile surface, and that plasma operation is limited by the tile surface and not the tile edges. The general concept for the tile design satisfying all the requirements is a symmetric surface with an angled ridge that goes through castellations and slices. In the paper we describe the detailed calculations of the power load on the different surfaces of the Be tiles and the solutions found for the different limiters (inner and outer poloidal limiters) and the vertical and horizontal protections of the LH and ICRH antennae and the Be dump plates for upper X-point protection.

[1] Thompson V. et al, this conference