Plenary Talk PV I Mon 9:45 Audimax

The first wall in fusion experiments - an interface under extreme operational conditions — •Rudolf Neu — MPI for Plasma Physics — Technical University Munich

With the largest fusion device, ITER, being built through an international collaboration in the south of France, the test for the viability of nuclear fusion for energy production gets within reach. The hot fusion plasma is confined by a strong magnetic field which conducts the edge plasma into the so-called divertor. It extracts the heat and helium ash produced by the fusion reaction, minimizing plasma contamination through the plasma-facing material. In order to deal with the parallel heat flux from the plasma being in the range of GW/m^2, a large fraction of the power must be dissipated in the edge plasma by radiation. A further reduction of the power density is achieved by inclining the plasma-facing components (PFCs), leading to power loads in the range of 10 MW/m^2. These loads are still larger than those in jet engines by about one order of magnitude and pose huge challenges to the PFCs. For ITER, the adopted solutions are actively cooled PFCs consisting of tungsten armour and heat sinks made of copper alloys. In a future fusion reactor, the demands to the PFCs will be further increased mainly through the considerably larger neutron fluence and lifetime requirements. In order to tackle this, novel metal-metal composites as well as new PFC designs are being developed as risk mitigating alternatives. The presentation introduces the challenges of power exhaust and gives an overview of the state-of-the-art solutions for ITER as well as of novel PFCs for a future fusion power plant.