IFERC Newsletter

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Meeting

3rd IFERC DEMO Review Meeting

The 3rd IFERC DEMO Review Meeting was held in Rokkasho on 28 September 2016 in conjunction with the 19th IFERC Project Committee (PC-19). Participants were 7 from EU (including 2 remote participants), 11 from JA experts, and 6 from IFERC. Progress of DEMO design activity (DDA), and DEMO R&D was reviewed by each home teams. The number of common view topics in EU and JA were increased and their studies have been progressed. DDA sessions were shortly summarized.

Progress in JA DEMO design was reviewed in the steady-state plasma design, power exhaust scenario, breeding blanket concept, remote maintenance, large size of the superconducting magnet, and safety research. DDA joint work was quite effective in identifying feasible directions for DEMO.

The EU fusion program and recent progress in EU DEMO design and R&D were reviewed: work to find integrated solutions of the power exhaust, power conversion to the grid and tritium breeding was emphasized, in order to select technical features of the device and operation conditions of coolant and materials.

Design efforts on common issues in JA and EU DEMO concepts were reviewed.

Plasma design for pulse and steady-state operations:

Previously, JA considered a steady-state DEMO design being capable of pulsed operation (about 0.5 hrs) in the early phase of operation. Recently, in EU, an attempt to combine DEMO1 (pulse) and advanced DEMO2 (steady-state) to Flexi-DEMO is discussed. Issues for steady-state design such as high current drive efficiency and bootstrap current control were reported.

The plasma vertical stability for the elongated plasma and the design study on conducting shell have been progressed in JA and EU. In addition, an optimization method of the plasma ramp-up/down (EU) and a flux-saving study (JA) were reported.

Power exhaust design:

Power exhaust scenarios for the 1.5-2GW fusion power level have been developed in JA and EU. JA is developing a design with the total radiation fraction of ~80% of the heating power and the divertor larger than ITER. As a promising option, EU considers double-null divertor in order to reduce the peak heat load in the divertor and handle the significant first wall load at the plasma top. Issues such as in-vessel component design and tritium breeding ratio (TBR) were assessed.

Evaluation of the first wall load has progressed in JA and EU. Power load distributions of thermal plasma, radiation, and fast ion and alpha particles were reported. The result affects the shape of the breeding blanket, the separation from the plasma, conducting shell design, and toroidal coil size/number.

Breeding blanket (BB) design:

The current BB design marginally achieves the TBR requirement. The BB coverage on the plasma and non-breeding area such as the divertor, limiters, and heating and diagnostic ports were carefully evaluated in EU and JA. In addition, reduction in the BB thickness vs TBR (JA) and 3D-structure of the BB vs neutron protection against the vacuum vessel (EU) were reported.

Plant system design:

Important issues on the DEMO plant design started to be discussed. First, the electric power load for the reactor cooling system was reported from EU and JA in order to assess the station service power and eventually net electric power. Second, tritium handling in DEMO was firstly discussed, and evaluation of the tritium permeation to the coolant, de-tritiation system and techniques were reported.

In addition, progress and common technical issues in the TFC design and fabrication (baseline and options), and remote maintenance of the blanket and divertor modules were reported.

In R&D joint work between EU and JA, two significant results were reported. A compatibility study of SiC and SiC/SiC composites was continued with liquid Pb-Li metal (new blanket concept) at 700°C for 3000 hrs. Microscopic and tritium retention analysis of JET-ILW tiles and dust progressed in 2015-2016, and three papers were presented in 2016 major international conferences.

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