IFERC Newsletter

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Meeting

2nd IFERC DEMO Review Meeting

The 2nd IFERC DEMO Review Meeting was held in Rokkasho on 30 September 2015. Participants were 6 from EU (including 3 remote participatnts), 9 from JA (including 1 remote participant) and 7 from IFERC. The progress of DEMO design activities, DEMO R&D and common database of structural materials was presented by the home teams, summarising common views on specific issues such as the plasma design, divertor study, first wall heat load and remote handling..

Since the last workshop, the DEMO design activity in JA has been reinforced: a Joint Special Design Team was formed in June 2015 for Fusion DEMO. This “all Japan” team consists of 19 full time members from JAEA, NIFS and industry as well as 45 part-time members from JAEA, industry, university and NIFS. For the EU fusion program, the demonstration of electricity production ~2050 in a DEMO Fusion Power Plant is a priority. DEMO design and R&D activities in EU are organized with a central Project Control and Design/Physics Integration Unit, and distributed Project Teams aiming at design and R&D of components.

The latest design efforts on common issues in JA and EU DEMO concepts were reviewed.

Plasma design:

JA is exploring the possibility of higher elongation (larger than 1.65) to enhance the plasma performance, and design study on conducting shell has progressed. EU carried out sensitivity studies to evaluate the impacts of aspect ratio (2.6, 3.1, 3.6) and plasma physics uncertainties.

Divertor design:

JA is developing physics and engineering design of divertor and determining the size, based on conventional concept (single null, water-cooled tungsten target and plasma detachment with significant radiation fraction of 70-80%). In the EU, investigation of divertor configurations is underway, including single-null, double-null, Super-X and snowflake. Double-null divertor configuration is proposed to reduce the divertor size and to improve tritium breeding ratio (TBR).

First wall (FW) heat load and the design:

Evaluation of the maximum thermal heat loads (plasma, neutral and radiation) on FW started in EU and JA DEMOs in order to contribute to the blanket design: the general value is 0.2-0.5 MW/m^2, and it is increased to 0.3-0.6 MW/m^2 at the upper FW, depending on the plasma configuration and exhausted power to the SOL.

Toroidal field coil (TFC) and ripple level:

TFC design (number and size) has a major impact on DEMO cost, technology and performance. Currently, a target TF ripple of 0.3 % is intended on the EU side with 18 TFCs. JA aims for a target ripple of 0.5 % at the plasma surface with 16 TFCs. The ripple loss of energetic ions on the FW will be important in determining the design target of TF ripple amplitude.

Remote maintenance:

EU and JA agreed that a banana-shaped segment transport scheme using all vertical maintenance ports is appropriate for TFC size, power supply for PFCs, segment transportation, while difficulties remain in in-vessel transferring mechanism of segment, pipe connection and conducting shell design.

In addition, the progress in safety studies by JA such as the total loss of coolant and the resulting temperature rise of vacuum vessel due to residual heat was reviewed.

As a joint work between EU and JA, a scale-up production of Pb-Li alloy was initiated for the main erosion/corrosion experiments using ENEA equipment. The first analysis of JET-ILW tiles and dust (transported from JET/CCFE to IFERC in 2014) started.

The objectives and status of Material Database & Handbook were reviewed. Gap analyses between the current design code philosophy and RAFM database are underway. Re-evaluation of F82H data of 3 large batches continued, with emphasis on fatigue, creep and creep-fatigue. The irradiation database is also under rearrangement and the structure of Material database is ready. The work starts with Advanced Steels & High Heat Flux Materials data.

(Nobuyuki Asakura)