IFERC Newsletter

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International Fusion Energy Research Centre, Rokkasho, Aomori 039-3212, Japan

Meeting

20th IFERC Project Committee (IFERC PC-20) meeting

1. General

The 20th International Fusion Energy Research Centre (IFERC) Project Committee (IFERC PC-20) meeting was held at Rokkasho on 22nd – 23rd March, in conjunction with the 5th CSC Review Meeting and CSC closing ceremony. Thirty-two participants attended the IFERC PC-20 in person or via videoconference (VC). Among these were 6 committee members, including the PC chair, David Maisonnier, 8 project team members, including the Project Leader, Noriyoshi Nakajima, one secretary, 2 JA invited experts, 15 experts from the EU and JA Implementing Agencies (3 EU experts via VC).

IFERC project proceeds as originally planed except for minor delay of reports, and summarization of the activities is ongoing. The executive summaries of the 2nd intermediate report of DEMO Design Activity, of the final report of CSC Activity and of the final report of DEMO R&D Activity were distributed as agreed documents. Also, the contents of the 2nd intermediate report of DEMO Design Activity and of the final report of CSC Activity without attachments were reported for review. The final report of DEMO R&D Activity will be reviewed in the next PC-21.

Taking account of the proposal on extension of IFMIF/EVEDA and STP projects until the end of March 2020, the extension of IFERC project was proposed together with update of the value estimates and allocation of contributions of the parties and update of the project team. In the extended period, only activities related to DEMO and REC are planned in voluntary contribution basis. This extension was approved at BA SC-20 held on 27th April.

2. DEMO Design Activities (DDA)

According to Work Programme 2016 (PC 17-13), DDA mainly concentrated on two tasks; 1) design sensitivity studies and integration of component design and R&D for DEMO pre-conceptual design, and 2) further work on critical design issues that were identified to be resolved in the Intermediate Report compiled in February 2015 (1st DDA Intermediate Report). The 2nd Intermediate Report summarizes the results carried out jointly by Europe and Japan under the BA IFERC DEMO Design Activity (DDA). The main goals of this activity are:

- to specify the DEMO technical prerequisites and high level requirements;
- to identify and address the main design and technical challenges in physics, engineering and technology;
- to identify the critical R&D activities to be undertaken to overcome the major design and technical issues identified.

These goals are expected to be achieved in May 2017, as originally planned. However, taking advantage of the extension of the BA, the joint DDA work will continue up to December 2019 and the DDA final report will be issued at the end of the activities.

Notwithstanding different design approaches between Europe and Japan, the preliminary design concepts developed in Europe and Japan have many similarities. Some of the main findings appear in Design Parameters, Power exhaust, Remote maintenance, Superconducting magnets and Safety.

The DEMO Design Activities conducted under the framework of BA collaboration have proved to be very effective in reaching the foreseen objectives and deliverables. The main benefits that have emerged from this collaboration include: 1) synergies arising from working toward a common aim; 2) technical dialogue and improved design creativity; 3) opportunities to benchmark major design and analysis tools; and 4) increased confidence in the design approach, design drivers and perception of remaining technical risks that have been developed jointly.

3. DEMO R&D

Based on the common interest of both IAs toward DEMO, the DEMO R&D activities have been carried out

successfully in accordance with the Work Programme 2016 and Procurement Arrangements (PAs), for the continued five task areas: T1) SiC_f/SiC Composites, T2) Tritium Technology, T3) Materials Engineering for DEMO Blanket, T4) Advanced Neutron Multiplier for DEMO Blanket, and T5) Advanced Tritium Breeders for DEMO Blanket. The PAs of these activities will terminate on 31 May 2017. Thereafter EU and JA activities on DEMO material R&D will continue as part of the DDA.

As to EU/JA joint collaboration, analysis of JET-ITER Like Wall (ILW) title and dust was carried out. It is indicated that the total amount of remaining tritium in dust particles during carbon wall phase is higher than that during ILW phase. It is found that by using IP (Imaging Plate) technique, the amount of tritium deeply retained in the tiles is almost the same in the inboard and outboard sides of ILW. Through microscopic analysis of the surface structures of the inner divertor tiles of ILW, it is found that very local erosion and deposition simultaneously occurred in a very small area of about 1 mm square.

As for activities in EU, studies have been implemented for T1 at CIEMAT. In radiation effect tests for alumina, both conductivity and luminescence results indicated the potential use of plasma etching not only for damage recovery, but also as a pre-treatment to enhance material stability during irradiation.

As to T1 SiC_f/SiC Composites, an investigation was completed for the corrosion behavior of CVI SiC_f/SiC composites with liquid Pb-Li alloy under rotating disc flow condition at 973 K up to 3000 h by using the large-scaled rotating disc equipment. It was found that the thinning depth of the base-sample was almost unchanged even after 3000 hours-test, and the key corrosion driving sources were confirmed.

Concerning T2 tritium technology, three subjects; tritium accountancy, basic tritium safety and tritium durability have been successfully carried out.

Regarding T3 Structural materials, through various tests and analyses, reduced activation ferritic /martensitic steel F82H has successfully demonstrated its stable potential, with the real scale production technology.

As to T4 advanced neutron multiplier for DEMO blanket, it is confirmed that (i) as-granulated prototypic Be intermetallic compounds (beryllide) pebbles have better oxidation resistance than pure Be pebbles, and (ii) the hydrogen generation ratio of as-granulated $Be_{12}V$ pebbles is two orders of magnitude smaller than that of pure Be pebbles. It is also shown that beryllides have strong potential for use in high-temperature environments.

As for T5 advanced tritium breeders for DEMO blanket, (i) the effect of the solvent used on the dissolution of $Li_{2+x}TiO_{3+y}$ pebbles with 20 wt% Li_2ZrO_3 added, (namely LTZO20 pebbles) was investigated for reprocessing and re-use of advanced breeder pebbles, and (ii) LTZO20 pebbles exhibited good tritium release properties. Especially, the ratio of the recovered HTO was less than 1.1 %, and the amount of HTO did not increase with increasing temperature.

4. Computational Simulation Centre (CSC)

The last 5th cycle of simulation projects has been successfully completed under the very high availability over 98% and the very high usage rate over 90% under the continuous and dedicated supports by the integrated project team of CSC including HPC team with the assistance of the Standing Committee. As of February 2017, 639 peer-reviewed papers (448 for EU and 191 for JA) are accepted or published in the major scientific journals of the fusion society like Physics of Plasmas (120 papers) and Nuclear Fusion (103 papers) and also in Physical Review Letters (15 papers).

After the completion of the last 5th cycle of simulation project, dismantling of Helios system started on January and was complete in the middle of February 2017. The ownership of MIC system, GPGPU system, L1 disks, tape system and some IT servers was transferred from F4E to QST. The 5th CSC review meeting was held on 22 March 2017 in conjunction with IFERC PC-20. Scientific highlights and some statistical reports on simulation achievements have been presented.

Finally, by issuing the final report of CSC activity, all the CSC activities were very successfully completed in full accordance with the project plan and with the schedule of the various PAs (one progress report will be issued in May 2017 as a closing report).

5. Remote Experimentation Centre (REC)

Based on partially prepared equipment and network in the REC room, various verification tests of REC functionality were implemented in 2016. The fast data transfer test with ITER of the large amount of data, 50TB per day, was successfully implemented together with the data transfer test with RFX and test for remote experimental tools with JET.

Recently, the environmental preparation of the REC room and installation of REC network have been completed. The large video wall and the server with the management software to use the tape library of Helios were installed by using the EU Common fund for REC. Tests with the tape library started in April 2017.

The software packages addressing the fundamental applications on the remote experiments were successfully developed by March 2017 in collaboration with the Satellite Tokamak program. Development of some other software packages will be completed soon. The verification tests or demonstration of those software packages will be implemented from the end of May to early June 2017. Demonstrations with WEST and JET are planed in 2018.

(IFERC Project Leader: Noriyoshi Nakajima)