

IFERC Newsletter

IFERC

IFERC-N-2014-9, 15 December 2014

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

DEMO R&D Activity

R&D on SiC/SiC Composites: Status of Pb-Li Compatibility Study

Silicon carbide (SiC) and SiC_f/SiC composites are considered as structural and/or functional materials for applications to advanced blanket systems due to their excellent thermo-mechanical properties at high temperatures, low induced activity, good resistance against irradiation, high chemical stability, and high heat resistance. For instance, in the flow channel insert (FCI) concept (as a near-term application), liquid lead-lithium (Pb-Li) eutectic alloy is used both as coolant and tritium breeding material. Identifying compatibility of SiC and SiC_f/SiC composites with liquid Pb-Li is therefore strongly required to design a liquid metal breeding blanket system of the DEMO.

Accordingly, ENEA Frascati originally proposed to investigate the erosion-corrosion behaviour of SiC and SiC_f/SiC composites in liquid Pb-Li under the BA activities. Following discussions at the technical meetings of the 7th Workshop of DEMO R&D (October 4-6, 2010 at Fusion for Energy (F4E) in Barcelona, Spain) and the 9th Workshop of DEMO R&D (September 8-9, 2011 at ENEA in Frascati, Italy), both JA and EU agreed that EU would be responsible for the design and construction of the erosion-corrosion test equipment, preliminary testing, and delivery to Rokkasho, and JA would be responsible for the main testing in the Rokkasho IFERC DEMO R&D laboratory, with the equipment provided by EU.

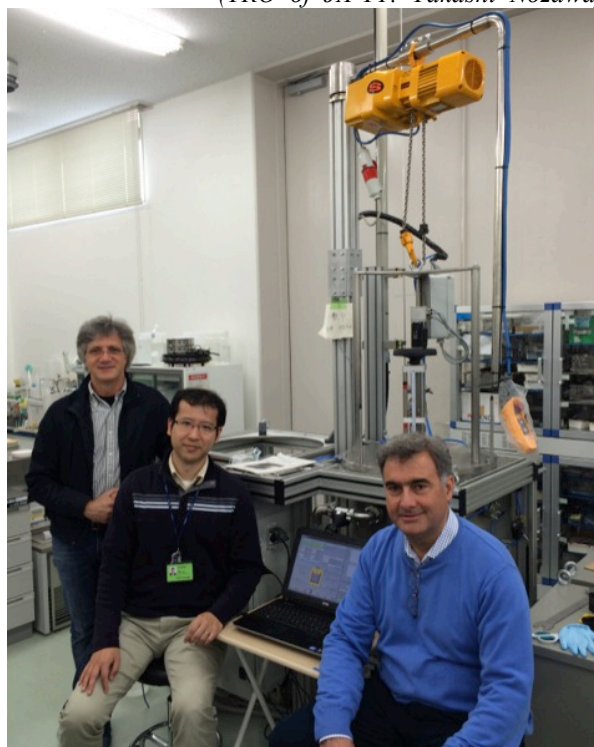
With this agreement, JA proposed the R&D on the compatibility of SiC and SiC_f/SiC composites with liquid Pb-Li, which was not included in the original R&D items. The main objective of this work is to investigate compatibility of SiC and SiC_f/SiC composites with liquid Pb-Li for the application of the Dual Coolant Breeding Blanket concept. Following a peer-review process by the JA and EU experts in 2012, the detailed R&D items were finally determined.

The main functions of the erosion/corrosion test equipment that the ENEA Frascati designed and provided were demonstrated at ENEA Frascati in 21-22 January 2014 for the preliminary acceptance by JAEA, followed by the delivery of the equipment to the Rokkasho BA site in 19 May 2014. After the ownership transfer on 4 June 2014, the equipment was installed in the DEMO R&D building at Rokkasho BA site. After installation of the equipment, the test system was switched on and the start-up operation was carried out

with delegates from the ENEA Frascati. With a confirmation of successful operation of the heating system, the installation of the equipment was finally completed by the end of June 2014. The main work is planned in 2015 with supply of the mass production of the starting Pb-Li.

In parallel, supporting activities have been launched in JA from 2013 in collaborations with JA universities. Alloying technology development, qualification and fundamental characterization of starting Pb-Li were considered, and the conceptual design of the test system to study the joint effect of magnetic field and absorbed gas in Pb-Li corrosion process started as preparatory work. Specifically, under these activities, the mapping of the Li-O bond on the Pb-Li alloy was first obtained in the world. The result obtained highlights the importance of the qualification of the Pb-Li alloy, since impurities may impact on the compatibility with SiC materials. A detailed evaluation is planned in 2015 and beyond.

(TRO of JA-TI: Takashi Nozawa)



Erosion/corrosion test equipment at Rokkasho BA site