IFERC Newsletter

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R&D

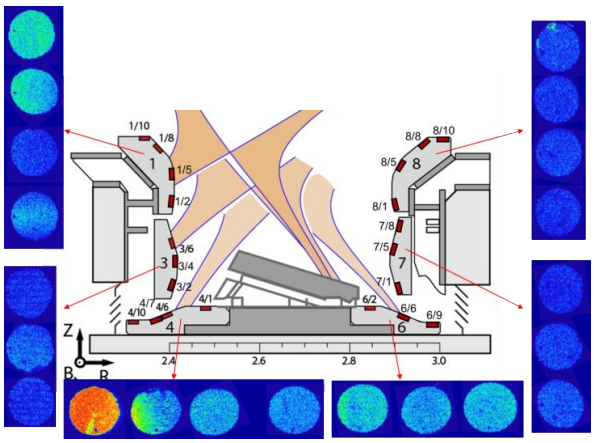
Collaborative analysis of dust and tiles from ITER-Like Wall of JET

In the vacuum vessel of a fusion reactor, the plasma interacts with the surface of materials that are placed on the vessel. This plasma surface interaction wears off the surface material and forms a re-deposition layer on the tile and fine grains like powder. It is well known that fine grains, which are called “dust”, and the re-deposition layer contain high concentration of hydrogen isotopes from the past study. Because accumulation of hydrogen isotopes increases tritium inventory in the vessel and affects fusion fuel cycle, the reduction of the products is considered important not only for a DEMO reactor but also for ITER. To avoid this issue, tungsten and beryllium were selected as divertor and first wall materials for ITER. The Joint European Torus (JET) in UK implemented tungsten coating of carbon tiles, and carried out ITER-Like-Wall (ILW) experiments. Japan and EU decided to carry out characterization of the re-deposition layer and dust of JET during the ILW experiments as part of the DEMO R&D under the Broader Approach (BA) activities. From 2013, collaborative studies for that purpose have been carried out with Japan universities at IFERC.

Shown in Fig. 1 is a typical tritium distribution on JET divertor tiles, where the red color indicates high tritium concentration. The tile of the left edge of the floor, corresponding to the inner divertor, shows high tritium concentration in comparison with others.

This result indicated that tritium concentration significantly changed with the position of the tile. In collaborative studies, the modification of the surface, especially the re-deposition layer, and the composition of the layer have been investigated with several analytical techniques using the equipment in IFERC. The same analytical techniques have been applied to the dust and Fig. 2 shows the cross-sectional image of dust. A thin layer was observed in the dust and it was found that the dust was produced by the sputtering of the wall. Because there are many kinds of dust depending on different generation mechanisms, it is necessary to analyze much more dust to estimate the impact on tritium inventory from the dust. These results are expected to make a great step forward in the DEMO design and preparation of tritium operation of ITER.

(Kanetsugu Isobe)



Fug. 1 Typical example of tritium distribution measured with Imaging Plate.

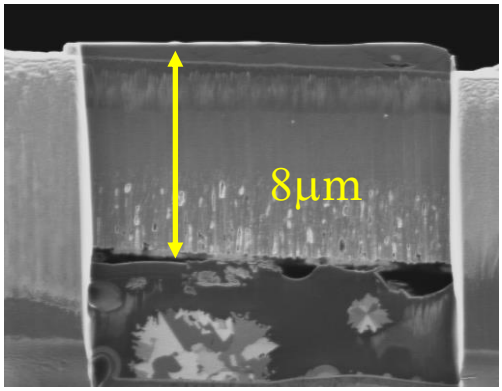


Fig.2 Cross-sectional SEM (Scanning Electron Microscope) image of the dust.