

STUDIES ON EFFECTS OF HIGH CONCENTRATION TRITIUM WATER ON CONFINEMENT MATERIALS AND TRITIATED WATER PROCESSING

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In a fusion reactor, tritium must be handled in a vacuum vessel, a fuel cycle, and other systems. It is quite significant subject how to confine the tritium in these systems. ITER is the first machine in the world where the tritium confinement would be demonstrated as a reactor. To analyze the data obtained at ITER, it is required to establish the database for tritium handling technology through a series of basic studies. Especially, it is strongly desired to get the data for tritiated water. This is because tritiated water is much hazardous than the hydrogen form of tritium. In addition, there is no systematic database for tritiated water. For these reasons, our attention is focused on the study on the behavior of tritiated water in the fuel cycle system and structural materials of the system.

As for the behavior of high concentration tritium water, we could get a series of valuable data for the corrosion of the tritiated water against metal materials. In the case where a metal material is in water, an oxidized layer is formed at the surface of the metal. The oxidized layer functions as a passive layer for the corrosion. However, it has been observed that the formation of the oxidized layer was prevented by the presence of tritium in water (0.23 GBq/cc). The permeation of tritiated water vapor through metal materials and organic compounds has also been studied.

The chemical exchange column has been applied in ITER as the tritium recovery system from tritiated water. A set of data for an advanced chemical exchange column has been obtained. The packing and catalyst are mixed into a column, in contrast to ordinary columns. It has been observed that there was possibility that the advanced column has a large separation factor in comparison with the ordinary columns. Tritium durability tests have also been carried out for the electrolysis cell of the chemical exchange column. It is expected that a large amount of tritium contaminated water is produced from a DEMO reactor. Some possible methods for tritium recovery from the above water have also been studied: an advance adsorption method; and an advance catalyst.