Contribution ID: **134** Type: **Poster**

Exhaust Behavior and Mass Balance of Tritium in Large Helical Device

Tuesday 23 October 2018 08:30 (20 minutes)

The control and management of tritium in a fusion test facility is one of the important issues from the viewpoints of radiation safety and public acceptance. As for the tritium control in a fusion test device, understanding of tritium behavior in the exhaust gas would give us new knowledge into the characteristics of the tritium release and inventory. In the deuterium plasma experiment on the Large Helical Device (LHD) which has the stainless based first wall, a small amount of tritium is produced by deuterium-deuterium reaction in the core plasma and it can be used as a tracer. A portion of produced tritium is exhausted from the vacuum vessel via the vacuum pumping system. To investigate the tritium behavior, the tritium in the exhaust gas was monitored by a water bubbler system for discriminating chemical forms and an ionization chamber.

In the exhaust gas from LHD, the chemical forms of tritiated hydrogen gas was more than 95% and the tritiated hydrocarbons was a few %. Since the divertor tiles are made of carbon, a part of tritium was incorporated into the hydrocarbons by chemical sputtering. The ratio of tritiated hydrocarbon exhaust gas was less than that in JT-60U which has carbon-based first wall. On the other hands, the tritium in the plasma facing component was released by the He and D2 glow discharge cleaning operation. The tritium release mechanism was supposed to the hydrogen isotope exchange reaction and diffusion limited process.

The tritium exhaust rate was gradually increased with the progress of deuterium experiment. Then, the total amount of exhausted tritium was approximately 35.5% of produced tritium at the end of the plasma experimental campaign. It suggested that two-thirds of produced tritium would be implanted in the first wall. The ratio of exhaust tritium during plasma experiment in LHD was about 1.5 times larger than that of JT-60U. Thus, the metal first wall would reduce the tritium inventory in the fusion machine.

The tritium tracer study in the first deuterium plasma experiment in LHD revealed that (i) the tritium on the surface was removed by hydrogen isotope exchange reaction and the tritium release from plasma facing component was diffusion limited process, and (ii) The metal wall is one of key factors to control the tritium inventory and to reduce the tritium compounds in exhaust gas.

Country or International Organization

Japan

Paper Number

FIP/P1-7

Author: Dr TANAKA, Masahiro (National Institute for Fusion Science)

Co-authors: Ms KATO, Hiromi (National Institute for Fusion Science); Mr SUZUKI, Naoyuki (National Institute for Fusion Science)

Presenter: Dr TANAKA, Masahiro (National Institute for Fusion Science)

Session Classification: P1 Posters

Track Classification: FIP - Fusion Engineering, Integration and Power Plant Design