§22. Investigation of Tritium Tracking and Safety Confinement for D-D Burning in LHD

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When the D-D burning experiment will start in LHD in the near future, tritium will be generated in the plasma chamber of LHD in the course of D-D burning. Part of the tritium generated in the plasma chamber migrates through structural materials with surfaces of stainless steel or other alloys and is sorbed in/on the component materials, and the rest of it is evacuated by the vacuum pump system and then is supposed to be transferred to the tritium removal system. Consequently, the former, i.e., the investigation of tritium tracking and tritium safety confinement and the latter, i.e., the establishment of the tritium removal system, affect the reliability of the D-D burning experiment in LHD. Especially, tracking and safety confinement of a large amount of tritium at a very low level have not been established anywhere. In the present study, the tritium-relating issues, tritium tracking in the fusion facing materials and the tritium safety confinement, were reviewed by many tritium researchers and discussed extensively at NIFS. Then an experimental investigation was made on the tritium tracking and safety confinement.

Extensive discussion of the investigation of the tritium tracking and safety confinement for the D-D burning in LHD was made on October in 1999 at NIFS. The workshop report[1] was issued in 1999. Participants were more than 50 researchers including Japanese universities, JAERI, NIFS and other institutes. The number of the oral presenters was eight. The topics reviewed are (1) tritium tracking in the D-D burning in LHD, (2) tritium behaviors in KUCA, (3) tritium migration in cement relating with fission reactor decommission, (4) tritium technology in fusion reactors, (5) JT-60 recent accomplishments and D-T fusion reactor study review, (6) carbon first wall and hydrogen recycling, (7) blanket and tritium breeding study (9) tritium chemical study. Other tritium-relating issues were also discussed there. Discussion made there was useful not only for the D-D burning experiment in LHD but also for the tritium safety study and fusion reactor designs worldwide.

Tritium experimental investigations were also carried out in Kyushu University[2]. The isotopic exchange process was investigated experimentally. HT in the gas phase released accidentally was easily exchanged with H_2O adsorbed on material surfaces as shown in Fig. 1. Therefore, it was found that the exchange process has to be investigated in

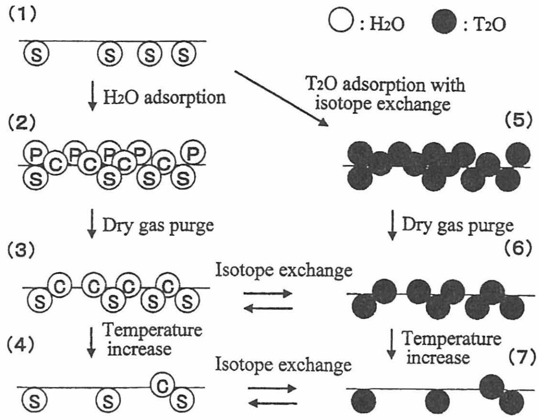

Fig. 1. Schematic diagram to compare the condition of the surface water. (P, C and S in this figure mean physically adsorbed water, chemically adsorbed water and structural water, respectively.)

terms of physically adsorbed water, chemically adsorbed water and structural water.

Figure 2 shows experimental results of tritium trapping capacity on various surfaces of stainless steel. It was found that the trapping capacity strongly depends on surface conditions, and the surface condition can be evaluated in terms of the surface condition factor, α_f. The value of α_f was 1 for polished surfaces and a very low value for commercial tubes.

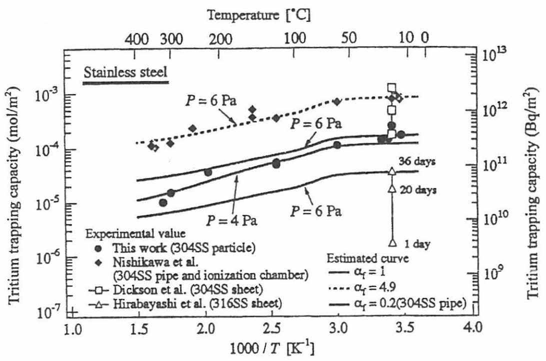

Fig. 2 Experimental results of tritium trapping capacity on various surfaces of stainless-steel.

References
1) edited by Nishikawa, M.: Report of workshop on investigation of tritium tracking and safety confinement for D-D burning in LHD (in Japanese), in Toki, October (1999)
2) Nishikawa, M. et al.: J. Nucl. Mater., 277 (2000) 99.