

### §23. Development of More Sophisticated Tritium Recovery System of Fusion Power Plant

Munakata, K., Hara, K., Wada, K.  
 (Faculty of Engineering and Resource Science, Akita Univ.),  
 Tanaka, M.

It is planned to conduct deuterium plasma experiments in National Institute for Fusion Science (NIFS). In these experiments, D-D fusion reactions take place and tritium is produced, and thus the release of tritium to the environment has to be minimized. Therefore, there is a necessity that the tritium recovery system with large-scale and higher integrity is developed and constructed. However the previous experimental and engineering database obtained by several researchers on adsorbents cannot be applied to the design of updated tritium recovery system since the adsorbents used in the previous studies are not been produced any longer in the industry. Therefore, it is required to obtain and accumulate updated database for chemical engineering design by testing most recently commercial and available catalysts and adsorbents in experiments. In this work, we selected a catalyst (DASH520) and an adsorbent (pellet-type MS5A) and examined their performance.



Fig. 1 Visual image of experimental apparatus for hot experiments

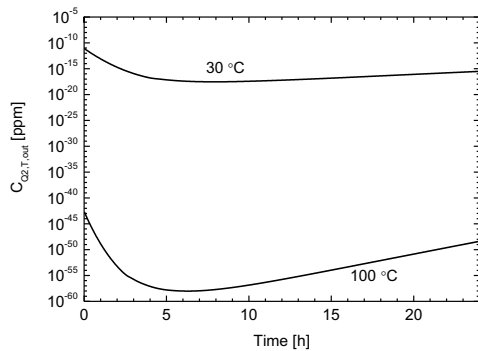


Fig. 3 Change in (a) concentration of molecular form of tritium in outlet gas of catalysts bed and (b) concentration of tritiated water vapor on outlet stream of adsorption bed.

(Temperatures shown in the figures represent the temperature of the process as at inlet of the catalyst bed.)

The experiments on catalytic activity for oxidation over the catalyst were performed using hydrogen isotopes such as  $H_2$ ,  $D_2$  and  $T_2$ . Figure 1 shows a visual image of an experimental apparatus used for tritium experiments. Figure 2 shows mass transfer capacitances for oxidation of hydrogen isotopes over the catalyst. Figure 1 indicates that isotope effects on the catalytic oxidation of hydrogen isotopes are not explicitly observed.

The authors performed simulation studies of a detritiation system designed by NIFS. Catalytic reaction rates, adsorption rates, adsorption equilibrium and so forth were quantified from the experimental results performed up to now, which were used in the simulation studies.

Figure 3 (b) shows changes in the conversions of hydrogen isotopes over the catalyst bed designed in NIFS in the case where a model exhaust gas was processed using the detritiation system composed of catalyst and adsorption beds. As seen in the figure, catalytic activity changes with lapsed time, since water adsorption on the catalyst progresses and reaction heat are generated. Figure 3 (a) shows changes in concentration of the tritiated water vapor in the outlet stream of the adsorption bed. The breakthrough of adsorption of tritiated water vapor starts approximately 15 h after the commencement of the detritiation system regardless of the difference in operational temperatures of the catalyst beds.

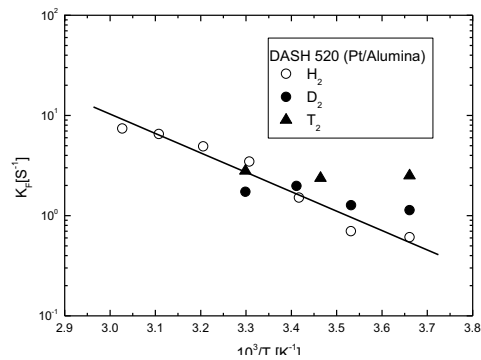


Fig. 2 Mass transfer capacitance for catalytic oxidation of hydrogen isotopes

