

### §3. Development of Advanced Catalyst for Isotope Exchange Reaction Quantification of Reaction Rate

Munakata, K., Shinozaki, T. (Interdisciplinary Graduate School of Engineering Sciences Kyushu Univ.), Asakura, Y., Uda, T., Tanaka, M. (NIFS), Sugiyama, K. (Nagoya Univ.)

The isotope separation by chemical exchange is an indispensable process, which is used for the treatment of tritiated water generated in heavy water reactors. In fusion power plants, which are now under development, the treatment of tritiated water is required as well, and thus the establishment of the chemical exchange process is necessary. In the chemical exchange process, the catalyst, which promotes the isotope exchange reaction, plays a key role. Therefore, catalysts with advanced performance need to be developed. Diversified processes would be placed in the limited space of fusion power plants. The development of the catalysts with advanced performance could lead to higher operation efficiency and decreased volume of the chemical exchange process.

In this work, a Pt/Kogel catalyst was prepared by an incipient wet impregnation method. For the preparation of the catalyst, the solution of platinum amino-complex was used. The reduction treatment was first performed at 573 K under a hydrogen atmosphere by considering the thermo durability of the Kogel substrate. However, it was found that

the kogel substrate melts at this temperature. Thus, the reduction treatment was carried out at 423 K under the hydrogen stream.

In the experiments, a reactor made of quartz was used. The temperature of the reactor was changed in the range of 293 K to 373 K. The argon gas, which contained hydrogen and heavy water vapor, was introduced to the reactor. The concentrations of hydrogen and heavy water vapor at inlet and outlet stream of the reactor were measured with a mass spectrometer. The flow rates were controlled with conventional mass flow controllers.

Open symbols in Fig. 1 show the conversion ratio of deuterium atom from heavy water to  $D_2$  as a function of temperature, when the argon gas containing hydrogen of 5000 ppm and heavy water vapor of 5000 ppm was introduced to the reactor charged with 0.46 g of the Pt/Kogel catalyst prepared in this work. As seen in the figure, the temperature dependence of conversion ratio is small. The conversion ratio ranges from 35 to 40 % in the experimental temperature range, which slightly increases with increasing temperature. Closed symbols in Fig. 1 show the conversion ratio over a commercial Pt/Kogel catalyst. In this case, the temperature dependence of conversion ratio is also small; the conversion is almost from 35 % in the experimental temperature range. Comparison of these results suggests that the conversion ratio over the Pt/Kogel catalyst prepared in this work is slightly higher than that over the commercial Pt/Kogel catalyst. Therefore, it can be said that the fabrication process of the catalyst used in this work is suitable for the preparation of Pt/Kogel catalysts.

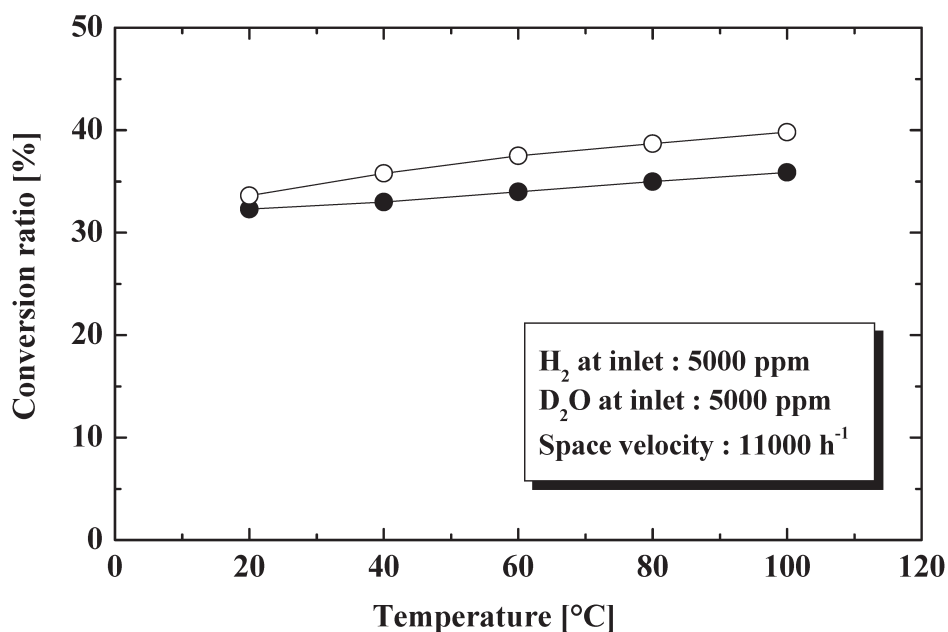


Fig. 1 Conversion ratio of deuterium over Pt/Kogel catalyst