# § 3. Development of High Performance Catalyst for Oxidation of Tritium in Gaseous Phase

Munakata, K., Koga, A., Kanjo, S., Yokoyama, Y., Ianovski, D. (Interdisciplinary Graduate School of Engineering Sciences Kyushu University),
Asakura, Y., Uda, T.

Recovery of tritium released into the working area of fusion power plants or tritium-handling facilities is a key technique to establish the safety related to the fusion technology. The catalytic oxidation and adsorption is the most conventional and reliable method for removing tritium that is accidentally released into the working area of these facilities. If accidental tritium releases take place, large amounts of air should be processed by the air cleanup system. Therefore, the air cleanup system needs be designed to deal with the air with high volumetric velocity. The high throughput of air causes pressure drop in the catalyst bed, which results in higher loading to pumps or air compressors. The honeycomb catalysts, which are generally used in the automotive industry, are designed to deal with high throughput exhaust gases. Thus, it is worthwhile to study the application of the honeycomb catalysts to the air cleanup system. Figure 1 shows the calculated pressure drops as the function of linear velocities of the gas flowing through a packed bed (3 mmϕ particle) and a small-diameter (1 mm) tube modeled as a pass in a honeycomb. It is seen that the pressure drop is apparently smaller in the case of the small-diameter tube, which indicates that honeycomb catalyst is more suitable for the treatment of high-throughput air. In our previous works, the catalytic activity of metal honeycomb catalysts with the cell density of 300 CPSI was investigated. However, those oxidation performances were found to be low. This time, the authors investigated the catalytic performance of cordierite-based honeycomb catalysts. In addition, the effect of increase in cell density on the catalytic activity was studied.

Figure 2 shows the conversions of $H_2$ and $CH_4$ over the Pt/cordierite catalyst with the cell density of 400 CPSI. As seen in this figure, $H_2$ is almost completely oxidized at 100 °C even at the space velocity of 16700 $h^{-1}$, which indicates that the performance of the Pt/cordierite catalyst is higher than that of conventional Pd/alumina catalyst. Thus, it was found that the Pt/cordierite catalyst is effective for oxidation of hydrogen isotopes in the gases with higher throughput. Figure 3 shows the conversions of $H_2$ and $CH_4$ over the Pt/20%Cr-5%Al-Fe catalyst with the cell density of 400 CPSI. As seen in this figure, $H_2$ is almost completely oxidized at 100 °C even at the space velocity of 8500 $h^{-1}$. In comparison with the results for the metal honeycomb catalysts (with the cell density of 300 CPSI) studied previously, considerable improvement in catalytic performance was observed. This is probably because of the increase of the cell density, resulting in higher surface area. Additionally, the use of metal honeycomb catalysts makes it possible to raise rapidly the temperature of the catalyst system due to the higher heat conductivity of metals.

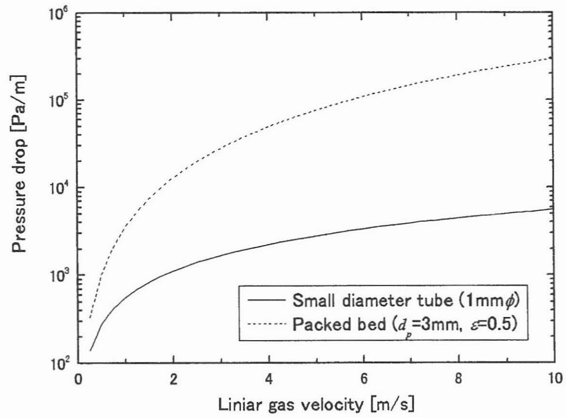


Fig. 1 Calculated pressure drop

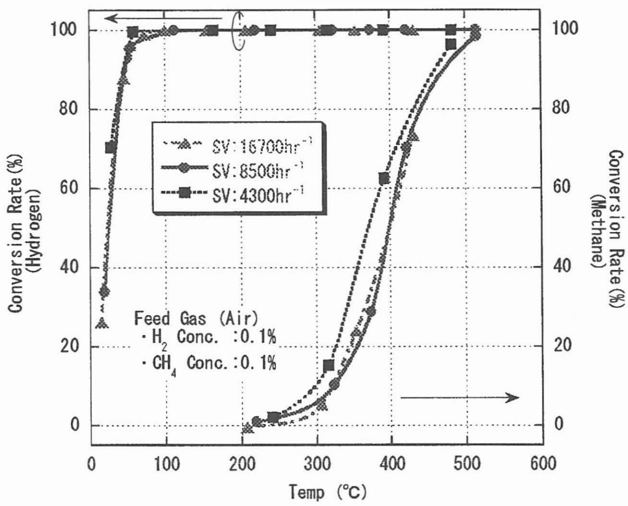


Fig. 2 Conversions of $H_2$ and $CH_4$ over Pt/cordierite catalyst

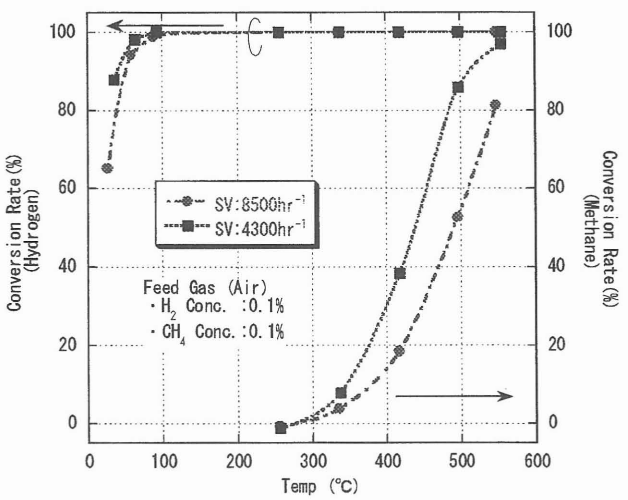


Fig. 3 Conversions of $H_2$ and $CH_4$ over Pt/20%Cr-5%Al-Fe catalyst