§3. Methane Decomposition on Nonvolatile Getter Materials of ZrNi

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In our previous reports, a new type of tritium cleanup system was proposed, in which tritium was removed in a form of hydrogen molecules, and a decomposition process vessel was introduced to convert various tritiated compounds into hydrogen molecules. With the intention of developing the vessel, we took up ZrNi alloys and experimentally investigated methane decomposition properties of the alloys.

Through previous experiments, we have expected that ZrNi alloys must be promising for the decomposition of tritiated compounds. And last year, a series of advanced performance tests of methane decomposition with ZrNi alloys were carried out relating to the temperature dependence, gas flow rate dependence and granular size dependence.

Fig.1 shows the results of the gas flow rate dependence, with which experiments were performed under four different gas flow rates, 20, 35, 70, 100cc/min. The detail of experiment was shown in our annual report(1997) on this series. In Fig.1, the change of methane and hydrogen concentrations in all figures were qualitatively similar, although many differences of quantitative performance were found.

At the first stage of the change, just after the start of the experiment, the methane concentration decreased immediately without observing hydrogen. At the second stage, from about ten minutes to one hour, the methane concentration recovered by degrees, and the gradual increase of hydrogen concentration began. At the third stage, from one hour to some 20 or 30 hours, the decrease of methane and the increase of hydrogen were led to a full scale decomposition reaction. The briskest decomposition reaction of methane and generation of hydrogen were maintained for a while. After that, at the last stage, the methane concentration subsequently increased and the hydrogen concentration decreased utterly quite gradually, then the methane decomposition did not advance any longer.

All the experimental results showed the four-step-change mentioned above. However the definite dependence of decomposition properties under the decomposition conditions was recognized for the duration of briskest decomposition, volumes of decomposed methane and generated hydrogen.

As for on the other dependence tests of temperature and granular size, the four-step-change was also observed. We will investigate the physical and chemical meaning of the four-step-change next year.

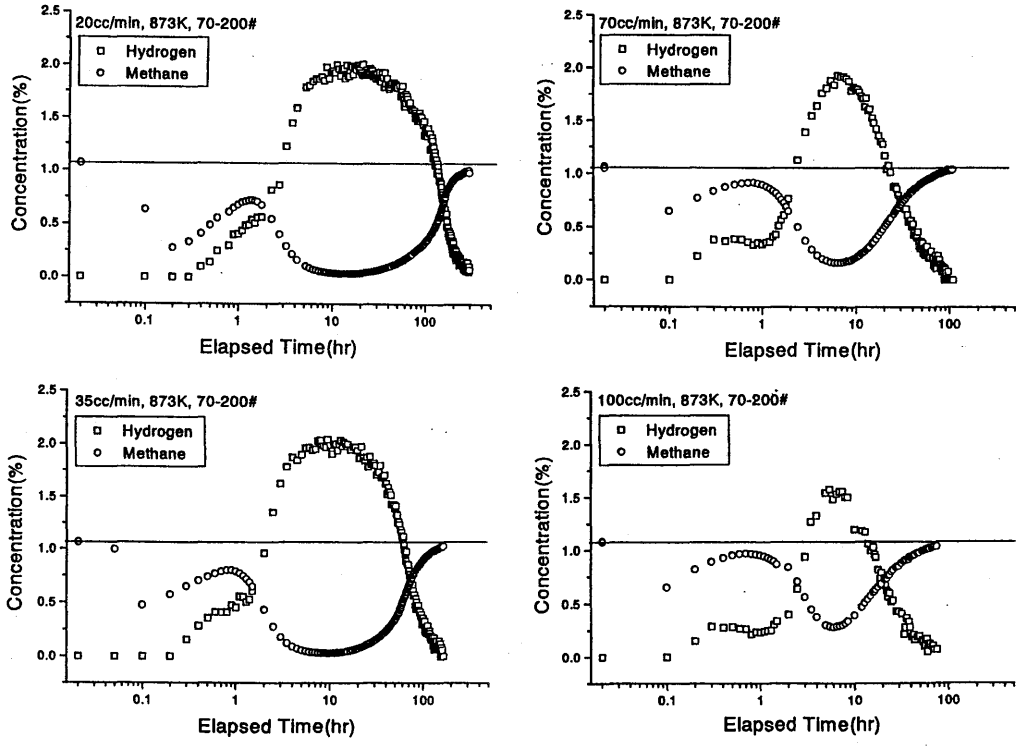

Fig. 1 Gas Flow rate dependence of methane decomposition property