§4. An Application of Tritium Gas Monitor

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Koyanaka and Miyatake showed that, using manganese oxide of spinel crystal structure as catalyst, tritium ion in water is absorbed in solid phase of the catalyst.[1] Their following experiment was also indicated that, with the aid of catalyst, tritium in water can be separated from liquid phase as tritium (HT) and /or tritium water (HTO) gases. Our tritium gas monitor designed for measurement of the tritium concentration in air, which has been developed to improve the detection sensitivity better than 1 mBq/cm^3, was applied to observe the outbreak of HT and HTO gas from low-concentration tritium water in the catalytic reactor.

Fig. 1 is a simplified electronic block diagram of the tritium gas monitor. The proportional counter detects βrays from tritium in the flowing counter gas (PR gas), which passes through the catalytic reactor (not drawing in the figure). Two-parameters spectrum of output signals from the proportional counter i.e., energy and rise time, is accumulated in multi-channel pulse height analyzer.

A typical rise time spectrum is given by Fig. 2, which was obtained by summing up counter signals along the parameter of energy. It is clear that the evident peak in Fig. 2 is caused by tritium β rays. It is not difficult to remove HTO gas from the flowing counter gas. A further experiment to measure counts caused by HT gas only is now in progress.

To perform the measurement for the catalyst of manganese oxide, we had to improve the whole system of the tritium gas monitor including both and soft parts, i.e., gas line to control the flow of counter gas, tritium gas source and computer program for analyzing sequential two-parameters spectrum data. These improvements may be very useful to elaborate the sensitivity of tritium concentration in air, which is the primary purpose of tritium gas monitor.

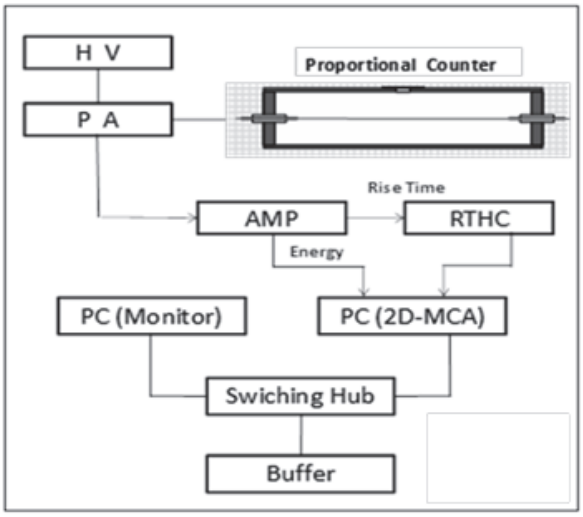

Fig. 1. Simplified electronic block diagram of the tritium gas monitor.

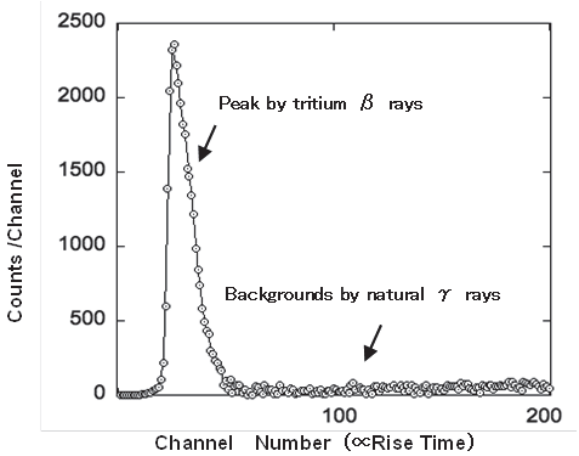

Fig. 2. Rise time spectrum of radiation signals from the tritium gas monitor.

1) H. Koyanaka, and H. Miyatake, Extracting tritium from water using a protonic manganese oxide spinel, *Separation Science and Technology*, **50**, 14, 2142-2146, 2015.