

## §7. Design Fabrication of Tritium Gas Infusion System

Kawano, T., Tanaka, M., Asakura, Y., Uda, T., Sugiyama, T. (Nagoya Univ.), Isozumi, Y., Tosaki, M. (Kyoto Univ.)

For the purpose of certifying that the concentrations of radioisotopes in the exhaust gas do not exceed their legal limits, several gas monitors are being developed at various laboratories. In the NIFS, we are developing the tritium gas monitor with sufficient sensitivity to be able to detect the tritium concentration limits regulated in the law. The regulated tritium concentration limits at an exhaust port are  $70 \text{ Bq/cm}^3$  and  $5 \times 10^{-3} \text{ Bq/cm}^3$  for gases of tritiated hydrogen and tritiated water vapor respectively according to Japanese law. In our monitor, a proportional counter is employed as a tritium gas detector and methane gas is used as the counting gas for reducing the influence of radon in the exhaust air. This proportional counter is bicylindrical; the inner and outer cylinders are referred to as the main detector and the guard detector, respectively. The guard detector is attached to eliminate noise signals induced by incident radiation like cosmic rays, which reduces the detection limit of the monitor, based on the anticoincidence method between the guard and main detectors. Moreover, our monitor differs from conventional ones in that a pulse-shaping analyzer (PSA) is used to distinguish signals due to tritium from other signals.

In the previous study, the performance of our developed tritium gas monitor was examined by using a 5-kBq enclosed tritium wide-area reference source and tritium gas itself was not used. However, we think the performance test using actual tritium gas is necessary for evaluating the monitor precisely, so we designed and fabricated a tritium gas infusion system. Figure 1 shows the fabricated tritium gas infusion system, which is composed of three parts, part 1: tritium gas detector; part 2: infusion instrument; and part 3: volume estimation.

The tritium gas detector is the proportional counter explained above and counting gas of pure methane enter into the system through the counting gas inlet (upper left side in Fig.1) by pressure force of a cylinder bottle of methane and sent into the tritium gas detector and the infusion instrument.

The infusion instrument is installed a pump and used to inject tritium gas into the system through the tritium gas inlet with a syringe. Injected tritium gas spreads and mixes

into the flow of methane counting gas inside the infusion instrument. Mixture of the injected tritium gas and methane counting gas is sent to the detector by a pump in the infusion instrument. The pump is also used to keep steady flow of the mixture between the tritium gas detector and the infusion instrument.

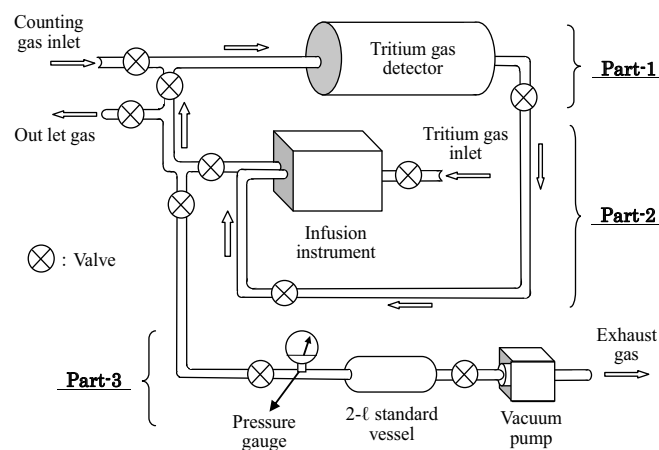


Fig.1 Tritium gas infusion system including connecting diagram of tritium gas detector, infusion instrument, standard vessel and vacuum pump.

The volume estimation contains a pressure gauge, a 2-L standard vessel and a vacuum pump. This part 3 is installed to estimate inner volume of the entire system including whole pipes connecting three parts by observing variation in pressure at the pressure gauge. Thus determined volume of the entire system is used to evaluate tritium concentration in the detector after tritium gas is injected and mixed with flowing counting gas of methane in the infusion instrument.

The tritium gas infusion system fabricated was partly tested its performance and precise examination will be planned.