Extraction of hydrogen and tritium using a high temperature type proton conductor for tritium monitor

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To improve the sensitivity of the tritium monitor, a tritium monitor equipped with a membrane separator has been proposed. The proposed system would be useful not only for the elimination of unwanted interference in the tritium monitor, but also for the enrichment of tritium concentration.

As for the membrane separator, a high temperature type proton conductor, which has the function of electrochemical hydrogen pump, has the attractive advantages. It is able to extract hydrogen gas from water vapor by the electrolysis. Hence, we have chosen the proton conductor of the one-end-closed tube made of $CaZr_{0.9}In_{0.1}O_{3-\alpha}$ as a hydrogen pump. The shape of the test tube was 12 mm inner diameter, 0.75 mm thickness and 340 mm length. The platinum electrode was attached on both sides of the test tube and the effective area was approximately 62 cm^2. To supply tritiated water vapor to the anode, argon gas was passed through a water bubbler filled with tritiated water of about 1000 Bq/cm^3, which was immersed in a constant temperature water bath adjusted to 10^oC. The concentration of tritiated water vapor (HTO) was approximately $6.6x10^{-3}$ Bq/cm^3 and the water vapor partial pressure was 1.2 kPa. Dry argon gas was fed to the cathode. These flow rates were 100 cm^3/min. The test tube was heated up to 973 K by an electric furnace. Then, the constant current was passed through between the electrodes by a galvanostat. Tritium gas was collected by a water bubbler system equipped with copper oxide heated to 325 ^oC. The sample water collected tritium gas was measured by a liquid scintillation counter.

As the result, tritium gas (HT) could be extracted along with hydrogen extraction. The tritium evolution rate reached 0.28 Bq/min and tritium recovery rate was 0.43 at 124 mA. It indicates that tritium gas can be extracted and controlled by the electrochemical hydrogen pump using proton conductor even at very low tritium concentration. The other experimental results of hydrogen pumping characteristics will be presented.