

§10. Study on Separation of Hydrogen Isotopes Using Vycor Glass Tube

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1. Introduction

Tritium compounds that is a fuel for nuclear fusion and is slightly produced at nuclear power generation contains main tritium gas (HT) and minor tritiated water vapor (HTO). The dose coefficient of HTO on human body is much higher than that of HT. Therefore, it is necessary to separate tritium compounds to each chemical form to maintain reasonably the safety and environment in a nuclear power plant. In this study, the separation cell used with the porous Vycor glass tube was proposed as the separation cell of tritium compounds. The permeating rates of HT and HTO through the porous Vycor glass tube wall were investigated at various temperatures on the separation cell used with the porous Vycor glass tube in which residual water was eliminated by heat treatment at 453K.

2. Experimental

The specific activity of the air containing tritium compound (HT or HTO) was about 4MBq l^{-1} . The separation cell consists of the porous Vycor glass tube (Corning Glass #7930, length: 155mm, internal diameter: 7.6mm and thickness: 1.2mm) and jacket tube (Pyrex glass). The porous Vycor glass tube is set up in the center of jacket tube (Pyrex glass) by using with silicon rubber and seal tapes. The micropore distribution and BET specific area of the porous Vycor glass tube was of approximately 2nm of maximum value and $220\text{m}^2\text{g}^{-1}$, respectively. The temperature inside of the porous Vycor glass tube was detected by chromel-alumel thermo-couple and controlled using with nichrome wire heater and air flowing (0.7 L/min).

3. Results and Discussion

The permeations of HTO through the porous Vycor glass tube wall at 373, 413, and 453K were as observed after about 4, 7, 10 h, respectively (Fig. 1). The permeating rate of HTO decreased remarkably against the cell temperature. On the other hand, both permeations of HT through the porous Vycor glass tube wall at 373 and 453K were observed after about 0.3 h (Fig. 2). These facts suggest that the separation cell operated at 453K is able to separate HTO from HT within 8h.

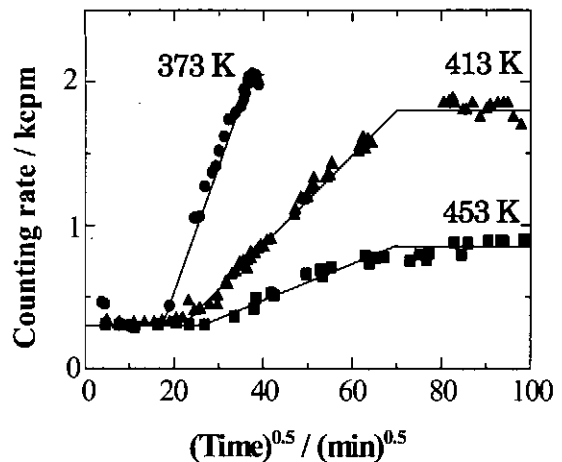


Fig.1 Amount of HTO permeated through the porous Vycor glass tube wall.

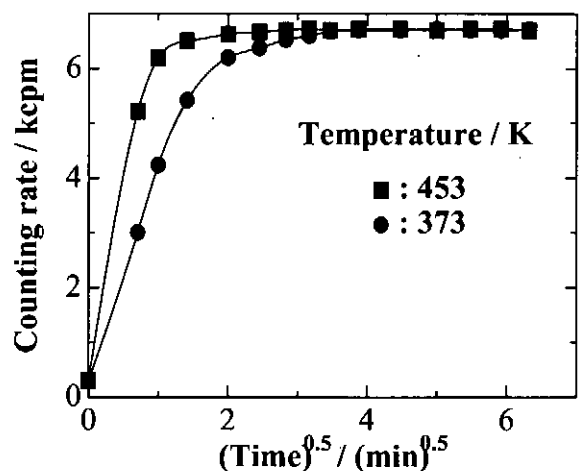


Fig.2 Amount of HT permeated through the porous Vycor glass tube wall.