

Safe Handling of Hydrogen Isotopes

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150

Abstract

The use of hydrogen isotopes in a PHWR raises particular safety issues due to the combined effects of their physico-chemical properties and radioactive nature. Even if the safe handling of hydrogen isotopes has already been demonstrated, it is unanimously recognized that further efforts are still to be concentrated on the improvement of current concepts. The aim of this article is to verify the most prominent safety related aspects associated with the safe storage, analysis and recombination reaction of hydrogen isotopes.

1.

,
가 가

가
가 .

가

가

가

가 1/10,000 - 1/20,000

가

2.

2-1.

가

가

10^{-12} Pa

2~6 mm

가

600 ~ 650

10

38 μ m

10%

9.5 mm ~ 38 μ m

400 ~ 450

TiH_{0.6} ~ TiH_{1.4}

HTO

100

10^{-5}

HT

10^{-7}

TiT

H₂O

가

가

2-2.

“ ”, “ ”, “ ”

SUS 316L , . SUS

20 μm 가 . 6.5 ,

1.5 . 850 , TiT

0.5MCi . 25 TiT 10^{-12} Pa

2-3.

가

200 kg .

17W . 17W ,

4 cm .

가 10^{-8} Pa m^3/s

500 kg 9m

15 cm 1m .

800 30 .

가 9m 1m

B(u) .

3.

3-1.

가 .

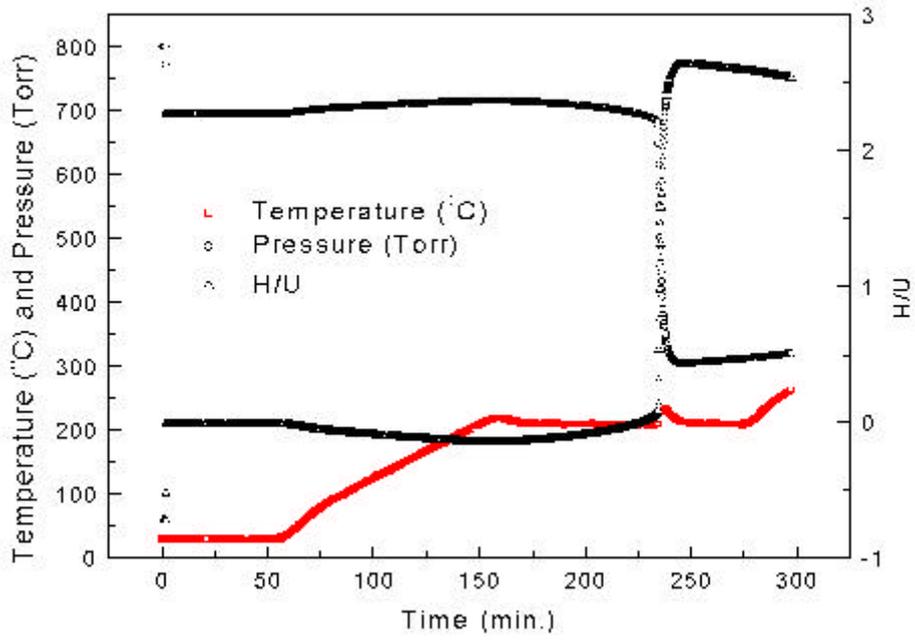
H/U

1 .

3g . 450 2 가 450 3

가 (715cc)

800Torr
 가 200 1
 2.6H/U
 가 450 , 0Torr
 가



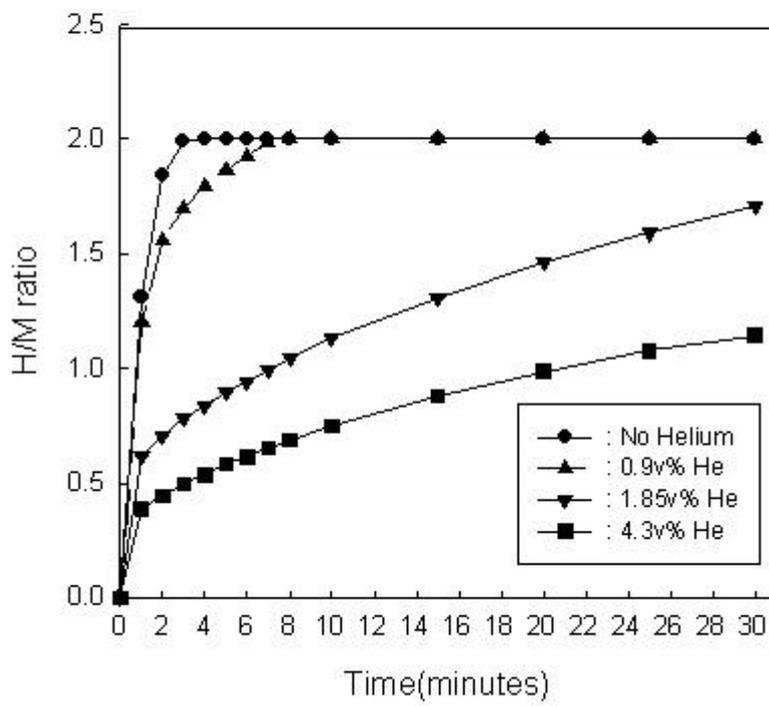
1.

3-2.

1.85v%, 4.3v% - 가
 800 1 Ti sponge activation 400
 H/M 2 가
 가 400 가 가
 가 2
 가 가
 가

가
가 가 , 가 가 가
가 가 , W. J. Holtlander
- 가 가

[1-4]



2. (Ti sponge at 400)

4.

4-1.

fitting

가

가

3



3.

4-2.

0.6%

가

106 -212cm/s

가

가

100

가

75

100 90% 3.2mm 0.5wt.%
 glass bead 5cm 10cm

J

Hidden Analytical HAL-2

Quadruple gas analyzer

4-3.

가

column

가

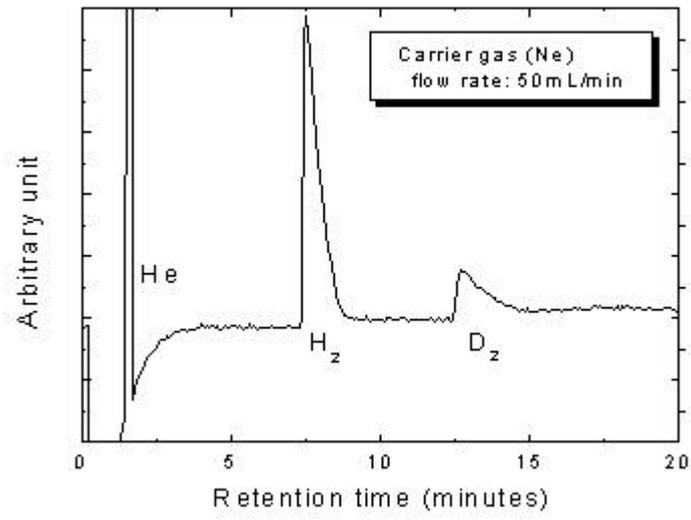
(manifold) (10⁻⁶ Torr)
 (10⁻² - 1000 Torr)가
 196 molecular sieve column trap

(thermal conductivity detector, TCD)

() DS6200 GC

Microvolume TCD

10% (MnCl₂)
 3m 4 100
 TCD 50ml/min He, H₂ D₂ 3.2ml
 (104.5 Torr) Ne
 2 He , 7 H₂ ,
 13 D₂ He,
 H₂, D₂ (0 , 1atm)
 가



4.

5.

10^{-12} Pa

2~6 mm

“ ”

가

가

가

5.

1. , “ ”, , 15 2 , pp.43-48 (2000)
2. Holtslander, W. J., Drolet, T. S., and Osborane, R. V., *"Recovery of Tritium from CANDU Reactors, Its Storages and Monitoring of its Migration in the Environment"*, AECL-6544 (1979)
3. Holtslander, W. J., and Yaraskavitch, J. M., *"Tritium Immobilization and Packaging using Metal Hydrides"*, AECL-7151 (1981)
4. Perevezentsev, A. N., et. al., *"Safety Aspects of Tritium Storage in Metal Hydride Form"*, Fusion Technology vol. 28, No. 3, Pt. 2, pp.1404-1409 (1995)

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