

Safe Handling and Storage of Hydrogen Isotopes

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 design of hydrogen isotope storage containers.

1.

가 가 가

가

가

가

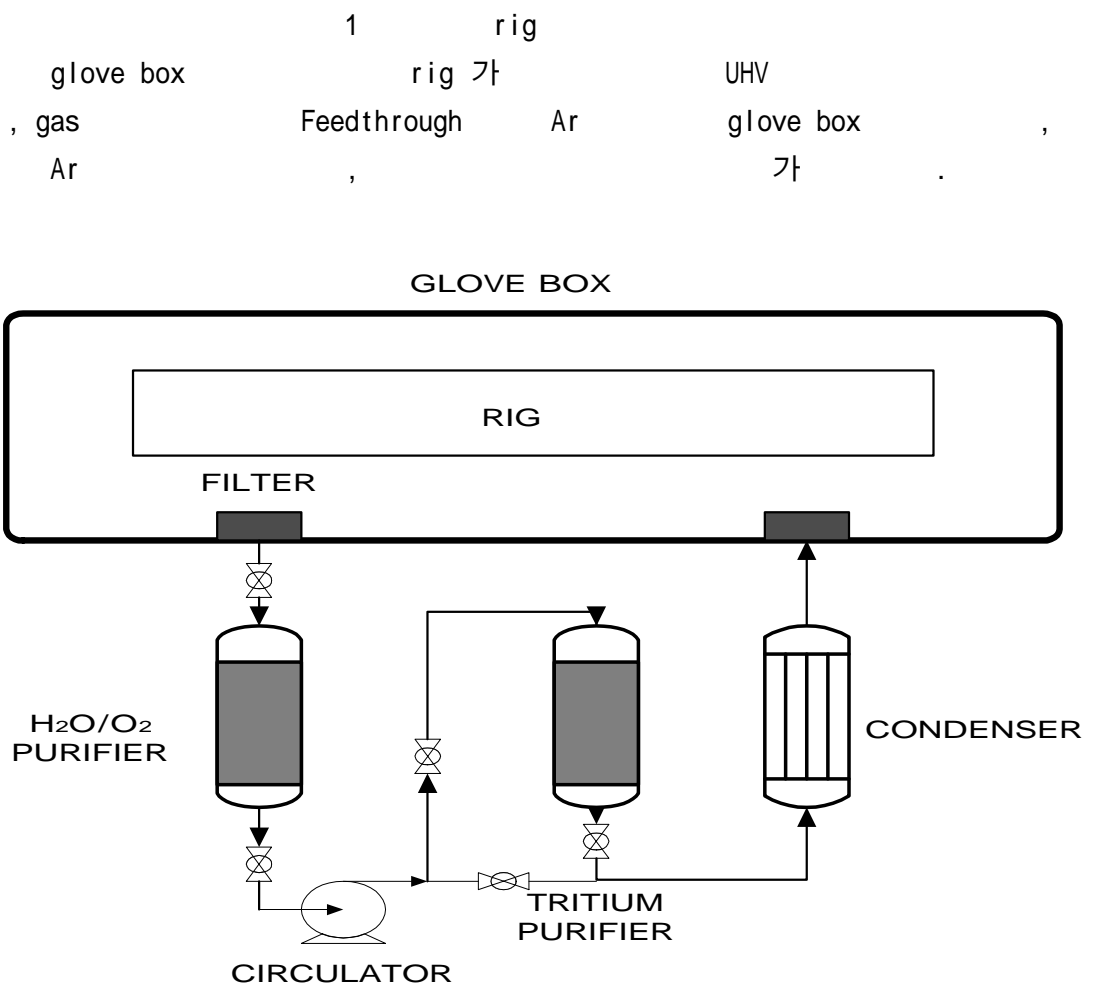
가

가 1/10,000

가

[1-4].

2.



1. Glove box Ar

- 1) glove box : ± 100 mm/H₂O Ar
- 2) Ar : 0.007% of box volume/hr, at 50 mm/H₂O.
- 3) Glove box Ar (Ar)
 H₂ < 1 ppm, O₂ < 10 ppm, Water vapor < 10 ppm

/ / monitor

- 1)
 - o Trace thermal conductivity analyzer
 - o range : 0 20 ppm
 - o accuracy : < 2% full scale
 - o response time : 90% of full scale in less than 60s
- 2)
 - o Trace oxygen analyzer
 - o range : 0 10 ppm
 - o accuracy : < 2% full scale
 - o response time : 90% of full scale in less than 65s at 25
- 3)
 - o Moisture analyzer
 - o sensor type : high capacitance Al₂O₃
 - o range : -100 20 dew point
 - o accuracy : < 3% full scale

Rig

5

3.

3-1.

가
가

10⁻¹²Pa

가

가

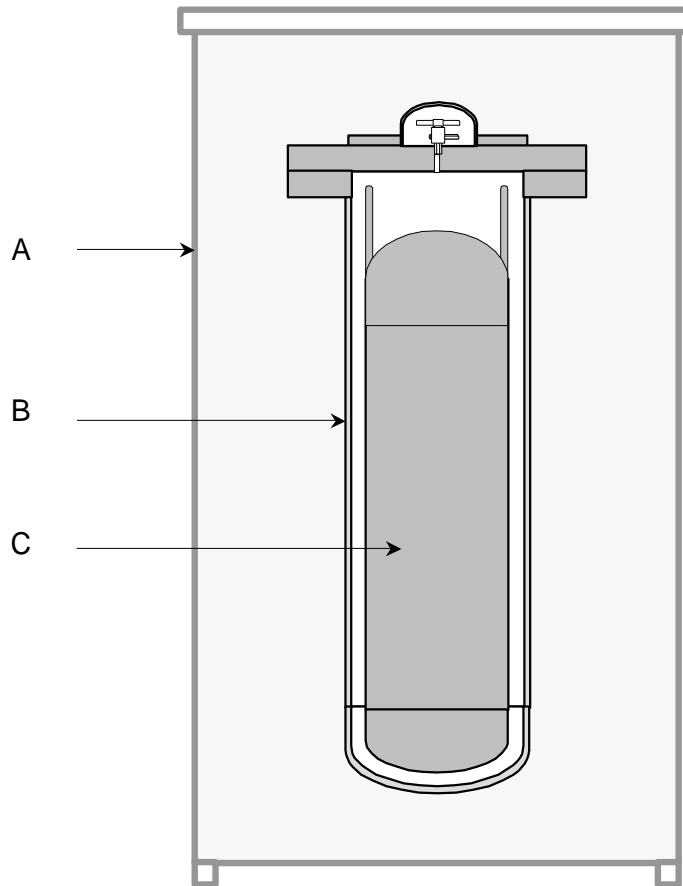
“ ” , “ ” , “ ” , SUS
 316L , . SUS 가
 6.5 , 1.5 .
 850 , TiT 0.5MCi
 1
 50 가 . Ti sponge
 He-3 가
 1 8,600 kPa (100) 10⁻⁵ 10⁻⁶ kPa
 (550)

1.

No.				
1		(kPa)	10-5 10-6	1
		()	550	
2		(kPa)	10-2	30 11
		()	300	
3	50	(kPa)	8210	
		()	40	
4		(kPa)	26.7	30 10
		()	550	
5	1	(kPa)	8600	
		()	100	
	2	(kPa)	10-5 10-6	
		()	550	

3-2.

가 2
Sch40S 1
Sch20S 2
STS 304 570mm, 980 mm, 2mm
1.5mm
1mm



2.
(A- 3 , B- 2 , C- 1)

3-3.

3-3-1.

	Ti		3	
	1KW	15	incoloy sheath cartridge heaters	가
3cm	SUS 310 plate	heater block	heater block	
50mm	ceramic board	heater block box		Ti
		heater block	5cm	5
port	K type thermocouples	sample port		sample
	temperature indicators	control panel		

i) sample: Ti sponges

ii) Sample : 1g

iii) Sample :

- Ti sponge particles: 2 12mm,

iv) : 25 840

Ti sponges(TiH₂) 800

spark 가 840

가



3-3-2.

4

9

5

가



4.

5.

6 1

가

4.

가

glove box
, gas

rig 가
Feedthrough

UHV
Ar

glove box

. Ar , 가
 - 가 50
 sponge He-3 가
 (550) 8,600kPa (100) 10^{-5} 10^{-6} kPa
 - 9 1
 가



6. 1

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)
5. , “ ” , (2002)

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