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Experimental reproducibility analysis in DU hydriding

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1. Introduction

A storage and delivery system (SDS) is used for storing hydrogen isotopes as a metal hydride form. The rapid hydriding of tritium is very important not only for safety reasons but also for the economic design and operation of the SDS [1-7]. For the storage, supply, and recovery of hydrogen isotopes, depleted uranium (DU) has been extensively proposed [8-11]. To develop nuclear fusion technology, it will be necessary to store and supply hydrogen isotopes needed for Tokamak operation.

In this study, to analyze experimental reproducibility, the DU hydriding/dehydriding were carried out 5 times. The experimental reproducibility of tank pressure on DU hydriding was analyzed. The experimental reproducibility of bed temperature on DU hydriding was also analyzed. The experimental reproducibility of apparatus was acceptable for all the experiments.

2. Experimental Apparatus and Measurement

Fig. 1 shows the experimental apparatus of the hydrogen storage bed. Hydrogen pressure is measured using a pressure gauge on a tank. The bed is heated by operating a heater controller. The data on the hydriding/dehydriding are collected and stored using a lapview program (v.8.6). The tank pressure and bed temperature for hydriding on DU were calculated.

Fig. 1. Apparatus of hydrogen storage bed.

3. Results and Discussion

Table I-V shows the tank pressures and bed temperatures. The initial pressure of a tank was about 86 torr. As the hydriding performs, the tank pressures decreased and they approached to about 2~3 torr in 10 minutes. The initial temperatures of a bed were about 27℃ and they approached to maximum temperature in 2 minutes and then 70℃ in 10 minutes.

Table I: Tank pressure and bed temperature of exp.1

Time (min)	Tank Pressure(torr)	Bed Temp.(℃)
0	85.9	26.3
2	46.6	153.0
4	25.7	130.4
6	13.9	102.4
8	6.4	83.5
10	1.7	69.7

Table II: Tank pressure and bed temperature of exp.2

Time (min)	Tank Pressure(torr)	Bed Temp.(℃)
0	86.0	26.7
2	45.2	151.8
4	25.5	128.3
6	14.2	102.2
8	7.0	83.8
10	2.5	70.4

Table III: Tank pressure and bed temperature of exp.3

Time (min)	Tank Pressure(torr)	Bed Temp.(℃)
0	86.2	26.6
2	44.9	148.8
4	25.6	124.7
6	14.6	100.0
8	7.4	83.0
10	2.9	70.3

Table IV: Tank pressure and bed temperature of exp.4

Time (min)	Tank Pressure(torr)	Bed Temp.(℃)
0	86.1	27.0
2	44.9	146.0
4	25.8	122.7
6	15.1	99.4
8	8.1	83.3
10	3.4	71.3

Fig. 2 shows the tank pressure of hydriding. As the hydriding performs, the tank pressure showed decreasing trend. Fig. 3 shows bed temperature of hydriding. The initial temperature of a bed was about 27℃.

Table V: Tank pressure and bed temperature of exp.5

Time (min)	Tank Pressure(torr)	Bed Temp.(℃)
0	86.0	26.7
2	46.4	144.2
4	27.8	120.1
6	17.1	97.7
8	10.0	82.5
10	5.4	70.9

As the hydriding performs, the temperature of a bed increased up to maximum temperature with exothermic reaction and then they showed decreasing trend. The experimental reproducibility of apparatus was acceptable for all the experiments.

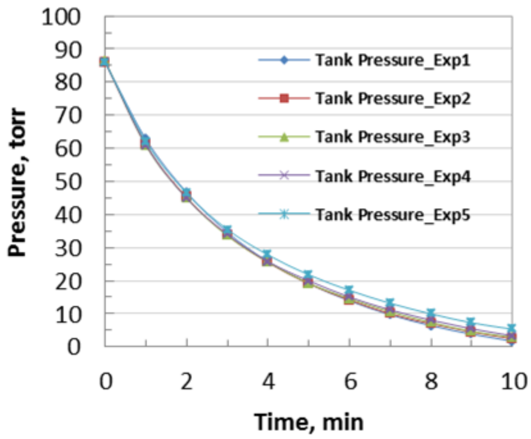

Fig. 2. Tank pressure of hydriding.

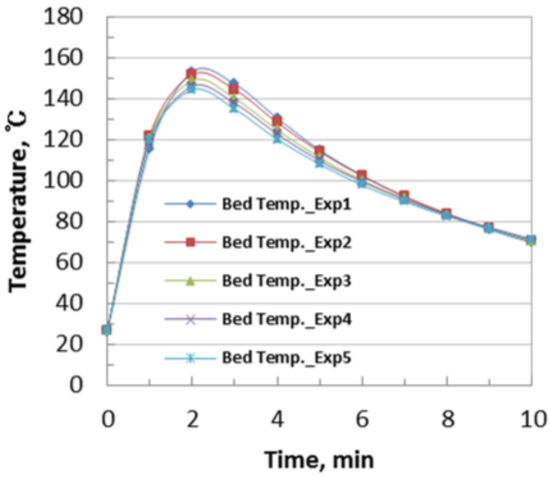

Fig. 3. Bed temperature of hydriding.

4. Conclusions

The experimental reproducibility of tank pressure on DU hydriding was analyzed. As the hydriding performs, the tank pressure showed decreasing trend. The experimental reproducibility of bed temperature on DU hydriding was also analyzed. As the hydriding performs, the bed temperatures increased up to maximum temperature with exothermic reaction and then they showed decreasing trend. The experimental reproducibility of apparatus was acceptable for all the experiments.

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