*Transactions of the Korean Nuclear Society Autumn Meeting*
*Gyeongju, Korea, October 29-30, 2009*

# Volume Change of ZrCo Hydride

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## 1. Introduction

The requirements for a tritium storage vessel for ITER are a fast tritium storage and delivery. The storage material of tritium has been used to store and deliver tritium from the storage vessel. The ZrCo powder, which is the storage material of tritium, has an excellent hydriding/dehydriding property. It has a slow chemical reaction property in case of contact with air. It is a non-nuclear material. On the contrary, uranium, which is also a storage material of tritium, has an excellent hydriding/dehydriding property and an excellent reaction velocity, but it has demerits such as high reactivity with air and oxygen, and it is a radioactive material [1]. The hydriding of ZrCo powder is an exothermic reaction, and it's dehydriding is an endothermic reaction. Hydrogen can be recovered from ZrCo hydride by heating. In this study, the ZrCo from SAES Getters was powdered in a reactor. After ZrCo hydriding had been carried out, the volume and the weight of ZrCo were measured. After ZrCo dehydriding was performed, the volume and the weight of ZrCo were measured, and the characteristics of the volume change of ZrCo hydride were analyzed.

## 2. Experimental Apparatus and Measurement

The hydriding/dehydriding of ZrCo from the SAES Getters company was carried out to measure the volume and the weight of ZrCo hydriding/dehydriding. Fig. 1 showed the hydriding/dehydriding apparatus of hydrogen. After the lines of the hydriding/dehydriding apparatus were made with a high vacuum using a rotary pump and a turbo molecular pump, the hydriding/dehydriding of ZrCo was performed, and the volume and the weight of ZrCo were measured. The ZrCo powder was put into the reactor, the hydriding/dehydriding of ZrCo was carried out and the volume and the weight of ZrCo were measured. The ZrCo powderization was carried out by repeating these processes. After each ZrCo powderization process was finished, the hydriding/dehydriding of ZrCo was performed, the volume and the weight of ZrCo were measured, and the characterization of the volume due to the hydriding/dehydriding of ZrCo was analyzed.

Fig.1. Hydriding/dehydriding apparatus of hydrogen.

## 3. Results and Discussion

Table 1 showed the volume and the weight of ZrCo due to the hydriding/dehydriding of ZrCo. Fig.2 and Fig.3 shows the volume and the weight of ZrCo due to the hydriding/dehydriding of ZrCo. As ZrCo powderization proceeds, the volume of ZrCo hydriding increased by 8.4cc (50% increase from the first stage) and the volume of ZrCo dehydriding increased by 7.0cc (25% increase from first stage). The weight of ZrCo hydriding increased by 0.23g from the first stage, while the weight of ZrCo dehydriding decreased by 0.03g. The weight increase of ZrCo hydriding was due to hydriding.

Table 1. Volume of ZrCo due to hydriding/dehydriding of hydrogen

| | | Volume(cc) | | Weight(g) |
|---|---|---|---|---|
| Initial value | | 5.6 | | 20.01 |
| 1 | hydriding | 8.4 | hydriding | 20.28 |
| | dehydriding | 6.8 | dehydriding | 20.01 |
| 2 | hydriding | 8.4 | hydriding | 20.25 |
| | dehydriding | 7.2 | dehydriding | 19.96 |
| 3 | hydriding | 8.4 | hydriding | 20.23 |
| | dehydriding | 7.0 | dehydriding | 19.96 |
| 4 | hydriding | 8.4 | hydriding | 20.17 |
| | dehydriding | 6.5 | dehydriding | 19.96 |
| | Hydride volume average | 8.4±0.0 | Hydride weight average | 20.23±0.05 |
| | Dehydrided volume average | 6.9±0.3 | Dehydrided weight average | 19.97±0.03 |

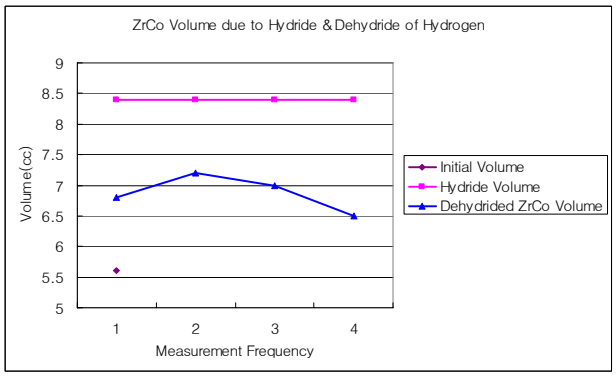


Fig.2. Volume of ZrCo due to hydriding/dehydriding of hydrogen.

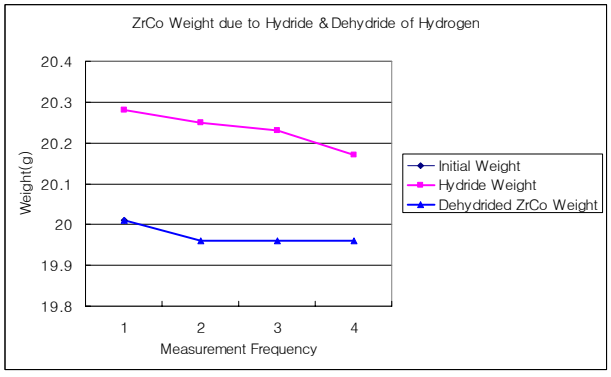


Fig.3. Volume of ZrCo due to hydriding/dehydriding of hydrogen.

## 4. Conclusions

The volume change was measured during the hydriding/dehydriding of ZrCo. The volume and the weight of ZrCo were varied due to the hydriding/dehydriding of ZrCo. As the ZrCo powderization proceeds, the volume of ZrCo hydride increased as much as 50% from the first stage and the volume of ZrCo dehydriding increased by 25% from the first stage. The weight of ZrCo hydriding increased by 0.23g from the first stage, while the weight of ZrCo dehydriding decreased by 0.03g. The weight increase of ZrCo hydriding was due to hydriding.

## Acknowledgement

This work is supported by the Ministry of Education, Science and Technology of the Republic of Korea under the ITER Project Contract.

## REFERENCES

[1] Hongsuk Chung et al., ITER Tritium SDS Design Verification, KAERI/RR-2879/2007(2008).