Rapid hydriding/dehydriding performance of the thin double layered annulus metal hydride bed

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Several concepts of the metal hydride beds have been introduced for the application to the hydrogen isotope storage and delivery. One of major important factors for the bed development is the hydriding and dehydriding capability. In order to improve this capability, a new thin double-layered annulus metal hydride bed is proposed recently. It consists of the thin and double layers of ZrCo which are confined by the cylinder-shaped SUS filter and the primary vessel wall. The helium channels for the in-bed calorimetry are drilled at the primary vessel wall. The major characteristics of this bed design are wide filter surface area for hydrogen isotope gas exchange and thin layer of ZrCo for heat transfer.

A mock-up includes 1.25 kg ZrCo that can store 70 g of tritium is fabricated and installed. Using the mock-up, the hydriding/dehydriding performance is tested with hydrogen gas. Real time measurement of temperature of ZrCo layer and pressure of hydrogen reservoir vessel and H_2 outlet line of the bed is done. Hydriding of 99% of about 7.8 mole of H_2 gas is completed in less than 15 minutes. Dehydriding procedure composed of pre-heating and delivery is affected by pre-heating scenario. With the pre-heating to 350 ℃, the delivery rate over 10 Pam^3/sec on average is obtained for the dehydriding of 90% of the H_2 gas stored. With the application of thin double layer of ZrCo and wide surface filter, rapid delivery of hydrogen isotope gas from the metal hydride bed is possible.