

Isotopic Exchange of a 1600 Liter Hydride Storage Vessel

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Titanium is used as a low pressure tritium storage material. A 4400 gram titanium hydride storage vessel (HSV) has been tested to examine its absorption desorption performance and its thermal response to the introduction of air into the vessel. The absorption/desorption rates and temperature rise during air passivation have been reported previously. As shown before, a practical desorption limit of roughly 0.25 Q/M was obtained when heating to 700°C which represents a significant tritium process vessel inventory. To prepare an HSV for disposal, batch-wise isotopic exchange has been proposed to reduce the tritium content to acceptable levels.

An HSV was loaded with deuterium and exchanged with protium to determine the effectiveness of a batch-wise isotopic exchange process. A total of seven exchange cycles were performed on the HSV. Gas samples were taken nominally at the beginning, middle, and end of each desorption cycle corresponding to nominal titanium loadings of 1.5 Q/M, 0.90 Q/M, and 0.28 Q/M, respectively. Sample analyses showed the isotopic exchange process does not follow the standard dilution model commonly reported. Samples taken at the start of the desorption process were lower in deuterium (the gas to be removed) than those taken later in the desorption cycle. The results are explained in terms of incomplete mixing of the exchange gas in a low pressure hydride.