The Effect of Gas Impurities on Low Pressure Hydride Absorption Measurements

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Absorption isotherm data exists for a wide variety of hydrogen-hydride systems. When working with high purity gases, appropriately sized equipment, and hydrides with equilibrium pressures above several hundred Pa, data collection is relatively straightforward. Special consideration must be given to experiments involving low equilibrium pressure hydrides (getters), as even sub-ppm levels of gas impurities can generate partial pressures many times greater than the equilibrium pressures to be measured. Tritium absorption experiments are further complicated by the continuous generation of helium-3. The time required to transfer and absorb a known quantity of tritium onto a sample ultimately limits the minimum pressure range that can be studied using a direct approach.

Equations are presented which show the pressure of helium-3 in a sample cell based on the volume of tritium to be absorbed, the sample cell volume and temperature, and the decay time of tritium. Sample calculations for zirconium show that at 300°C, the helium-3 pressure in the cell will be equal to the hydrogen absorption pressure after only milliseconds of tritium decay. At 600°C, the helium-3 pressure will equal the hydrogen absorption pressure after about an hour of tritium decay. An alternate method to obtain low pressure tritium absorption data is presented.