Characterizing a Cu/Mn Alloy for Extracting Oxygen from Inert Gas Streams

Lenhard, Grace (School: Grafton High School)

Glove boxes filled with inert gases are used to reduce the release of tritium into the atmosphere. A zirconium/iron (Zr-Fe) alloy is used to remove tritium chronically released into the glove boxes. However, some atmosphere permeates into the glove boxes through the gloves and seals. Oxygen and water in the atmosphere deactivate the Zr-Fe bed, so they must be removed from the gas stream. Currently, a molecular sieve removes water and a nickel bed removes oxygen. A copper/manganese (Cu/Mn) alloy was investigated as an alternative to nickel. Oxygen in a carrier stream of helium is flowed over the alloy, allowing it to getter oxygen. The amount of oxygen exiting the bed is measured as a function of time to determine the bed capacity. When the amount of oxygen leaving the bed is nearly equal to the amount of oxygen being flowed into the bed, the bed is considered full. This procedure was repeated for alloy temperatures of 200°C, 300°C, and 400°C with a helium flow rate of 1 LPM containing 1% oxygen. As the temperature increased, the bed capacity increased. However, a change in the bed temperature had little effect on the bed efficiency. Flowing oxygen over the bed also produced a small quantity of water, even if the bed had been dried beforehand, suggesting water creation from hydrogen somewhere in the system.