Gas Phase Chromatography of WBr_6

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The Heavy Element Volatility Instrument (HEVI)[1] was used to investigate the volatility of the W bromides. HEVI is an On-line isothermal gas phase chromatography system which separates short lived isotopes based on their volatility. The 2.4-min. ^{171}W and the 8.0-min. ^{172}W were produced at the 88-Inch Cyclotron by the reaction of ^{20}Ne with a target of ^{nat}Gd. Reaction products were transported by a He/KBr gas jet system and continuously collected on a quartz wool plug kept at 900° C in a quartz chromatography column. HBr was added at a rate of 100 ml/min in order to form the volatile bromide species of W, which were then swept into the isothermal section of the chromatography column. The separated species were reattached to KBr aerosols and transported through a capillary system onto a glass wool filter placed in front of an intrinsic Ge gamma detector. ^{171}W was identified by gamma spectroscopy of the 184, 294, and 479 keV lines and it's volatility determined. ^{172}W was identified by gamma spectroscopy of the 424 and 548 keV lines and it's volatility was determined. As expected, both isotopes showed exactly the same volatility behavior when their different half-lives were taken into account. The temperature at which WBr_6 was observed to be volatile was determined to be 130° C.

A Monte Carlo simulation program[2] was used to calculate the adsorption enthalpy of these species based upon their volatilities. The adsorption enthalpy was calculated to be -82±5 kJ/mol for WBr_6 on a SiO_2 surface based upon the volatility data collected.

Figure 1 shows the data for the most prominent gamma lines of each of the three isotopes, and the volatility curve calculated using an adsorption enthalpy of -82±5 kJ/mol for ^{172}W. The variation in yield with isotope is a function of the differences in their half-lives, but this variation results in no change in adsorption enthalpy when half-life is taken into consideration.

Footnotes and References

1. B. Kadkhodayan, *et al.*, *Nucl. Instr. Meth.* A317, 254 (1992).

2. A. Türler, K. E. Gregorich, D. C. Hoffman, D. M. Lee, H. W. Gäggeler, LBL annual report #31855, Nuclear Science Division (1991).

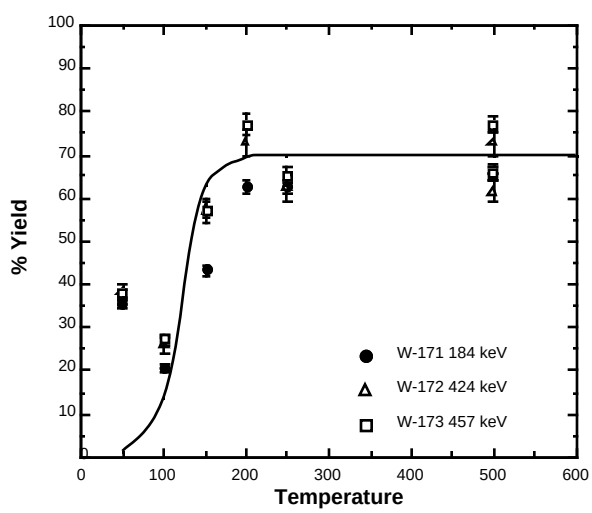

Fig. 1. Observed yields of WBr_6 as a function of temperature. Only the data from the most prominent gamma line of each isotope is shown. The fitted curve shows the expected yield based upon the Monte Carlo calculation of an adsorption enthalpy of -82±5 kJ/mol, and is the best fit to the data.