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THE VAPOR PRESSURE OF URANIUM PENTAFLUORIDE IN THE SOLID AND LIQUID STATES

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ABSTRACT

This report describes experimental work from which equations for the vapor pressure of uranium pentafluoride were derived. The melting point of uranium pentafluoride was determined both by experiment and by simultaneous solution of the solidus and liquidus vapor pressure equations. Physical properties of uranium pentafluoride so determined are:

$$\text{Vapor pressure (solid) Log } P = -\frac{(8001 \pm 664)}{T} + (13.994 \pm 1.119)$$

$$\text{Vapor pressure (liquid) Log } P = -\frac{(5388 \pm 803)}{T} + (9.819 \pm 1.236)$$

where P is expressed in millimeters of mercury and T in degrees Kelvin.

Melting point = 348°C. (experimental); $353°\text{C.}\begin{cases}+13\\-16\end{cases}$ (simultaneous solution).

Heat of vaporization (solid) = 36.6 ± 3.0 kcal./mole

Heat of vaporization (liquid) = 24.7 ± 3.8 kcal./mole

Heat of fusion = 11.9 ± 4.2 kcal./mole

THE VAPOR PRESSURE OF URANIUM PENTAFLUORIDE IN THE SOLID AND LIQUID STATES

The melting point, vapor pressure, and associated thermodynamic properties of the metastable compound, uranium pentafluoride, have been investigated. Early estimates of the vapor pressure of uranium pentafluoride were calculated from a compilation of thermodynamic relationships developed by Brewer and co-workers (3) on the basis of analogy to other pentafluorides. Later works by Cameron (4); Gilpatrick, Baldock, and Sites (6); Crews and Davis (5); and Kobisk and associates (8) produced various experimental estimates for specific points which not only differed by several orders of magnitude from the values predicted from Brewer's relationships but also differed widely among themselves. However, in agreement with the general prediction for binary pentafluorides, all the values lie between the known vapor pressures of uranium tetrafluoride (9) and uranium hexafluoride (10) and are of such magnitude to indicate that the vapor pressure of uranium pentafluoride would be measurable by the vapor transpiration process. Because of the tendency of the uranium pentafluoride to disproportionate into uranium hexafluoride and diuranium enneafluoride (U_2F_9) (1), uranium hexafluoride maintained at a pressure above the reported disproportionation pressure was used as the carrier gas.

Since the melting point of uranium pentafluoride was within the selected experimental temperature range, it was necessary to determine this value in order to correlate the vapor pressure data with temperature. Determination of the melting point by observation of the cooling rate enabled separation of the data into two groups, one for the solid phase and one for the liquid phase, so that corresponding vapor pressure equations could be derived.

SUMMARY AND CONCLUSIONS

The vapor pressure of uranium pentafluoride was measured over the temperature range of 282° to 412°C. The vapor pressure-temperature relationships developed on the basis of the Clausius-Clapeyron equation are:

for solid UF_5

$$\text{Log } P = -\frac{(8001 \pm 664)}{T} + (13.994 \pm 1.119) \quad (1)$$

for liquid UF_5

$$\text{Log } P = -\frac{(5388 \pm 803)}{T} + (9.819 \pm 1.236) \quad (2)$$

where P is the vapor pressure of uranium pentafluoride in millimeters of mercury and T is the temperature expressed in degrees Kelvin. The indicated experimental limits of error are applicable at the 95 per cent level of confidence.

The experimentally determined melting point was 348°C. The melting point derived by solving the above equations simultaneously was $353^\circ\text{C.}\left\{\begin{matrix}+13\\-16\end{matrix}\right.$.

Other thermodynamic data derived from the vapor pressure equations are:

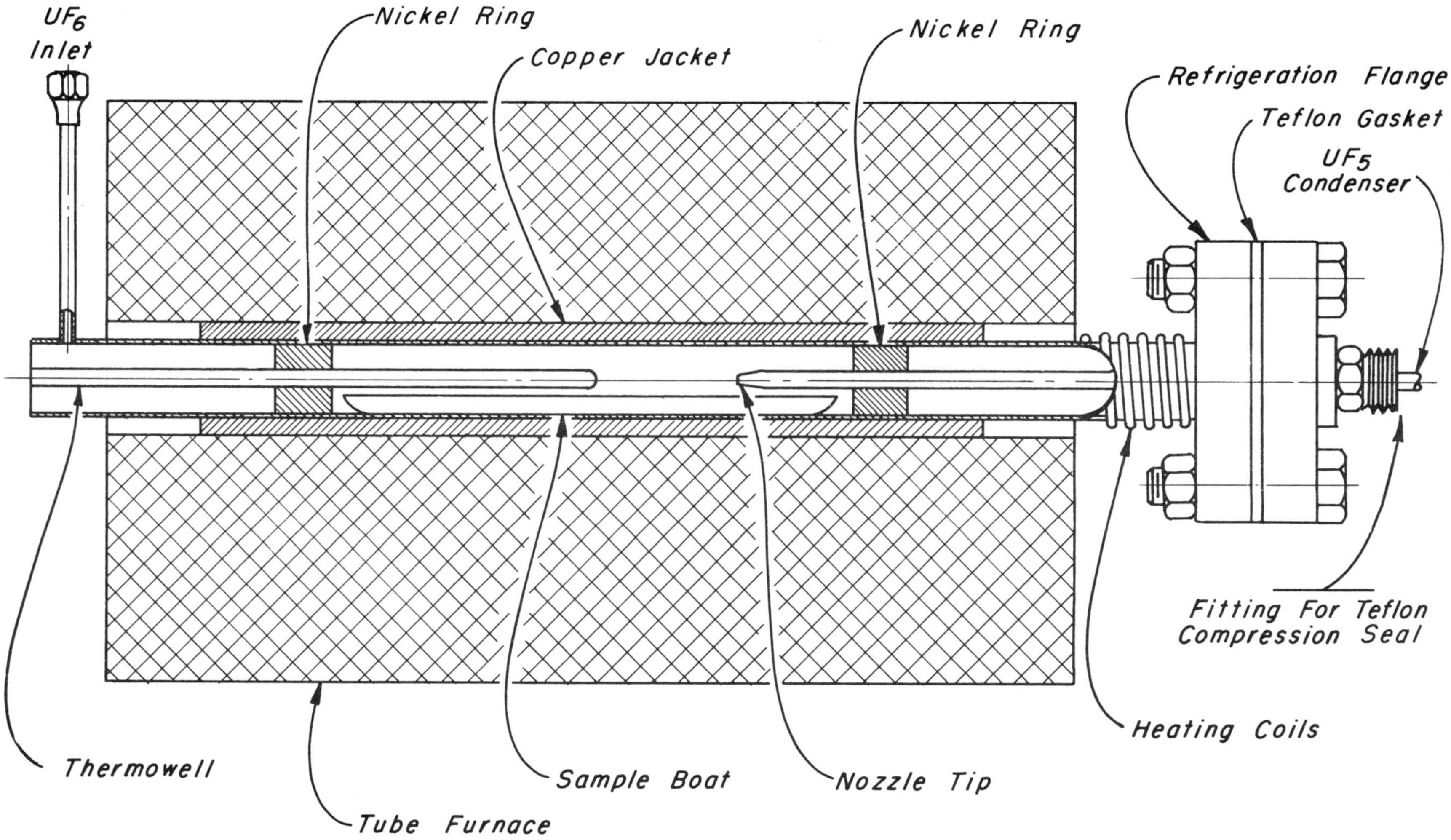
Heat of vaporization (solid) = 36.6 ± 3.0 kcal./mole
Heat of vaporization (liquid) = 24.7 ± 3.8 kcal./mole
Heat of fusion = 11.9 ± 4.2 kcal./mole

EXPERIMENTAL

Apparatus and Materials

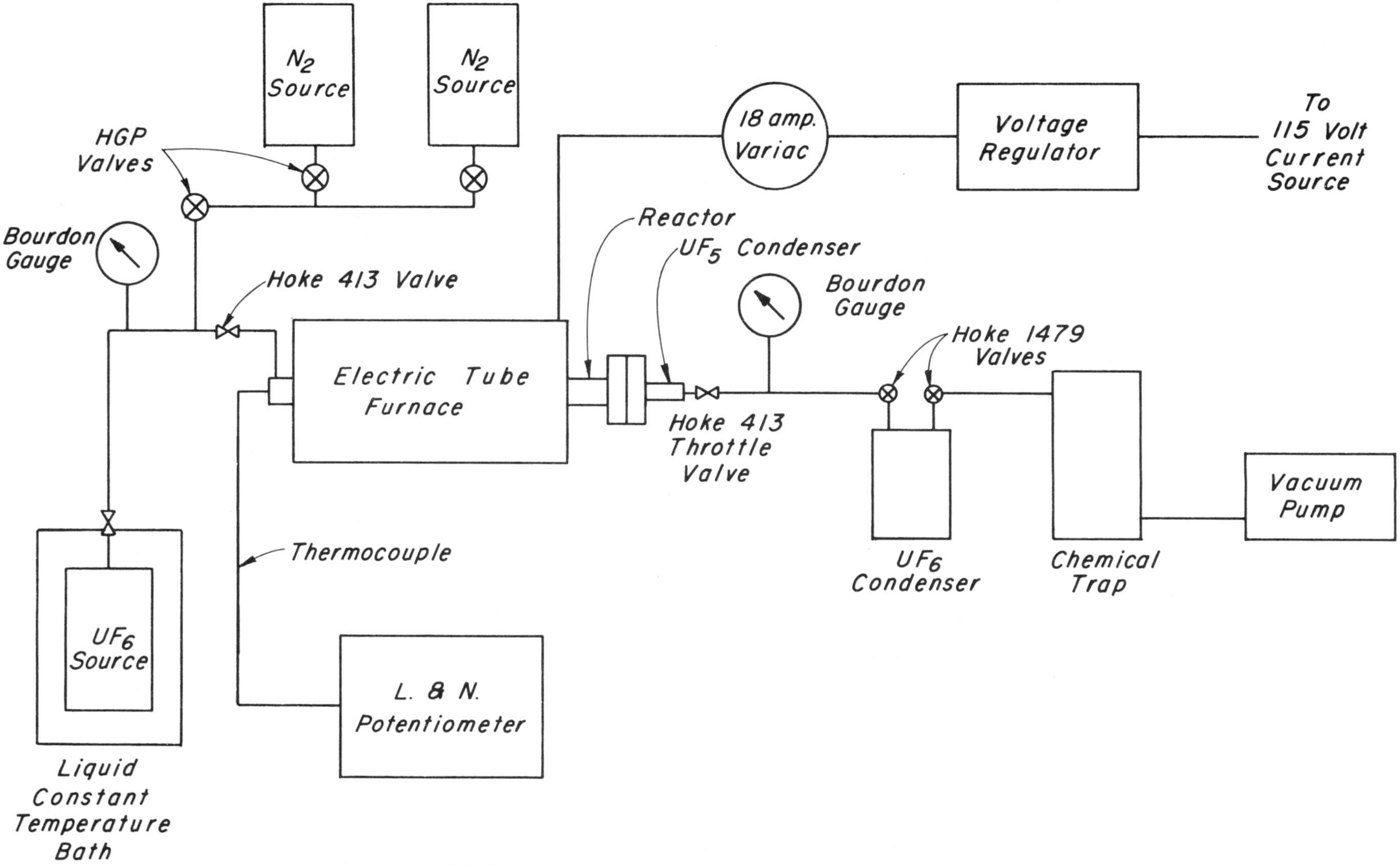
The reactor for the determination of vapor pressure (see figure 1) was constructed of 1-inch nickel tubing with a nickel thermocouple well entering the closed end and extending to the center of the reactor. An iron-constantan thermocouple previously calibrated against the melting point of reagent grade potassium dichromate was used for temperature measurements, and temperature conversions were made from the potentials measured by a Leeds and Northrup potentiometer. A gas manifold was also connected to the reactor for the introduction of uranium hexafluoride or nitrogen. A brass flange closure was silver soldered at the other end of the reactor to provide a means of opening completely one end of the reactor through which a nickel boat containing uranium tetrafluoride could be inserted. Close fitting nickel rings were located at both ends of the boat to center the boat in the heated zone and to reduce diffusion of uranium pentafluoride vapor toward the cooler ends of the reactor. The uranium pentafluoride condenser made of 1/4-inch nickel tube, 11 inches long with a nozzle tip to minimize diffusive effects, was inserted through the seal plate at the flange end of the reactor. It was necessary only that this condenser tube be held at some temperature cooler than the vaporization section of the reactor. The external uranium hexafluoride condenser was cooled in a dry ice-trichloroethylene slush. A jacket of 1-inch copper pipe split longitudinally was placed around the reactor to distribute the heat applied from a 750-watt Hevi-Duty electric tube furnace evenly over a greater portion of the reactor. The temperature was controlled by the output from an 18-amp. Variac fed by a 6-kva. Seco automatic voltage regulator. A flow diagram of the entire system is shown in figure 2. All parts of the system were pretreated with fluorine, the reactor being maintained during the pretreatment at a temperature equal to that used for the vapor pressure measurement. A source of nitrogen was also provided to permit purging the partially cooled system of uranium hexafluoride before removal of the uranium pentafluoride condenser.

The uranium hexafluoride source cylinder was placed in a liquid bath heated to maintain the cylinder pressure constant at the desired level. For the first runs, water was used for the bath, and in the later runs, Dowtherm A (a eutectic mixture of diphenyl and diphenyl ether) was used. A Bourdon tube pressure gauge was used to measure the pressure of uranium hexafluoride vapor supplied to the system.



ALL NICKEL VAPOR TRANSPIRATION REACTOR AND CONDENSER

FIGURE I



FLOW DIAGRAM OF EQUIPMENT
FOR URANIUM PENTAFLUORIDE VAPOR PRESSURE DETERMINATION

FIGURE 2

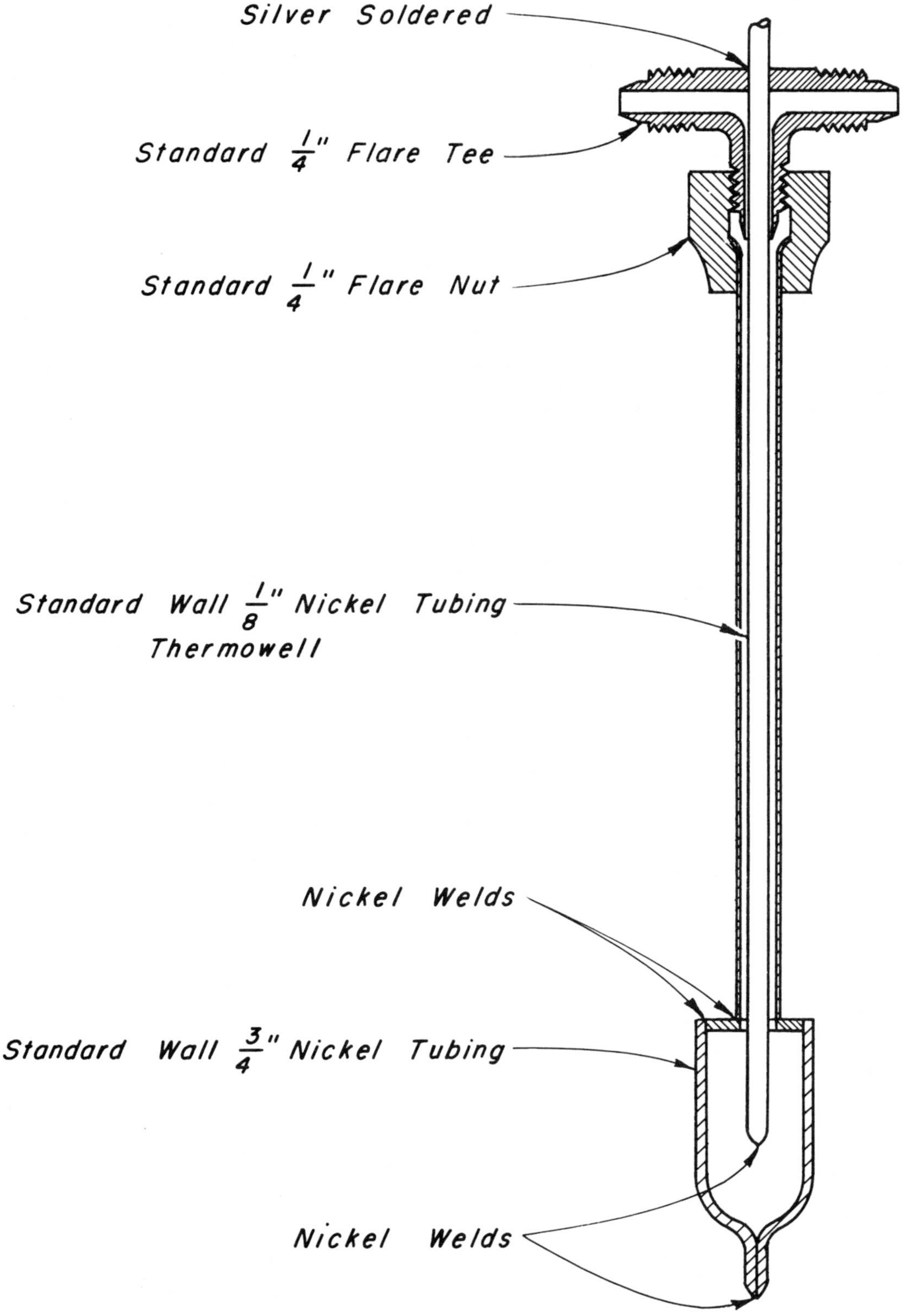
The melting point measurements were made using the melting point tube shown in figure 3. The tube was fabricated of commercially pure wrought nickel ("A" nickel), and all joints were nickel welded. The tube had been pretreated with fluorine at temperatures up to 490°C. for a period of several hours before use. A schematic diagram of the equipment used for the melting point determination is given in figure 4. The temperatures were measured using an iron-constantan thermocouple and a Brown Electronik recorder. The thermocouple-recorder combination had previously been calibrated against the melting point of reagent grade potassium dichromate. At this point the induced voltage from the couple showed no significant deviation from the appropriate standard voltage-temperature table.

The melting point tube was insulated from direct thermal radiation by a wrapping of alternate layers of glass wool and aluminum foil. It was heated in a vertically mounted tube furnace the temperature of which was controlled by the output of a 5-amp. Variac. The insulated tube fit loosely inside the furnace so that manual agitation of the sample was possible. Connection of the melting point tube to a cylinder of uranium hexafluoride equipped with a pressure gauge was arranged as shown by the schematic diagram in figure 4. The uranium hexafluoride pressure was controlled by the temperature of the oven which could be varied from room temperature to 400°C.

The uranium pentafluoride for both melting point and vapor pressure determinations was made in place by the reaction of uranium tetrafluoride and uranium hexafluoride equilibrated for a period of approximately 16 hours at a temperature of 230° to 250°C. The uranium tetrafluoride by analysis contained 75.4 per cent total U and 73.0 per cent U^{+4}. X-ray diffraction analysis of the original uranium tetrafluoride gave a pattern containing no foreign lines. Spectrochemical analysis showed 0.1 per cent total cationic impurities. The uranium hexafluoride employed was a sample of gaseous diffusion plant tails. Prior to use it was heated above its melting point, and the inert gases were flashed off until the measured cylinder pressure agreed with the reported vapor pressure of pure uranium hexafluoride. (10).

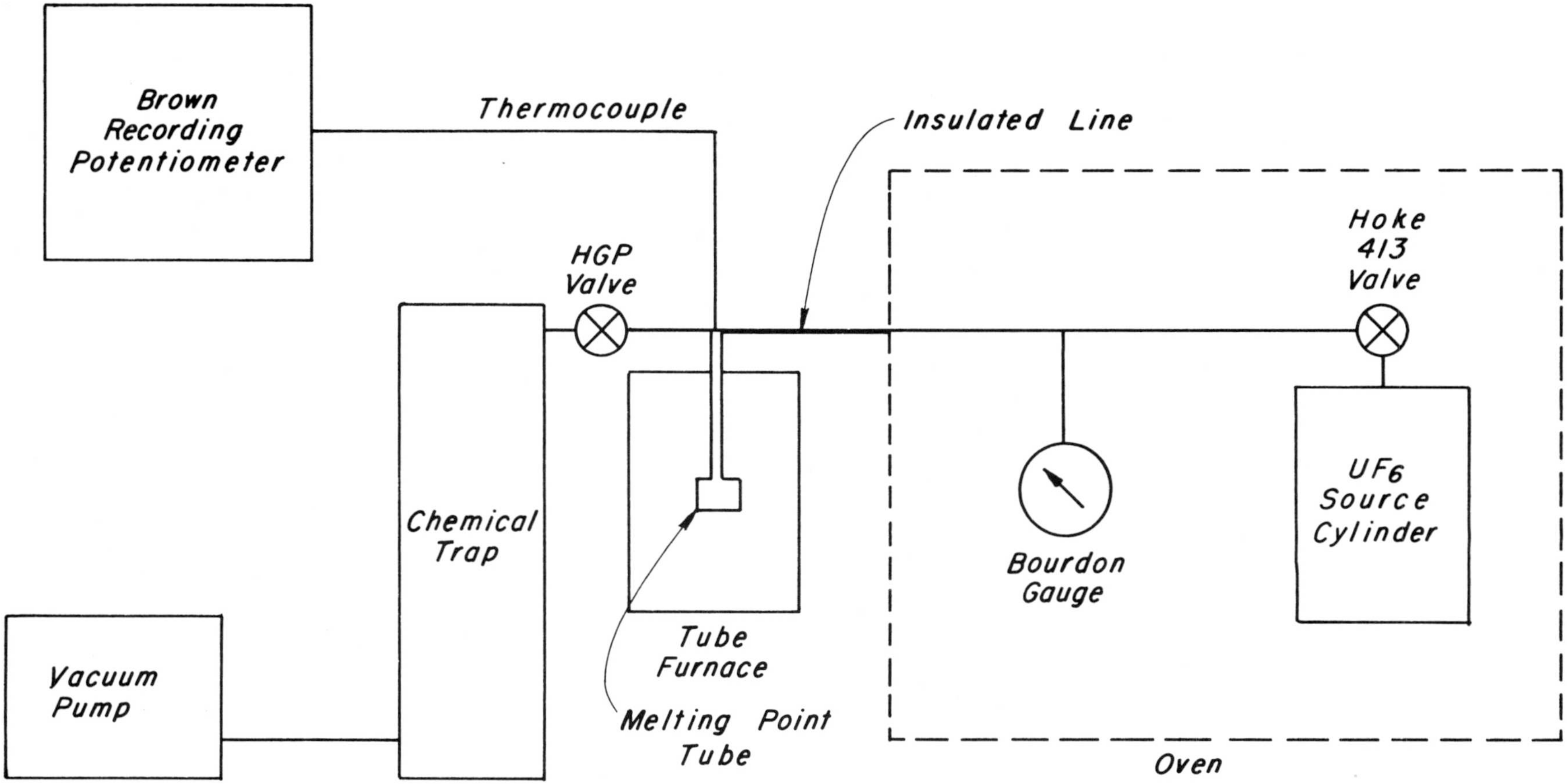
Procedure

By the vapor transpiration method employed for this investigation, a carrier gas is passed over the sample at the desired temperature at such a rate that the sample vapor saturates the carrier gas. The mixture is then passed through a series of condensers to separate the individual components of the mixture. The weight gains observed in each of the condensers are then used to determine the amount of sample transported in the vapor phase and the amount of carrier gas by which it was transported. In this determination, uranium hexafluoride vapor at a pressure above the reported dissociation pressure of uranium pentafluoride was used as the carrier gas. The relationship expressed by equation 3 was used to calculate the vapor pressure of uranium pentafluoride.



MELTING POINT TUBE

FIGURE 3



SCHEMATIC DIAGRAM OF EQUIPMENT
FOR URANIUM PENTAFLUORIDE MELTING POINT DETERMINATION

FIGURE 4

$$P_{UF_5} = \frac{N_{UF_5} \times P_{UF_6}}{N_{UF_6}} \qquad (3)$$

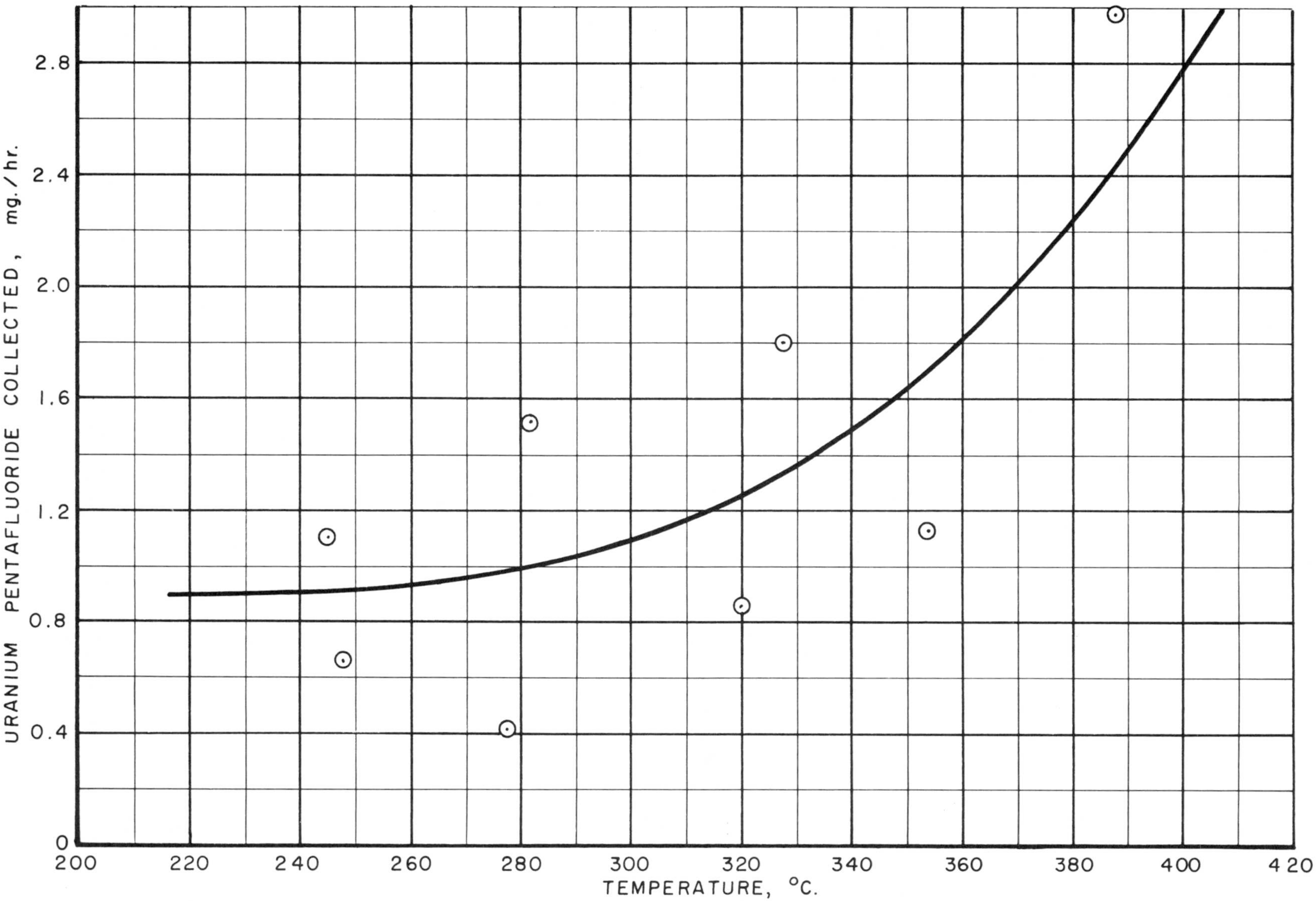
where P_{UF_5} and P_{UF_6} are the vapor pressures of uranium pentafluoride and uranium hexafluoride, respectively; N_{UF_5} is the amount of sample transported and collected expressed in moles; and N_{UF_6} is the amount of uranium hexafluoride used as a carrier gas expressed in moles. In using this expression, the relative magnitudes of the pressures involved permitted the assumption that the partial pressure of uranium hexafluoride and the total pressure of the system were not significantly different.

For the determination of each point on the vapor pressure curve, the uranium hexafluoride source was heated until the desired pressure was obtained; the heated uranium hexafluoride vapor was then admitted to the reactor where uranium pentafluoride had been prepared and was already under sufficient pressure of uranium hexafluoride to prevent its disproportionation; the reactor temperature was raised to the desired level; and the flow of uranium hexafluoride vapor saturated with uranium pentafluoride vapor was started through the weighed condensers when the valve between the condensers was opened. The gas flow was carefully throttled by this valve to be certain that the carrier gas remained saturated. X-ray diffraction analysis of a sample of the uranium pentafluoride thus transported showed it to be pure polycrystalline alpha uranium pentafluoride.

The possibility of two sources of error was anticipated. Reduction of uranium hexafluoride by the walls of the uranium pentafluoride condenser tube would accumulate uranium pentafluoride in addition to that transported by the gas stream, and any diffusive movement of uranium pentafluoride to the condenser occurring independently of the gas flow would also produce a weight gain not considered in the theoretical treatment of the data. Consequently, static experiments were performed under varying conditions of temperature and time of exposure in order to derive corrections for errors originating from these combined factors. These data are presented in figure 5 and in appendix A.

In preparation for the uranium pentafluoride melting point determination, a charge of uranium tetrafluoride was introduced to the weighed melting point tube through the flared connection. The tube was then closed by connection to the uranium hexafluoride manifold with a standard 1/4-inch flare T into which a 1/8-inch thermowell had been silver soldered. Uranium hexafluoride was admitted to the melting point tube from the heated source cylinder for preparation of the uranium pentafluoride.

The melting point was determined by the cooling curve method. By this method the sample is heated above its melting point and allowed to cool slowly. The cooling rate is nearly constant until the freezing (melting) point is reached. During the change of phase, the temperature remains nearly constant provided supercooling of the liquid has not occurred. After freezing is complete, a uniform cooling rate is again observed.



CORRECTION FOR REDUCTION-DIFFUSION ERRORS

FIGURE 5

A number of such cooling curves for uranium pentafluoride under a sufficient pressure of uranium hexafluoride to prevent disproportionation were obtained at various cooling rates both with and without agitation in order to establish the optimum experimental conditions. The best procedure consisted of heating the sample at least 20°C. above the melting point, reducing the voltage input to the tube furnace by a factor of two to allow cooling, and agitating the sample by shaking the melting point tube until the sample had solidified. After several cooling curves had been obtained, the tube was opened and more uranium tetrafluoride was added for conversion to uranium pentafluoride. Experimental cooling rates were then redetermined using the larger quantity of uranium pentafluoride.

Results

The vapor pressures experimentally determined for uranium pentafluoride at various temperatures are given in appendix B and are shown graphically in figure 6. Brewer's curve is also shown for comparison.

The flow rates were determined from the following equation derived from the ideal gas laws:

$$f = \frac{WT \times 3.885 \times 10^{-3}}{Pt} \qquad (4)$$

where f is the flow rate in cubic centimeters per minute; W is the weight of uranium hexafluoride in grams; T is the temperature expressed in degrees Kelvin; P is the pressure in atmospheres; and t is the duration of the run in hours. The flow rates ranged from 5 to 28 cc./min. The correction applied to each experimental vapor pressure measurement given in appendix B was taken from the best curve through the points obtained under static conditions and plotted in figure 5.

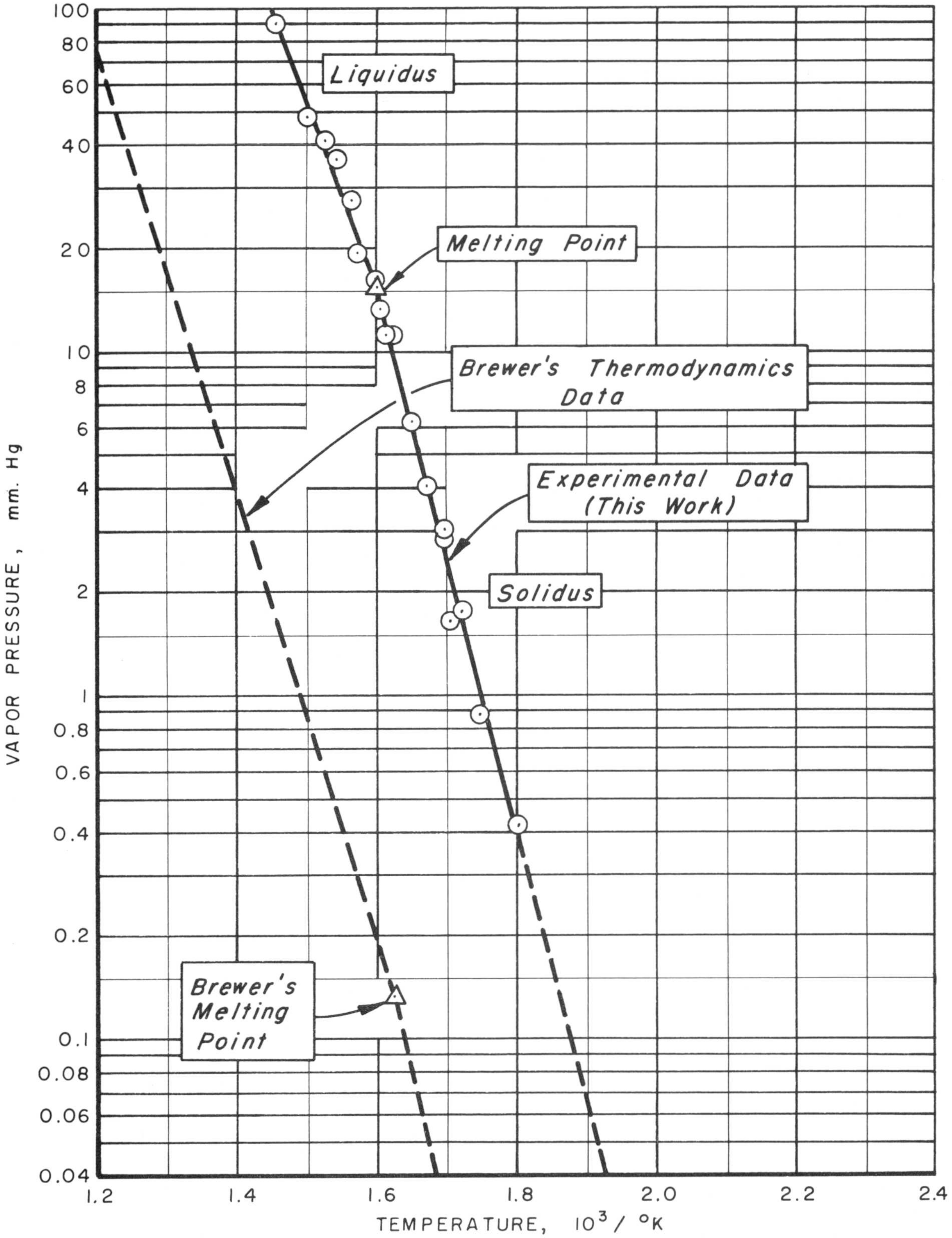
The melting points observed under different pressure of uranium hexafluoride are given in appendix C. The first freezing curves and those obtained after the addition of more uranium tetrafluoride gave melting points ranging from 345° to 348°C. No phase transitions other than the initial crystallization were indicated between 450° and 230°C. The weight loss of the melting point tube after an exposure of three weeks to liquid uranium pentafluoride and a cleaning with neutral sodium dichromate was 0.059 g. This is equivalent to 0.1 g. of nickel per sq. ft. per day.

DISCUSSION

A comparison of all of the known vapor pressure evaluations has been made in figure 7. Brewer's equations are based on the Kirchhoff equation and are as follows:

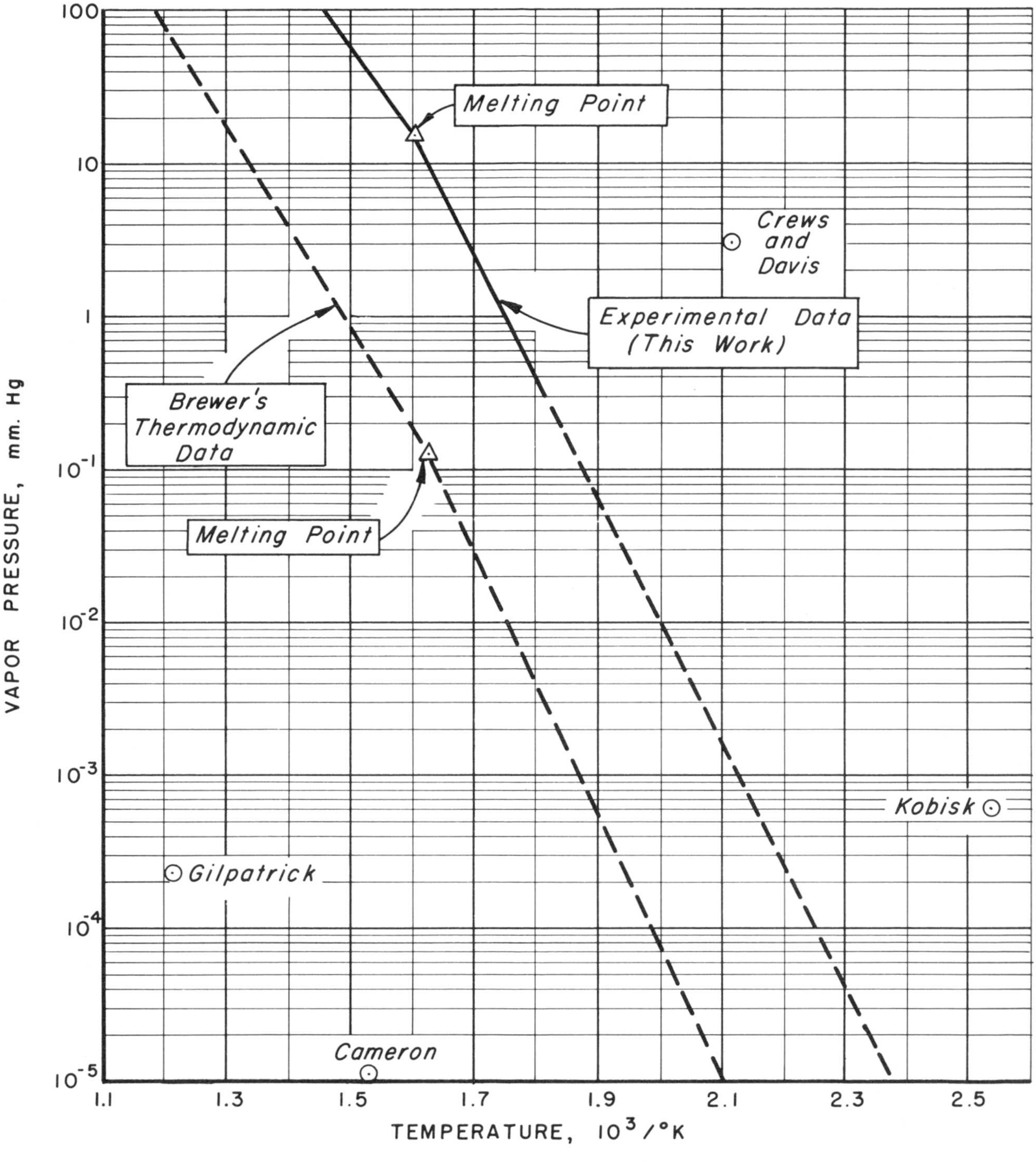
For solid UF_5

$$\log P = - \frac{51000 + 46\ T \log T - 194\ T}{4.575\ T} \qquad (5)$$



VAPOR PRESSURE OF URANIUM PENTAFLUORIDE

FIGURE 6



COMPARISON OF ALL EVALUATIONS
OF URANIUM PENTAFLUORIDE VAPOR PRESSURE

FIGURE 7

For liquid UF_5

$$\log P = - \frac{43000 + 46\ T \log T - 181\ T}{4.575\ T} \qquad (6)$$

where P is the vapor pressure of uranium pentafluoride in atmospheres, and T is the temperature expressed in degrees Kelvin. Brewer estimated his values by comparison with other pentavalent fluorides. Until the present time, this has been the relationship used by those interested in computations involving the vapor pressure of uranium pentafluoride.

Both Cameron and Gilpatrick based their vapor pressure calculations on observations made with the mass spectrometer. Cameron noted that a sample of uranium pentafluoride containing 15 per cent uranium tetrafluoride had a total ion intensity at 380°C. comparable to lithium iodide at that temperature and suggested the vapor pressure of the two halides were the same. On this basis, he proposed a value equal to the vapor pressure of lithium iodide which was calculated from the experimental data obtained by Brewer. Gilpatrick, independently of Cameron's investigation, studied uranium tetrafluoride at high temperatures with the mass spectrometer. Certain impurities in most of his uranium tetrafluoride samples gave UF_4^+ peaks which Gilpatrick attributed to uranium pentafluoride and from which he calculated a value for the vapor pressure.

Crews and Davis obtained a value which they identified as a maximum limit for the vapor pressure of uranium pentafluoride. By their method, uranium pentafluoride under a pressure of uranium hexafluoride was allowed to equilibrate at 200°C. A portion of the gas mixture was then flashed into another container at 25°C. The container was weighed and the uranium hexafluoride was removed, after which the container was reweighed to determine the amount of uranium pentafluoride transferred to the container. No corrections were made for the corrosive effects of the gases, and the amount of uranium pentafluoride found was extremely small.

The value obtained by Kobisk et al. was determined using a vapor transport method similar to that used in the present study. However, since the amount of uranium pentafluoride vapor transported was established by calculation from an indirect measurement, the accuracy of the value itself is open to some question.

Two assumptions on which this work is based are that uranium pentafluoride is a monomer in the temperature range studied and that the heat of vaporization remains constant. Although not experimentally established facts, these assumptions appear to be valid. Other potential sources of error are failure to saturate the carrier gas with uranium pentafluoride vapor and incomplete collection of uranium pentafluoride in the first condenser; however, the measured vapor pressure was independent of flow rate over the range of flows used, and no trace of deposited material was found beyond the first four inches of the condenser tube.

Previous workers (2) have observed that uranium pentafluoride melted at a temperature below 400°C., but a definite melting point was not determined. Brewer (3) reported that the melting point was 600°K.; actually, the point of intersection of his two vapor pressure equations occurs at 615°K. This is a reasonably accurate prediction of melting point to have been based upon a thermodynamic comparison with similar compounds.

Certain unique problems existed in the determination of the melting point of this material. Uranium pentafluoride disproportionates to form diuranium enneafluoride as in equation 7.

$$3\ UF_5 \rightleftharpoons U_2F_9 + UF_6 \tag{7}$$

When the uranium pentafluoride is molten, the concentration of diuranium enneafluoride will depend on its solubility in the melt. Within the range of complete solubility the concentration of the diuranium enneafluoride is inversely proportional to the uranium hexafluoride pressure. However, the existence of pure uranium pentafluoride cannot be assumed at high pressures of uranium hexafluoride due to the increased solubility of this gas in the molten salt with increased pressure. Because of these facts, it is impossible to measure experimentally the melting point of pure uranium pentafluoride; however, measurement of the melting point under the same conditions imposed for the vapor pressure determinations should give a value differing only slightly from that of the pure material providing the solubility of both uranium hexafluoride and diuranium enneafluoride in the molten salt are not high.

As appendix C shows, the melting point was constant at all uranium hexafluoride pressures above 1.7 atmospheres. This indicates that the diuranium enneafluoride concentration becomes appreciable only at lower pressures and that uranium hexafluoride gas is not very soluble in molten uranium pentafluoride. The lower melting points obtained at pressures below 1.7 atmospheres are probably caused by the presence of diuranium enneafluoride. This conclusion is supported by the observation that low melting points were obtained at the beginning of each run made immediately after the addition of extra uranium tetrafluoride before equilibrium was established and by the fact that the disproportionation pressure of uranium pentafluoride is 1.5 atmospheres at 370°C., the highest temperature reached while obtaining the values given in appendix C. The limited attack of the nickel container over a three-week period shows that nickel fluoride is not very soluble in liquid uranium pentafluoride. The weight gain of the sample during the exposure exceeds that for stoichiometric conversion of the uranium tetrafluoride to uranium pentafluoride. The excess could be attributable to the slight attack of the nickel container by uranium hexafluoride with uranium pentafluoride as a product, or it may have been caused by the reaction of uranium hexafluoride with absorbed water present as an impurity in the uranium tetrafluoride.

ACKNOWLEDGEMENT

The authors wish to acknowledge help received from others during the course of this investigation. The statistical treatment of the vapor pressure data to derive equations with the proper limits of error placed on their simultaneous solution was performed by Marvin A. Kastenbaum (7). Special instrumentation employed in making the measurements was supplied by J. Farquharson. For recognition of the need to establish the vapor pressure of uranium pentafluoride which led to this investigation the authors acknowledge the guidance of E. J. Barber and H. A. Bernhardt.

BIBLIOGRAPHY

1. Agron, P. A., The Thermodynamics of Intermediate Uranium Fluorides from Measurements of the Disproportionation Pressures, SAM Laboratories, Columbia University, declassified January 16, 1948 (AECD 1878).

2. Agron, P. A., and Zimmerman, G. L., The Chemistry of the Diffusion Process, Technical Information Service, U.S.A.E.C., Oak Ridge, Tennessee, NNES-II-6, (1952), p. 698, SECRET.

3. Brewer, L., Bromley, L. A., Giles, P. W., and Lofgren, N. L., The Thermodynamic Properties and Equilibria at High Temperatures of Uranium Halides, Oxides, Nitrides, and Carbides, U.S.A.E.C., Oak Ridge, Tennessee, September 20, 1945 (MDDC-1543).

4. Cameron, A. E., Private Communication.

5. Crews, J. C., and Davis, W., Jr., Unpublished Data.

6. Gilpatrick, L. O., Baldock, R., and Sites, J. R., Mass Spectrometer Investigation of UF_3, Union Carbide Nuclear Company, Oak Ridge National Laboratory, August 29, 1952 (ORNL-1376).

7. Kastenbaum, Marvin A., "A Confidence Interval of the Abscissa of the Point of Intersection of Two Fitted Linear Regressions", Biometrics, 15, 323-4 (1959).

8. Kobisk, E. H., Farrar, R. L., Ham, D. E., and Davis, W., Jr., K-1274, Appendix A, Union Carbide Nuclear Company, Oak Ridge Gaseous Diffusion Plant, February 5, 1957, SECRET.

9. Langer, S., and Blankenship, F. F., "The Vapor Pressure of Uranium Tetrafluoride", Abstracts of Papers, 135th Meeting, American Chemical Society, Boston, Massachusetts, April, 1959.

10. Oliver, G. D., Milton, H. T., and Grisard, J. W., "The Vapor Pressure and Critical Constants of Uranium Hexafluoride", J. Am. Chem. Soc., 75, 2827 (1953).

NOTEBOOK REFERENCES

Wolf, A. S., ORGDP Notebook Number 3568, pp. 1-62
Posey, J. C., ORGDP Notebook Number 3441, pp. 1-17.

Experimental work was completed March 19, 1958.

APPENDIX A

DATA FOR CORRECTION OF REDUCTION-DIFFUSION ERROR

Average Temperature, °C.	Average UF_6 Pressure, atm.	Duration of Exposure, hours	Weight Gain of UF_5 Condenser, mg.	Rate of Weight Gain, mg./hr.
245	1.66	5.0	5.6	1.12
248	1.58	16.0	10.7	0.66
278	1.60	16.0	7.0	0.44
282	1.79	5.5	8.3	1.51
320	1.84	16.0	13.9	0.87
328	2.00	16.0	28.4	1.79
353	1.84	6.0	6.9	1.15
387	3.02	5.0	14.0	2.80

APPENDIX B

URANIUM PENTAFLUORIDE VAPOR PRESSURE EXPERIMENTAL DATA

Temperature,		Pressure, atm.	Flow Rate of Carrier, cc./min.	Weight of UF_6, grams	Weight of UF_5, grams	Corrected Weight of UF_5, grams	Corrected Vapor Pressure of UF_5, mm. Hg
°C.	10^3/°K.						
282.0	1.801	1.27	12.87	151.67	0.0819	0.0619	0.42
299.0	1.748	0.88	26.60	62.83	0.0843	0.0778	0.88
307.0	1.724	1.35	21.52	80.05	0.1360	0.1286	1.74
313.0	1.706	0.77	13.50	73.34	0.2157	0.1967	1.66
316.8	1.695	1.73	25.38	115.00	0.2601	0.2527	3.05
317.3	1.694	1.46	12.60	52.16	0.1353	0.1273	2.86
323.5	1.676	1.46	11.52	43.53	0.1580	0.1503	4.05
333.0	1.650	1.81	10.92	50.36	0.2242	0.2158	6.23
343.3	1.622	1.76	14.19	72.98	0.5852	0.5745	11.13
345.3	1.617	1.60	18.26	85.20	0.7517	0.7407	11.17
349.0	1.607	1.81	12.39	51.03	0.4685	0.4596	13.10
354.0	1.595	1.83	27.90	136.26	1.5290	1.5179	16.38
361.0	1.577	2.33	12.06	68.47	0.7149	0.7039	19.24
366.5	1.564	2.78	12.71	71.16	0.8945	0.8848	27.77
374.0	1.546	2.37	12.70	77.87	1.2669	1.2534	30.64
381.0	1.529	2.41	6.58	31.19	0.6717	0.6603	40.99
392.0	1.504	2.58	10.70	64.09	1.5208	1.5055	48.69
412.0	1.460	3.13	10.55	62.06	2.2189	2.2030	89.26

APPENDIX C

MELTING POINT OF URANIUM PENTAFLUORIDE UNDER VARIOUS PRESSURES OF URANIUM HEXAFLUORIDE

UF_6 Pressure, atm.	Melting Point, °C.
4.6	348
3.4	348
3.0	348
2.9	348
2.5	348
2.1	348
1.7	348
1.4	345
1.2	346
0.9	345
0.7	346