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EVAPORATION THERMODYNAMICS FOR SOLUTIONS OF DIMETHYLZINC AND DIMETHYLTELLURIDE

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In the work with the help of a static method with a membrane zero-manometer, the liquid-vapor balance in the system “dimethylzinc – dimethyl telluride” in the temperature range 270–360 K with the content of dimethylzinc as 50.00 and 70.32 % mol. The total vapor pressure was measured for both saturated and unsaturated vapors for different samples. It was found that these solutions are not azeotropic. Using the equation of state $PV = nRT$, according to the thermal expansion of unsaturated vapor, the average molecular weight was calculated for mixtures “dimethylzinc – dimethyltelluride” mentioned compositions. The results of this calculation indicate the absence of significant association between molecules of the solution components in the gas phase.

Key words: dimethylzinc; dimethyltelluride; solution; vapor pressure; average molecular weight; static tensimetric method.

Introduction

The structure of selenium and tellurium compounds is intensively studied, in particular, in one of the sections of modern inorganic chemistry [1] the structure is considered for catenated selenium and tellurium compounds. Methyl and ethyl derivatives of these elements are used to produce selenium or tellurium. A review of work on the bi-methylation of selenium and tellurium was performed in [2]. Tellurium compounds are also used for the synthesis of films with thermoelectric properties by the method of electrodeposition [3]. In [4], organic tellurium compounds were considered in the creation of semiconductors based on the mercury-cadmium-tellurium system in the MOCVD (Metal Organic Chemical Vapor Deposition) process. Dimethylzinc is used to obtain various zinc-containing materials for electronics [5].

Earlier [6–9] based on the temperature dependence of the saturated vapor pressure of individual organoelement compounds and their equimolecular solutions of dimethylzinc-dimethylselenide and dimethyltelluride-dimethylcadmium in the range 280–340 K, we found that these systems in equimolecular ratio completely dissociate into constituent substances during the transition to the gas phase.

Given the existence of an azeotrope (at $x = 0.5$), we used Wilson's model to describe the liquid-vapor equilibrium in these systems [10]. Using the mathematical software package Mathcad 14 [11], the parameters of the Wilson model were calculated by iterations, on the basis of which the activity coefficients of solution components, excess solution functions were calculated and isothermal P-X state diagrams of dimethylzinc-dimethylselenide and dimethyltelluride. In [6, 7] the results are presented for determining the molecular weight of substances in the gas phase based on the study of linear expansion of unsaturated vapor.

The aim of this work is to study the behavior of the components of the solution of dimethylzinc-dimethyltelluride in the transition from liquid to gaseous phase based on the publication of primary data from a tensimetric experiment to determine the temperature dependence of saturated and unsaturated vapor pressure for a mixture of dimethylzinc – dimethyltelluride composition of 50.0 and 70.32 % mol, and also determining the molecular weight of substances in the gas phase based on the study of linear expansion of unsaturated vapor for solutions of dimethylzinc and dimethyltelluride. This work is a continuation of a series of works [6, 7].

Materials and methods of research

Samples of dimethylzinc (boiling point $46\text{ }^{\circ}\text{C} = 319\text{ K}$) and dimethyltelluride (boiling point $82\text{ }^{\circ}\text{C} = 355\text{ K}$) are described in [7] and purified by rectification under reduced pressure. The total content of impurities was determined by lowering the melting point and was 0.03 ± 0.02 mol. %. The content of metal impurities according to spectral data does not exceed 10^{-4} wt. %. According to gas-liquid chromatography, impurities of organic substances were not detected. Given the specifics of these substances – high reactivity with air components, high volatility and toxicity, they were stored in hermetically sealed vacuum ampoules. All operations related to the selection of a sample of individual elementorganic compounds (EOCs) were also performed under vacuum and EOCs were then filled with thin-walled micro-ampoules by vacuum distillation, sealed and weighed. Solutions were prepared by mixing pre-selected portions ($\Delta m = \pm 1 \cdot 10^{-2}$ mg) of the initial components.

For the substances the saturated vapor pressure temperature dependence was determined by the

static method with a membrane zero manometer. For the experimental setup a detailed description is given in [6, 7]. The accuracy of measuring temperature and pressure is 0.1 K and 130 Pa, respectively. The reliability of the tensimeter was tested in a series of experiments to measure the saturated vapor pressure temperature dependence for pentane, hexane and heptane. The results were compared with reliable literature data [12]. A comparative analysis of our and literature data was performed using the ANOVA method [13], which showed that our and literature data do not differ within the experimental error.

Results and discussion

We performed a series of experiments to determine the temperature dependence of vapor pressure for solutions of “dimethylzinc – dimethyltelluride”, the content of dimethylzinc in which was 50.00 and 70.32 % mol., respectively. Primary data of the obtained temperature dependences are given in Tables 1 and 2 (asterisk sign (*) means region of unsaturated vapor).

Table 1

Temperature dependences of vapor pressure for different mass samples of equimolecular solutions of dimethylzinc and dimethyltelluride

<i>T</i> , K	<i>P</i> , kPa	<i>T</i> , K	<i>P</i> , kPa	<i>T</i> , K	<i>P</i> , kPa	<i>T</i> , K	<i>P</i> , kPa
<i>m</i> =0.01244 g		<i>m</i> =0.01717 g		<i>m</i> =0.08588 g		<i>m</i> =0.16225 g	
292.1	8.3	288.9	8.6	273.3	5.7	299.5	16.2
295.3	9.0	295.7	10.7	283.3	8.6	309.1	23.0
300.2	9.9	303.0	13.0	284.1	9.1	319.1	31.9
307.5	11.1*	308.6	14.9	289.1	11.0	328.9	42.7
320.3	11.6*	324.2	16.4*	293.6	12.9	341.8	62.2
330.7	12.3*	343.4	17.7*	299.7	15.9	349.2	75.2
340.1	12.8*	354.4	18.2*	316.7	27.2	<i>m</i> =0.45918 g	
348.6	13.2*	362.9	18.9*	328.8	38.0	273.2	6.7
<i>m</i> =0.26614 g		<i>m</i> =0.27530 g		338.6	50.1	275.9	7.7
278.2	7.3	278.8	6.7	348.7	65.5	279.2	8.8
284.0	9.2	284.3	8.5	358.3	81.8	283.7	10.7
289.2	11.4	289.3	10.5			288.9	13.2
293.4	13.5	294.4	13.2			295.0	16.6
299.0	17.1	303.7	19.5			299.0	19.1
308.5	24.1	313.8	28.3			304.0	23.3
318.2	33.6	324.0	40.1			313.5	32.3
333.3	54.2	333.9	54.7			323.5	45.3
338.6	63.7	343.9	73.7			333.9	61.5
343.9	74.0					346.2	88.6

Temperature dependences of vapor pressure for different mass samples of equimolecular solutions of dimethylzinc (70,32 % mol.) and dimethyltelluride (29,68 % mol.)

T , K	P , kPa	T , K	P , kPa	T , K	P , kPa
$m=0.01804$ g		$m=0.08102$ g		$m=0.26925$ g	
273.2	5.3	273.2	8.8	273.2	10.5
282.3	6.9	280.6	11.7	282.9	15.7
288.6	8.3	288.4	15.7	289.5	20.5
293.6	9.9	293.9	18.9	294.0	24.5
298.6	11.9	298.6	21.9	298.6	29.1
301.4	12.9	306.5	27.6	306.3	38.3
308.3	15.7*	313.8	33.1	313.5	47.7
318.3	16.5*	321.3	39.7	320.4	58.8
328.3	17.1*	328.8	46.6	328.6	73.2
338.2	17.4*	336.0	54.9	333.7	83.3
348.1	18.4*	342.8	64.5	338.5	94.0
357.6	18.9*	347.6	71.9		
		352.8	80.7*		
		358.2	82.3*		
		362.7	83.3*		

Accepted designations: T – water temperature in the thermostat, K; P – vapor pressure, kPa; m – sample mass of substance, g.

For temperature dependences of saturated and unsaturated vapor, the experimental data were approximated by equations (1) and (2), respectively:

$$\ln P = \frac{A}{T} + B, \quad (1)$$

$$P = CT + D. \quad (2)$$

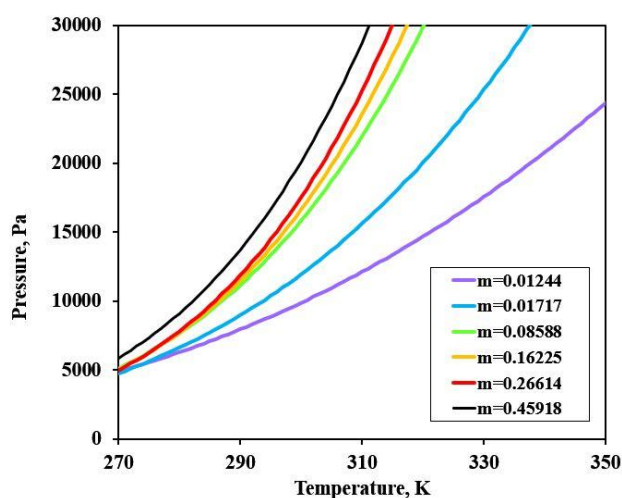


Fig. 1. Temperature dependences of saturated vapor pressure over a binary solution of the equimolecular system $ZnMe_2 \cdot TeMe_2$ for different solution mass

For equimolecular solutions “dimethylzinc – dimethyl selenide” [6] (9 experiments, 86 points) and “diethylzinc – diethyl selenide” [7] (5 experiments, 43 points) it was noted that the change of coefficients (A and B) in temperature dependences saturated vapor pressure is statistically insignificant for different samples masses of the solution that evaporates in a closed volume, ie these systems are monovariant and can be characterized as one-component.

In this work, both for the equimolecular solution of $ZnMe_2 \cdot TeMe_2$ and for the solution with $ZnMe_2$ content of 70.32 % mol. there is a difference between the temperature dependences of the saturated vapor pressure on the mass of the solution, which is shown as an example for comparison, in the form of model dependences according to equation (1) in Fig. 1 and 2.

According to [7], the following solutions have similar properties: 1) $ZnEt_2 \cdot SeMe_2$; 2) $CdMe_2 \cdot SeMe_2$; 3) $CdMe_2 \cdot TeMe_2$. Therefore, these systems are bivariate, ie the saturated vapor pressure depends on the mass of the solution evaporating in a closed volume of the tensimeter, which is typical for two-component systems.

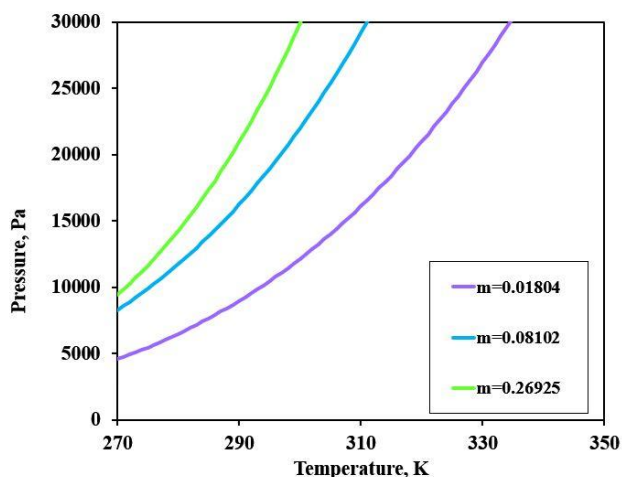


Fig. 2. Temperature dependences of saturated vapor pressure over binary ZnMe₂ and TeMe₂ solution with ZnMe₂ content of 70.32 % mol for different solution mass

For ZnMe₂ and TeMe₂ solutions of different composition and sample mass (*m*) the results of statistical processing for experimental data of pressure temperature dependence are presented in Tables 3 and 4 for saturated for unsaturated vapor, respectively. Sample standard deviations (*S_A*, *S_B*) of the coefficients *A* and *B*, which are given in Tables 3 and 4 are determined taking into account the 95 % confidence interval [14]. The obtained data are well described by equations (1) and (2) (in all cases the square of the correlation coefficient is greater than 0.99).

For different solution mass Fig. 3 and Fig. 4 show examples of determining the coordinates of the complete liquid evaporation point (*P₀*, *T₀*) by the temperature dependence of vapor pressure over a binary solution of ZnMe₂ and TeMe₂ with dimethylzinc content of 50.00 and 70.32 % mol., respectively.

Table 3

Parameters in temperature dependence of saturated vapor pressure (Pa) for dimethylzinc and dimethyltelluride solutions

Solution mass, <i>m</i> , g	Coefficients in the equation $\ln(P) = A/T + B$		<i>S_A</i>	<i>S_B</i> · 10 ²	<i>R</i> ²
	- <i>A</i> , K	<i>B</i>			
equimolecular solutions					
0.01244	1894	15.512	125.5	42.4	0.9956
0.01717	2481	17.658	73.9	24.7	0.9999
0.08588	3042	19.809	17.3	5.7	0.9997
0.16225	3225	20.469	19.3	6.0	0.9999
0.26614	3392	21.078	10.9	3.6	0.9999
0.27530	3556	21.565	21.6	7.1	0.9997
0.45918	3326	20.995	9.3	3.1	0.9999
solutions containing 70.32 % mol. of dimethylzinc					
0.01804	2626	18.158	101	35	0.9941
0.08102	2629	18.761	37.1	12.0	0.9980
0.26925	3108	20.666	33.4	10.9	0.9990

Table 4

Parameters in temperature dependence of unsaturated vapor pressure (Pa) for dimethylzinc and dimethyltelluride solutions

Solution mass, <i>m</i> , g	Coefficients in the equation $P = CT + D$		<i>S_A</i>	<i>S_B</i> · 10 ²	<i>R</i> ²
	<i>C</i> , Pa /K	- <i>D</i> , Pa			
equimolecular solutions					
0.01244	52.81	5196	2.51	829	0.9932
0.01717	62.93	3987	3.62	1253	0.9931
solutions containing 70.32 % mol. of dimethylzinc					
0.01804	63.62	3860	3.81	1270	0.9864
0.08102	263.7	12291	21.4	7653	0.9944

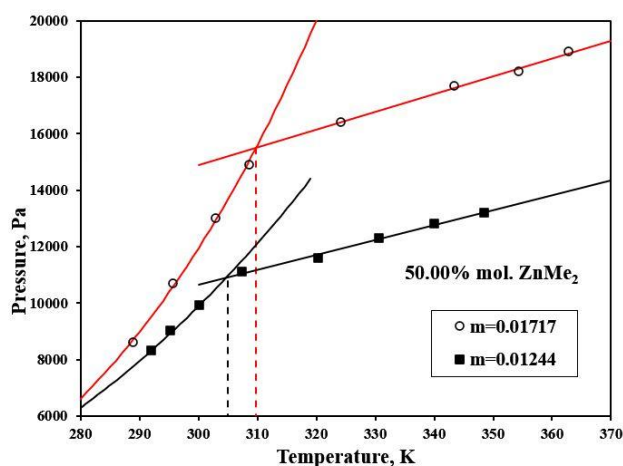


Fig. 3. Determination of the coordinates of the complete liquid evaporation point by the temperature dependence of the vapor pressure for the equimolecular mixture ZnMe_2 and TeMe_2 for different solution mass

To estimate the association of molecules of solution components in the gas phase, the average vapor molecular weight was determined by using P–T data in the unsaturated vapor region and equation of state (3) at the complete liquid evaporation point (P_0 , T_0)

$$PV_{IDEAL} = nRT \quad (3)$$

To calculate the coordinates (P_0 , T_0) of the complete liquid evaporation point, we solved a system of equations describing the temperature dependence of the saturated and unsaturated vapor pressure according to equations (1) and (2), respectively. The working volume of the membrane chamber (V) was determined in calibration experiments with different portions of

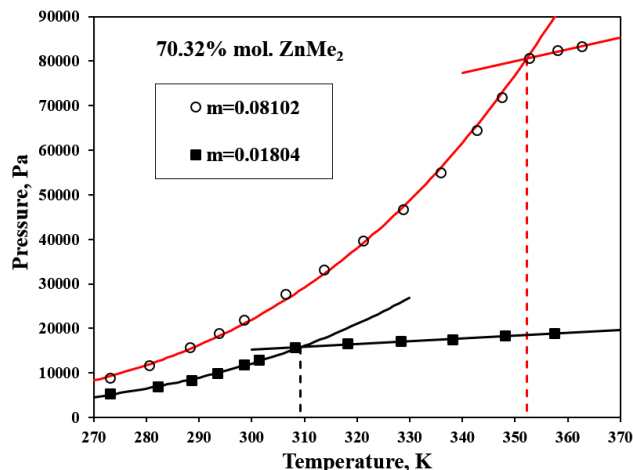


Fig. 4. Determination of the coordinates of the complete liquid evaporation point by the temperature dependence of the vapor pressure for the mixture ZnMe_2 and TeMe_2 with dimethylzinc content as 70.32 % mol. for different solution mass

pentane or hexane. Table 5 shows the results of calculating the coordinates of the complete liquid evaporation point and the average molecular weight in the vapor state ($M_{exp.}$) for the components of the solution of dimethylzinc-dimethyltelluride composition of ZnMe_2 as 50.00 and 70.32 % mol. The obtained information on the average molecular weight in the vapor state ($M_{exp.}$) in comparison with the theoretical values ($M_{theor.}$) allowed us to conclude that in the gas phase in the system “dimethylzinc – dimethyltelluride” components are in the monomeric state. Note that according to table 5 and Fig. 3 and 4 with increasing solution mass the temperature (T_0) increases for the moment of complete evaporation.

Table 5

Coordinates of the complete liquid evaporation point by the temperature dependence of the unsaturated vapor pressure and molecular weight of vapor according to equation (3) for solutions of dimethylzinc and dimethyltelluride

Solution mass, m , mg	V , cm^3	P_0 , Pa	T_0 , K	$M_{exp.}$, gram/mol
50.00 % dimethylzinc, $M_{theor.} = 126.6$ g/mol				
12.44	23.30	10787	305.0	125.5
17.17	22.22	15502	309.7	128.3
70.32 % dimethylzinc, $M_{theor.} = 113.9$ g/mol				
18.04	25.60	15818	309.3	114.6
81.02	25.60	80584	352.2	115.0

Table 6 shows that taking into account the statistically justified accuracy of the coefficients and temperature of the complete evaporation moment as

T_0 , the pressure difference ΔP_0 , calculated according to equations (1) and (2) at temperature T_0 , is in the range of 15–51 Pa, ie less than pressure mea-

surement error. Theoretically, the pressure difference P_0 , calculated according to equations (1) and (2) at temperature T_0 should be zero, because it is the point of intersection of the regions for saturated and unsaturated vapor. We were somewhat surprised by the fact that in none of the early works according to the monograph [15] when calculating the molecular

weight was not noted the inconsistency of the ratio T/P in the equation of state (3). We noted that in the area of thermal expansion with increasing temperature there is a decrease in the ratio of T/P for all EOCs and their solutions, which we studied earlier [6, 7], as well as for objects studied in this work (Table 7) and pentane.

Table 6

Pressure difference ΔP_0 , calculated according to equations (1) and (2) at temperature T_0 for the moment of complete evaporation of dimethylzinc and dimethyltelluride solutions

Solution mass, m , g	P_0 , Pa by eq. (1)	P_0 , Pa by eq. (2)	Pressure difference, ΔP_0 , Pa	Content $ZnMe_2$, % mol.
0.01244	10962	10911	-51	50.00
0.01717	15476	15502	26	50.00
0.01804	15806	15818	15	70.32
0.08102	80539	80584	45	70.32

Table 7

Dependence of the ratio T/P on temperature for the unsaturated vapor region during evaporation of dimethylzinc and dimethylteluride solutions

50.00 % mol. $ZnMe_2$		70.32 % mol. $ZnMe_2$	
T , K	T/P , K/kPa	T , K	T/P , K/kPa
$m=0.01244$ g		$m=0.01804$ g	
307.5	27.70	308.3	19.64
320.3	27.61	318.3	19.29
330.7	26.89	328.3	19.20
340.1	26.57	338.2	19.44
348.6	26.41	348.1	18.92
$m=0.01717$ g		357.6	18.92
324.2	19.77	$m=0.08102$ g	
343.4	19.40	352.8	4.37
354.4	19.47	358.2	4.35
362.9	19.20	362.7	4.35

Table 8

Results of thermal expansion of nitrogen gas

T , K	P , kPa	T/P , K/kPa	T , K	P , kPa	T/P , K/kPa
Experiment 1			308.1	48.4	6.366
294.5	13.8	21.341	318.4	50.0	6.368
303.2	14.3	21.203	328.8	51.6	6.372
313.5	14.7	21.327	343.3	53.8	6.381
322.9	15.1	21.384	362.5	56.7	6.393
338.5	15.9	21.289	328.5	51.5	6.379
353.3	16.7	21.156	308.1	48.4	6.366
367.7	17.3	21.254	Experiment 3		
352.6	16.8	20.988	303.4	55.0	5.516
338.0	16.1	20.994	318.5	57.7	5.520
313.6	15.0	20.907	333.6	60.3	5.532
Experiment 2			348.3	63.1	5.520
297.6	46.8	6.359	362.2	65.6	5.521

This phenomenon, in our opinion, can be caused by two reasons: 1) change in the working volume of the membrane zero manometer due to its thermal expansion; 2) deviation of the properties of the investigated gaseous substances from the properties of the ideal gas.

To test the first assumption, as the most successful model of an ideal gas the thermal expansion of nitrogen gas was investigated (Table 8). It was found that for thermal expansion of nitrogen gas in the entire working range of temperature and pressure, the T/P ratio does not tend to decrease, ie the glass manometer used in our work, when the temperature changes, maintains a constant volume

within the accuracy of pressure and temperature measurement.

Statistical processing of experimental data on the thermal expansion of nitrogen gas (Table 9) shows that the shade D in equation (2) is insignificant, ie in this case we can apply equation of state (3).

Note that the results of statistical analysis showed that the coefficient D in equation (2) for pentane is statistically significant (Table 10). Therefore, when calculating the free volume of the manometer and the molecular weight of organoelement compounds, it is necessary to take into account the deviation of the pair of these compounds from the ideal.

Table 9

Statistical processing of experimental data on thermal expansion of nitrogen gas

Experiment number	Coefficients in the equation $P=CT + D$		S_C	S_D	R^2
	$C, Pa/K$	$-D, Pa$			
Exp. 1	48.3	363	1.8	581	0.9895
Exp. 2	152.7	-1355	0.4	119	0.9999
Exp. 3	180.4	-219	1,6	525	0.9998
Experiment number	Coefficients in the equation $P=CT$		S_C	S_D	R^2
	$C, Pa /K$	$-D, Pa$			
Exp. 1	47.22	0	0.12	–	0.9999
Exp. 2	156.88	0	0.10	–	0.9999
Exp. 3	181.09	0	0,09	–	0.9999

Table 10

Statistical processing of experimental data on thermal expansion of gaseous pentane

No.	Coefficients in the equation $P=CT + D$		S_C	$S_D \cdot 10^{-3}$	R^2
	$C, Pa / K$	$-D \cdot 10^{-3}, Pa$			
1	95.8	2.54	1.7	0.58	0.9982
2	104.1	4.9	3.6	1.2	0.9964
3	127.0	2.3	0.75	0.24	0.9983
4	143.8	1.8	1.2	0.38	0.9981
5	159.0	2.5	0.39	1.2	0.9984
6	173.9	2.79	2.5	0.81	0.9980
7	178.7	6.2	3.4	1.1	0.9983
8	182.0	24.3	8.5	2.8	0.9961
9	182.3	8.5	3.3	1.1	0.9982
10	189.4	10.6	0.98	3.2	0.9984
11	236.4	14.1	3.9	1.3	0.9961
12	265.1	15.6	9.6	3.0	0.9963
13	283.0	18.1	13.0	4.2	0.9944
14	312.8	22.3	7.6	2.4	0.9962
15	364.2	17.0	6.8	2.2	0.9983

If this deviation is not taken into account, then it can lead to a systematic difference between the ideal and real value when using equation (3) instead of more accurate equation (4). Expression (4) is obtained taking into account the relation (5), which follows from the comparison of equations (2) and (3):

$$P-D V_{REAL} = nRT \quad (4)$$

$$C = \frac{nR}{V_{REAL}} \quad (5)$$

Let's estimate the value of this difference when calculating the working volume of the manometer by expression (6) and for the difference relative to the ideal value (7):

$$\frac{V_{REAL}}{V_{IDEAL}} = \frac{P_0}{P_0 - D} = \frac{1}{1 - \frac{D}{P_0}} \quad (6)$$

$$\delta\% = \frac{|V_{IDEAL} - V_{REAL}|}{V_{IDEAL}} \times 100\% = \left| 1 - \frac{V_{REAL}}{V_{IDEAL}} \right| \times 100\% \quad (7)$$

Table 11

Coordinates of the point of complete liquid evaporation according to the temperature dependence of the pentane vapor pressure

No	<i>m</i> , mg	<i>P</i> ₀ , kPa	<i>T</i> ₀ , K	- <i>D/P</i> ₀	Relative difference, % by eq. (7)
1	17.05	23.5	272.2	0.108	9.7
2	16.49	23.5	272.1	0.209	17.3
3	26.60	33.2	280.1	0.069	6.5
4	30.70	39.1	284.0	0.046	4.4
5	33.39	43.0	286.3	0.058	5.5
6	30.60	47.5	288.8	0.059	5.6
7	29.59	45.2	287.6	0.137	12.0
8	34.60	50.4	290.3	0.482	32.5
9	28.43	43.8	286.8	0.194	16.2
10	32.75	43.7	286.7	0.243	19.5
11	39.50	55.0	292.5	0.256	20.4
12	47.98	63.2	296.2	0.247	19.8
13	47.83	66.1	297.4	0.274	21.5
14	50.94	71.4	299.4	0.312	23.8
15	41.70	94.9	307.3	0.179	15.2
Average δ , %				(15.3 ± 4.5) %	

Table 12

The confidence intervals of the slope *C* and the intercept *D* in equation (2) of experimental data on thermal expansion of gaseous pentane

No.	<i>N</i>	<i>f</i>	<i>t</i> (0.95, <i>f</i>)	ΔC , Pa/K	ΔD , Pa
1	7	5	2.57	4.4	1491
2	5	3	3.18	11.4	3816
3	6	4	2.78	2.1	667
4	6	4	2.78	3.3	1056
5	7	5	2.57	1.0	308
6	9	7	2.45	6.1	1985
7	6	4	2.78	9.5	3058
8	3	1	12.70	108.0	35560
9	5	3	3.18	10.5	3498
10	5	3	3.18	3.1	10176
11	10	8	2.31	9.0	3003
12	4	2	4.30	41.3	12900
13	5	3	3.18	41.3	13356
14	8	6	2.45	18.6	5880
15	5	3	3.18	21.6	6996

The D/P_0 values and the relative difference (%) are given in Table 11. Note that the D/P_0 value is a measure of the deviation of pentane vapor from the ideal gas, and the relative difference calculated by formula (7) reaches an average of (15.3 ± 4.5) %.

In Table 12, which shows the confidence intervals of the slope C and the intercept D in equation (2).

These confidence intervals are calculated as the product of the corresponding standard quadratic deviations S_C and S_D (table 10) and the statistical quantile t -distribution [14] for a confidence probability of 0, 95 and $f = N-2$ as the degree of freedom.

According to the level of our experiment accuracy which is shown as the diagram in Fig. 5, the D value was determined with an average relative error of 59 %.

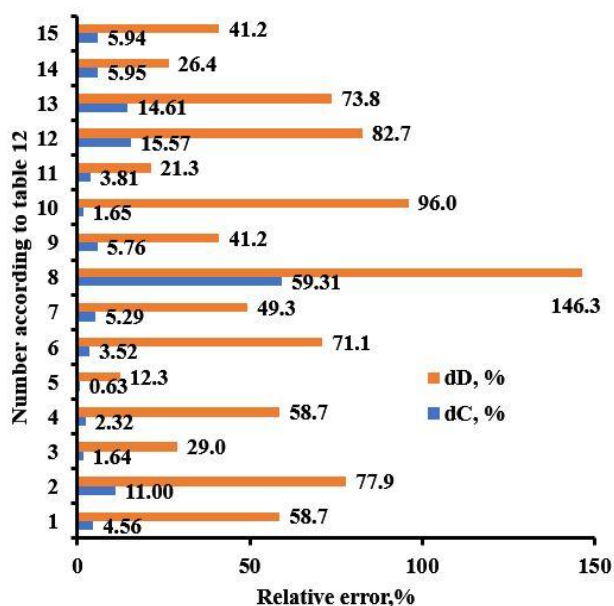


Fig. 5. Relative error for determination of slope C and intercept D in equation (2) for experimental data of thermal expansion of gaseous pentane

Therefore, the working volume of the manometer and the molecular weight of the test substances should be calculated by equation (4), but according to the existing level of accuracy of our experiment, the error in determining the D value is significant, so the calculation of these values by equation (3) at the point of complete evaporation is duly justified.

Conclusions

As a result of the research, reliable data were obtained to determine the temperature dependence of the vapor pressure of the dimethylzinc-dimethyl tellurium system of 50.0 and 70.32 % mol. $ZnMe_2$. According to the characteristic types of RT curves observed in this case, it should be noted that in contrast to equimolecular solutions “dimethylzinc – dimethyl selenide” [6], “diethylzinc – diethyl selenide” [7] and “dimethyltelluride – dimethylcadmium” [9] the “dimethylzinc – dimethyl telluride” system is bivariate for content 50.00 and 70.32 % mol. $ZnMe_2$.

According to the data of thermal expansion, the average molecular weight of the vapor of the mixture “dimethylzinc – dimethyl telluride” of 50.00 and 70.32 % mol. $ZnMe_2$. These calculations indicate that in the vapor above the solution of “dimethylzinc – dimethyl telluride” for the entire investigated temperature range (270–360 K) and the components are in the monomeric state for the composition mentioned above.

The obtained results can be used in thermodynamic calculations in the development of EOC cleaning technologies and obtaining high-purity coatings and films by the method of gas - transport reactions.

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ТЕРМОДИНАМІКА ВИПАРОВУВАННЯ РОЗЧИНІВ ДИМЕТИЛЦИНКУ ТА ДИМЕТИЛТЕЛУРИДУ

У роботі за допомогою статичного методу із мембранним нуль-манометром експериментально досліджено рівновагу рідина – пара в системі "диметилцинк – диметилтелурид" у діапазоні температур 270–360 К із вмістом диметилцинку 50,00 та 70,32 % моль. Загальний тиск пари виміряно для обох ділянок як насиченої, так і ненасиченої пари та для різних наважок. Встановлено, що ці розчини не є азеотропними. Використовуючи рівняння стану $PV = nRT$, за даними термічного розширення ненасиченої пари розраховали середню молекулярну масу пари сумішей "диметилцинк – диметилтелурид" вищевказаного складу. Результати цього розрахунку вказують на відсутність істотної асоціації молекул компонентів розчину в газовій фазі.

Ключові слова: диметилцинк – диметилтелурид; розчин; тиск пари; середня молекулярна маса; статичний тензіметричний метод.