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THERMAL PROPERTIES OF AN AQUEOUS SOLUTION OF SODIUM CHLORIDE AT A CONCENTRATION OF 200 g/liter

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Results are offered from a study of density and vapor tension of an aqueous solution of sodium chloride at temperatures of 598.15°K and pressures to 40 MPa.

The experimental values of density and vapor tension of an aqueous solution of sodium chloride containing 200 g salt per liter of solution were obtained by the constant-volume piezometer method. The pressure was measured by load piston manometers, types MP-600 and MP-60, with 0.05% accuracy, and the temperature was determined by a reference platinum resistance thermometer with uncertainty of ±0.02°.

The total relative uncertainty in density determinations did not exceed ±0.1%.

The experimental data are presented in Table 1. Also shown are measured values of vapor tension and densities of the saturated liquid at temperatures of 373.15-598.15°K (last column), obtained by graphic extrapolation of the isotherms to the corresponding saturation pressures.

The vapor tension of sodium chloride P_s (MPa) for concentrations of $C = 0-300$ g/liter is described by the equation

$$P_s = P_w \cdot 10^{-1.77975 \cdot 10^{-4} \cdot C^{1.1}}.$$

This equation generalizes the experimental data with an error no greater than ±0.2%.

NOTATION

P, pressure, MPa; T, temperature, °K; ρ, liquid density, kg/m³; P_s, saturated vapor pressure of solution, MPa; P_w, saturated pressure of water vapor, MPa; C, solution concentration, g/liter; $v = -1.77975 \cdot 10^{-4}$, coefficient.

TABLE 1. Density of Aqueous Solution of Sodium Chloride at Concentration of 200 g/liter; T, °K; P, MPa; ρ, kg/m³

T=298,15		T=323,15		T=348,15		T=373,15		T=398,15		T=423,15		T=448,15	
P	ρ	P	ρ	P	ρ	P	ρ	P	ρ	P	ρ	P	ρ
39,897	1143,1	40,002	1131,2	39,751	1116,5	39,983	1101,2	39,612	1083,6	39,976	1066,0	39,832	1046,6
31,023	1139,6	31,762	1127,7	29,252	1111,9	32,183	1097,4	30,295	1079,6	32,102	1062,1	32,031	1042,5
22,930	1136,4	22,180	1124,1	20,212	1108,1	23,700	1093,7	22,326	1075,9	24,247	1058,1	23,111	1038,0
13,173	1132,3	12,003	1119,6	12,600	1105,1	14,488	1089,6	12,321	1071,4	15,623	1054,2	13,578	1033,0
8,851	1130,5	7,899	1117,9	8,549	1103,0	10,201	1087,6	7,719	1069,5	11,149	1052,0	9,324	1031,1
4,449	1128,9	4,201	1116,5	4,687	1101,5	5,450	1085,5	3,900	1067,6	7,137	1050,0	5,480	1029,0
0,302	1127,4	0,700	1115,1	0,709	1100,1	0,788	1083,4	0,651	1066,2	1,369	1047,6	1,343	1027,2
						0,0881	1083,1	0,2017	1066,0	0,4139	1047,0	0,7770	1026,9

T=473,15		T=498,15		T=523,15		T=548,15		T=573,15		T=598,15	
P	ρ	P	ρ	P	ρ	P	ρ	P	ρ	P	ρ
39,963	1026,8	39,647	1004,6	39,689	982,1	39,604	958,1	39,897	931,6	39,755	901,4
32,756	1022,4	31,651	999,6	33,719	977,5	31,350	950,9	33,560	925,1	32,381	893,4
23,120	1016,9	23,534	994,5	25,920	971,9	24,123	944,8	26,524	917,9	26,368	886,9
14,650	1012,0	14,750	989,0	18,113	966,1	17,198	938,9	18,902	910,3	20,241	880,0
10,002	1009,1	10,234	986,1	14,202	963,4	13,760	935,8	15,753	907,0	16,885	876,2
6,801	1007,0	6,813	984,2	9,500	960,1	10,372	932,8	12,899	903,9	13,913	872,9
2,212	1005,0	2,750	981,6	4,137	956,2	5,847	928,9	8,901	899,7	10,998	869,6
1,354	1004,3	2,222	981,2	3,464	955,8	5,174	928,3	7,469	898,2	10,477	868,9