PHYSICOCHEMICAL STUDY OF AQUEOUS DIOXAN SOLUTIONS

IX. AQUEOUS DIOXAN SOLUTIONS OF SULFURIC ACID

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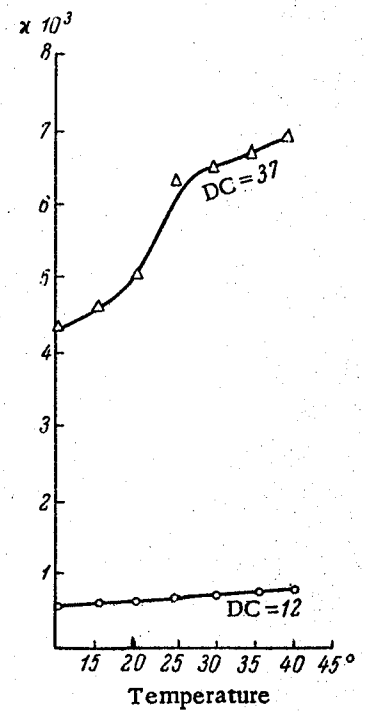
The properties of solutions of hydrogen chloride in dioxan [1], and in aqueous dioxan mixtures [2] and also sulfuric acid solutions in dioxan [3], were described earlier. In the present work the electrical conductivity of sulfuric acid in aqueous dioxan mixtures is studied.

It has been shown [3], that sulfuric acid solutions in dioxan, not only at low, but even at considerable concentrations (~10 mole %) are very bad conductors of electricity. Even for sulfuric acid concentrations of 2.48 N, the equivalent electrical conductivity of sulfuric acid solutions in dioxan is equal to 0.0238 Ω^{-1}. For aqueous solutions of 2 N concentration, the equivalent electrical conductivity of sulfuric acid reaches about 220 Ω^{-1}, i.e., approximately 10,000 times as much. At the same time, sulfuric acid in dioxan, as in water, forms a complex compound – the crystalline dioxanate [3, 4]. It was of interest to study the behavior of sulfuric acid in mixed aqueous dioxan solvent for varying ratios of dioxan to water. For this purpose, 0.1 N and 0.01 N solutions of sulfuric acid were prepared in aqueous dioxan mixtures having electrical constants equal to 12 and 37. If we add to these the well studied solutions of sulfuric acid in water and also solutions of sulfuric acid in dioxan [3], we obtain a series of solutions of sulfuric acid in media with the following dielectric constants: 2.28, 12, 37 and 81.



Dependence of specific electrical conductivity of 0.1 N solutions of sulfuric acid in aqueous dioxan on temperature.

Aqueous dioxan solutions of sulfuric acid were prepared in graduated jars with ground-glass stoppers. They were both transparent and colorless like aqueous solutions of sulfuric acid and kept well. The results of the specific and equivalent electrical conductivity measurements for sulfuric acid in aqueous dioxan mixtures are given in Table 1.

As seen from the data in Table 1, at different concentrations and temperatures, specific electrical conductivity of aqueous dioxan solutions of sulfuric acid increases with increasing content of water in the system.

The specific electrical conductivity of solutions increases with increasing temperature, as may be concluded from Fig. 1. The curve for DC = 12 in the temperature range studied is represented by an ascending straight line; for DC = 37 the increase is more pronounced and not so even.

TABLE 1

Specific Electrical Conductivity of Aqueous Dioxan Solutions of Sulfuric Acid.

DC	H_2SO_4 concentration (N)	$\varkappa \cdot 10^3$						
		45°	40°	35°	30°	25°	20°	15°
12	0.1	0.7431	0.7311	0.7014	0.6671	0.6328	0.5982	0.5609
12	0.01	0.1108	0.1060	0.09811	0.09609	0.09156	0.08396	0.07816
37	0.1	6.901	6.639	6.561	6.393	5.184	4.618	4.412
37	0.01	0.7027	0.6311	0.5801	0.5373	0.4875	0.4267	0.3941

TABLE 2

Equivalent Electrical Conductivity of Aqueous Dioxan Solutions of Sulfuric Acid.

DC	Dilution	λ						
		45°	40°	35°	30°	25°	20°	15°
12	10	7.431	7.311	7.014	6.671	6.328	5.982	5.609
12	100	11.08	10.60	9.811	9.609	9.156	8.396	7.816
37	10	69.01	66.39	65.61	63.93	51.84	46.18	44.1
37	100	70.27	63.11	58.01	53.73	48.75	42.67	39.41

The results are no less interesting on comparing the values for the equivalent electrical conductivities of these solutions.

As seen from the data in Table 2, an increase in the relative water content is accompanied by an increase in equivalent electrical conductivity of aqueous dioxan solutions of sulfuric acid.

SUMMARY

1. Specific and equivalent electrical conductivity of solutions of sulfuric acid in aqueous dioxan mixtures with high dielectric constants 37 and 12, have been determined. The studies were carried out at the temperature range 15 to 45°, for each 5°.

2. It has been established that for different concentrations and the same temperature, the electrical conductivity of solutions is higher, the greater the amount of water contained in the aqueous dioxan solvent.

3. Electrical conductivity of the solutions increases with increasing temperature.

LITERATURE CITED

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