

Determination of Ionic Mobilities of Uranium in Aqueous Solutions at 25 °C by Use of Conductivities

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In pure water the limiting ionic conductance of ($\frac{1}{2}$ UO_2^{2+}) was found to be $57 \text{ cm}^2 \Omega^{-1} \text{ mol}^{-1}$ by use of conductivity measurements of $\text{UO}_2(\text{ClO}_4)_2 \cdot x\text{H}_2\text{O}$ in diluted perchloric acid.

In order to optimize nuclear fuel reprocessing, there still is an urgent need for investigating transport processes of the actinides in aqueous solutions. Since for the standard system water ionic mobilities of uranium had already been determined by us from combined transference- and conductance measurements of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in diluted nitric acid¹, the conductivities of $\text{UO}_2(\text{ClO}_4)_2 \cdot x\text{H}_2\text{O}$ in perchloric acid solutions were determined in a concen-

tration range of $10^{-4} n \leq c \leq 6 \cdot 10^{-3} n$ now to confirm those results. The concentration of the UO_2 -ion constituent was gained from gravimetric determinations by use of 8-hydroxyquinoline, the p_{H} -value of each solution being calculated with relative high accuracy from these data and the analytical concentration of perchlorate, got from gravimetric determination by nitron².

Using Mac Innes principle³ the limiting equivalent conductivity of $\text{UO}_2(\text{ClO}_4)_2$ could be calculated for the standard state "water" at 25 °C delivering the value

$$\Lambda_{(1/2 \text{UO}_2(\text{ClO}_4)_2)}^0 = 124 \pm 2 \text{ cm}^2 \Omega^{-1} \text{ mol}^{-1}$$

and the association constant

$$K_A = (9800 \pm 500) \text{ l}^2 \text{ mol}^{-2},$$

the limiting ionic conductance of ClO_4^- in water⁴ being $(67.36 \pm 0.05) \text{ cm}^2 \Omega^{-1} \text{ mol}^{-1}$. The corresponding value of the UO_2^{2+} -ion was found to be

$$\lambda_{(1/2 \text{UO}_2^{2+})}^0 = (57 \pm 2) \text{ cm}^2 \Omega^{-1} \text{ mol}^{-1} \text{ or}$$

$$u_{(\text{UO}_2^{2+})}^0 = (5.9 \pm 0.2) \cdot 10^{-4} \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$$

respectively.

These values are in excellent accordance with those gained from our previous investigations¹.

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² J. Loebich, Angew. Chem. **39**, 432 [1926].

³ D. A. Mac Innes, J. Amer. Chem. Soc. **47**, 1922 [1925].

⁴ R. A. Robinson and R. H. Stokes, Electrolyte Solutions, Butterworths, London 1959, revised 1970.

