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

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(Z. Naturforsch. **32 a**, 186 [1977]; received December 31, 1976)

In pure water the limiting ionic conductance of $(\frac{1}{2}\,UO_2^{2+})$ was found to be 57 $cm^2\,\Omega^{-1}\,mol^{-1}$ by use of conductivity measurements of $UO_2(ClO_4)_2 \cdot xH_2O$ 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 $UO_2(NO_3)_2 \cdot 6\,H_2O$ in diluted nitric acid [1], the conductivities of $UO_2(ClO_4)_2 \cdot x\,H_2O$ in perchloric acid solutions were determined in a concentration range of $10^{-4}\,n \leqq c \leqq 6 \cdot 10^{-3}\,n$ 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 nitron [2].

Using Mac Innes principle [3] the limiting equivalent conductivity of $UO_2(ClO_4)_2$ could be calculated for the standard state "water" at 25 °C delivering the value

$$\Lambda^0_{(1/2\,UO_2(ClO_4)_2)} = 124 \pm 2\ cm^2\,\Omega^{-1}\,mol^{-1}$$

and the association constant

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

the limiting ionic conductance of ClO_4^- in water [4] being $(67.36 \pm 0.05)\ cm^2\,\Omega^{-1}\,mol^{-1}$. The corresponding value of the UO_2^{2+}-ion was found to be

$$\lambda^0_{(1/2\,UO_2^{2+})} = (57 \pm 2)\ cm^2\,\Omega^{-1}\,mol^{-1} \text{ or}$$

$$u^0_{(UO_2^{2+})} = (5.9 \pm 0.2) \cdot 10^{-4}\ cm^2\,V^{-1}\,s^{-1}$$

respectively.

These values are in excellent accordance with those gained from our previous investigations [1].

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