Determination of Ionic Mobilities of Uranium in n-Propanol at 25 °C

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In the *n*-propanol $UO_2(NO_3)_2 \cdot 2\,H_2O$-System the limiting ionic conductance of $(\frac{1}{2}\,UO_2^{2+})$ was found to be 15,94 $cm^2\,\Omega^{-1}\,mol^{-1}$ at 25 °C, its association constant being $5{,}2 \cdot 10^9\,l^2 \cdot mol^{-2}$.

In order to investigate transport phenomena of the actinides in aqueous and nonaqueous solutions for possible applications in nuclear fuel reprocessing the equivalent conductivities of $UO_2(NO_3)_2 \cdot 2\,H_2O$ were determined in *n*-propanol at 25 °C in a concentration range of

$$4 \cdot 10^{-5}\,n \leqq c \leqq 7 \cdot 10^{-4}\,n$$

with high accuracy ($\Delta \Lambda_{rel} = 0.05\%$).

By use of the Fuoss-Krauss-equation, modified for 2:1-electrolytes, the limiting equivalent conductivity of $UO_2(NO_3)_2 \cdot 2\,H_2O$ at infinite dilution was calculated to be

$$\Lambda^0_{(1/2\,UO_2(NO_3)_2 \cdot 2\,H_2O)} = (29.55 \pm 0.02)\ cm^2\,\Omega^{-1}\,mol^{-1}$$

the association constant being

$$K_A = (5.2 \pm 0.5) \cdot 10^9\,l^2 \cdot mol^{-2}\,.$$

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Using the value of the limiting ionic conductance of NO_3^- in *n*-propanol at 25 °C

$$(\lambda^0_{NO_3^-})^{25°C}_{n\text{-prop.}} = (13.61 \pm 0.02)\ cm^2\,\Omega^{-1}\,mol^{-1}$$

and applying Kohlrausch's law the limiting ionic conductance of UO_2^{2+} was calculated in this solvent, the results being

$$(\lambda^0_{(1/2\,UO_2^{2+})})^{25°C}_{n\text{-prop.}} = (15.94 \pm 0.01)\ cm^2\,\Omega^{-1}\,mol^{-1}$$

and

$$(u^0_{(UO_2^{2+})})^{25°C}_{n\text{-prop.}} = 16.52 \pm 0.02) \cdot 10^{-5}\,cm^2\,V^{-1}\,s^{-1}$$

for the corresponding mobility.

The $\lambda^0_{NO_3^-}$-value was obtained from conductance measurements of $NaNO_3$, the limiting equivalent conductivity being

$$(\Lambda^0_{NaNO_3})^{25°C}_{n\text{-prop.}} = (23.97 \pm 0.02)\ cm^2\,\Omega^{-1}\,mol^{-1}\,,$$

and measurements of transference numbers of Na^+ in the systems NaBr/*n*-propanol and NaJ/*n*-propanol by use of the radioisotope method, which deliver the limiting ionic conductance of Na^+ in this solvent to be

$$(\lambda^0_{Na^+})^{25°C}_{n\text{-prop.}} = (10.36 \pm 0.03)\ cm^2\,\Omega^{-1}\,mol^{-1}\,.$$

If the unmodified Fuoss-Krauss-equation is used, negative values of $\Lambda^0_{UO_2(NO_3)_2 \cdot 2\,H_2O}$ will be obtained from our data. Moreover there wasn't any minimum of the conductivity-concentration curve to be observed. Thus any pretended $UO_2(NO_3)_2 \cdot 2\,H_2O$ to act as 1:1-electrolyte or to form triplett-ions in this solvent could not be confirmed.