Determination of Conductivities and Transference Numbers of NaBr and NaJ in n-Propanol at 25 °C by Use of the Radioisotope Method

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(Z. Naturforsch. **32 a**, 185 [1977]; received December 31, 1976)

In *n*-propanol the limiting ionic conductance of Na^+ was found to be 10,36 $cm^2\,\Omega^{-1}\,mol^{-1}$ at 25 °C from conductivity- and transference measurements of NaBr and NaJ by use of the radioisotope method.

In order to split up equivalent conductivities of actinides into the corresponding ionic mobilities in nonaqueous solutions, transference numbers of Na^+ were determined in the systems NaBr/*n*-propanol and NaJ/*n*-propanol at 25 °C within a concentration range of $10^{-1}\,n$ to $2\cdot10^{-3}\,n$. Using these data the variety of conductance data of tetraalkylammonium- and alkalihalides in *n*-propanol [1–3] were split up into limiting single ion conductances.

Using Co as indicator the boundaries at higher concentrations were localized by the ordinary optical version of the moving boundary method, those at lower concentrations by use of our radioisotope method [4], the following indicator solution being labelled with Co-60.

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The data of the transference numbers of Na^+ in the NaBr/*n*-propanol system are in accordance with Longsworth- and Stokes-functions within the concentration range from $10^{-2}\,n$ to $2\cdot10^{-3}\,n$.

The limiting value of the transference number of Na^+ at 25 °C is:

$$(t^0_{Na^+})^{NaBr}_{n\text{-prop.}} = 0.4561 \pm 0.0001 .$$

Since the equivalent conductivity at infinite dilution of NaBr in *n*-propanol, calculated by Justice's equation, is

$$(\Lambda^0_{NaBr})^{25°C}_{n\text{-prop.}} = 22.78\ cm^2\,\Omega^{-1}\,mol^{-1} ,$$

the association constant being $K_A^{NaBr} = 317\ l\cdot mol^{-1}$, the limiting ionic conductance of Na^+ calculated from these data is

$$\lambda^0_{Na^+} = (10.39 \pm 0.03)\ cm^2\,\Omega^{-1}\,mol^{-1} .$$

To confirm these results, the transference numbers of Na^+ in NaJ/*n*-propanol and their corresponding conductance data were determined. These data, also fitting Longsworth- and Stokes functions within the same concentration range, are:

$$(t^0_{Na^+})^{NaJ}_{n\text{-prop.}} = 0.4261 \pm 0.0001 ,$$
$$\Lambda^0_{NaJ} = 24.23\ cm^2\,\Omega^{-1}\,mol^{-1} ,$$
$$\lambda^0_{Na^+} = (10.33 \pm 0.03)\ cm^2\,\Omega^{-1}\,mol^{-1} ,$$
$$K_A^{NaJ} = 173\ l\,mol^{-1} .$$

The limiting single ion conductance of Na^+ is in accordance with the previous one within the error limit, delivering an average value of

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

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