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CATIONIC MOBILITIES IN FUSED CESIUM NITRATE AND THALLOUS NITRATE

by

S. FORCHERI and C. MONFRINI

1963

Joint Nuclear Research Centre
Ispra Establishment (Italy)

Materials Department
High Temperature Chemistry

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The authors' names are listed in alphabetical order.

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CATIONIC MOBILITIES IN FUSED CESIUM NITRATE AND THALLOUS NITRATE

Sir:

In the course of the past few years many papers dealing with the determination of transport numbers of ions in pure ionic melts have been published. Most of the experiments were made with porous plug cells[1-4] in which the plugs act as reference frames for the ionic velocities.

In our present work we used the experimental technique of electrophoresis on thin layers for the determination of single ionic mobilities in molten salts. The layer consisted of fine alumina powder sprayed on a sintered non-porous alumina support strip (30 cm. × 1.5 cm. × 2 mm. thick). The thickness of the layer was about 10 mg./cm.^{2}. It was impregnated with the pure salt under test and doped at one end with a small amount of radioactive cations. The cell terminals consisted of two platinum electrodes immersed in the melt contained in crucibles. The electric connection between the crucibles and the strip was achieved by asbestos paper bridges. The potential gradient along the alumina strip during the experiments was measured by two auxiliary platinum wire electrodes in contact with the strip at both ends. The mobility data reported are referred to this potential gradient.

Under normal experimental conditions the field strength was 3–6 v./cm. and the running time was 1–2 hr. The current was 10–45 ma., which corresponds to a maximum Joule heat of 0.2 w./cm.^{2}. This value is small enough to avoid temperature differences along the strip.

When the experiment was completed, the strip was cooled to room temperature and the activity distribution scanned by a G.M. window counter in which the aperture was 0.5 mm. In Table I we compare a few results obtained for alkali nitrate melts with those obtained by other authors who determined the porous plug transport numbers in the same systems. We also give original results for cesium nitrate at 450° and thallous nitrate at 250°.

The mobilities in the third column are the results of runs carried out at different potential gradients.

Table I

Cationic Mobilities of Pure Fused Salts

Salt	T, °C.	$u \times 10^4$, cm.^{2} v.$^{-1}$ sec.$^{-1}$	Av.	Previous work
$CsNO_3$	450	1.56 1.69 1.64	1.63 ± 0.07	. . .
$TlNO_3$	250	1.08 0.99 1.04 1.11	1.05 ± 0.06	. . .
$NaNO_3$	350	3.86 3.90 3.84	3.87 ± 0.07	3.86 ± 0.05[a]
KNO_3	350	2.04 2.08 2.12	2.08 ± 0.06	2.21 ± 0.11[a]
$AgNO_3$	250	2.57 2.68 2.47	2.57 ± 0.11	2.87 ± 0.19[b]

[a] Reference 1. [b] Reference 2.

We feel that electrophoresis on thin layers in fused salts is an accurate and useful method for determining electrical transport properties of ionic melts.

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