become then $D(B-S)=1.85$ Å and $D(B-Se)=1.99$ Å, *i.e.* about 0.05 Å longer than the observed values in $B(SCH_3)_3$ and $B(SeCH_3)_3$ respectively. We conclude therefore that the π-bond order is non-negligible in $\rangle B-Se\langle$ as well as in $\rangle B-S\langle$ bonds.

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Density and Surface Tension of Molten Manganese—Cesium Chloride Mixtures

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Density and surface tension of molten $MnCl_2-CsCl$ were investigated to supplement absorption [1] and Raman spectroscopic [2] studies. The density and surface tension were determined from liquidostatic weighing and the pin detachment force, respectively. The principle and experimental details have been previously described.[3–5]

Anhydrous salts were obtained from $MnCl_2 \cdot xH_2O$ (*p.a.* Merck, Darmstadt, Germany) and

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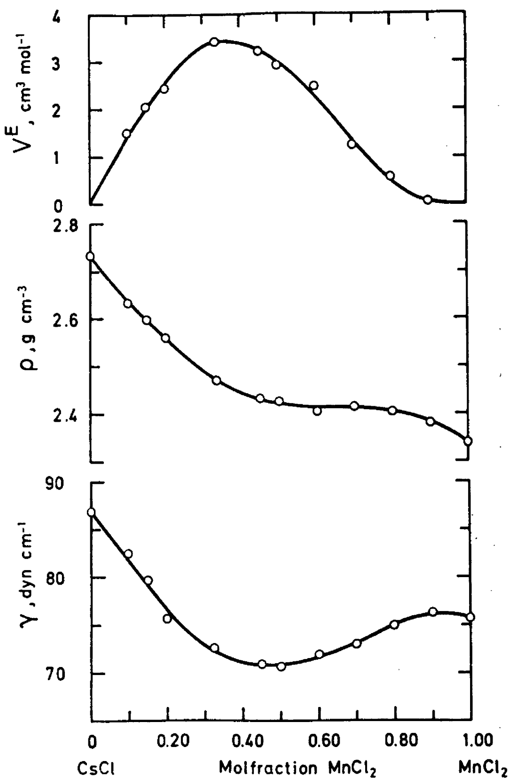

Fig. 1. Surface tension, γ; density, ρ; and molar excess volume, V^E, for molten mixtures of CsCl and $MnCl_2$ at 700 °C.

Table 1. Density, ϱ, surface tension, γ, and excess molar volumes, V^E, for molten $CsCl-MnCl_2$ mixtures at 700 °C.

Mol fraction $MnCl_2$	ϱ g cm^{-3}	$\alpha \times 10^{-4}$ g cm^{-3} K^{-1}	γ dyn cm^{-1}	$-\alpha \times 10^2$ dyn cm^{-1}K^{-1}	V^E cm^3 mol^{-1}
0	2.735	10.7	86.9	8.4	0
0.10	2.635	10.0	82.5	5.9	1.497
0.15	2.534	10.0	73.7	6.8	2.047
0.20	2.560	9.3	75.6	6.3	2.429
0.33	2.470	7.7	72.6	6.0	3.434
0.45	2.435	8.4	70.9	6.4	3.202
0.50	2.426	8.4	70.6	5.3	2.935
0.60	2.404	7.2	71.8	5.6	2.482
0.70	2.414	8.3	72.9	5.9	1.248
0.80	2.401	7.5	74.9	5.3	0.566
0.90	2.380	6.4	76.3	3.5	0.047
1.00	2.337	4.8	75.6	0.6	0

CsCl (Analar, Hopkin and Williams, England) by standard procedures.[3]

The experiments were performed in the temperature range 660 – 740 °C, and least-squares programs were used for determination of the temperature coefficient. The average standard deviation for the fitting was 0.15 % for the surface tension and 0.03 % for the density, except for the 60 mol % $MnCl_2$ mixture, where the standard deviation of the density was 0.13 %.

Table 1 gives the surfaces tension, density and calculated excess molar volume at 700 °C and the determined temperature coefficients. Fig. 1 shows the concentration variation at 700 °C graphically. The density and surface tension data for the pure salts are in good agreement with those reported in the literature (ϱ for $CsCl = 2.734$,[3] from this work $\varrho = 2.735$. γ for $CsCl = 87.4$,[4] from this work $\gamma = 86.9$. ϱ for $MnCl_2 = 2.332$,[6] from this work $\varrho = 2.337$).

Excess molar volume as well as excess surface tension, defined as deviation from additivity, exhibit maxima near 33 mol % $MnCl_2$ (Cs_2MnCl_4), similar to observations made in the corresponding $CsCl-MgCl_2$ system.[3,4] This supports the existence of the spectroscopically detected $MnCl_4^{2-}$.[1,2]

The properties of pure $MnCl_2$ also show similarities to those of pure $MgCl_2$. The temperature coefficient of the surface tension for $MnCl_2$ is abnormally low compared with the mixtures with CsCl, and close to that of pure $MgCl_2$: 0.6×10^{-2} *versus* 0.4×10^{-2} dyn cm^{-1} K^{-1} for $MgCl_2$. The thermal expansion coefficient is also considerably lower than for CsCl, although not as low as for $MgCl_2$: 4.8×10^{-4} *versus* 2.9×10^{-4} g cm^{-3} K^{-1} for pure $MgCl_2$.

Consequently, the shape of the density and surface tension curves *versus* concentration shows great similarities to those of $RbCl-MgCl_2$ and $CsCl-MgCl_2$.[3,4] The curves (Fig. 1) are S-shaped, being convex upwards on the $MnCl_2$ side and concave on the CsCl side.

Apart from the existence of $MnCl_4^{2-}$ configurations in these melts, one cannot draw any other definite conclusion concerning the structure. The postulated octahedral coordination of Mn^{2+} in $MnCl_2$-rich mixtures is,[1] however, not contradicted by this study, as a change from octahedral to tetrahedral coordination is expected to be accompanied by volume expansion, in agreement with the positive excess molar volume having a maximum close to 33 mol % $MnCl_2$.

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