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The lattice constants and expansion coefficients of some halides. By P. G. HAMBLING, *The University, Reading, England*

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The precision electron-diffraction study of a series of materials in progress here has required a knowledge of their lattice constants and expansion coefficients as determined by the X-ray diffraction method. In cases where previous measurements have not been available, or have not been sufficiently accurate, a new determination has been made. Such measurements made on caesium iodide have already been reported (Rymer & Hambling, 1951). The present note records measurements made on potassium chloride, potassium iodide and thallic chloride, using the same technique. The powders were loaded into sealed silica tubes in a manipulating box, in which a dry atmosphere was maintained.

The lattice constants were in all cases measured in ångströms, using the standard wave-lengths given by Bragg (1947). Reference is made to previous measurements made on the materials. The results are quoted here in ångströms, the standards used in the early measurements having been examined so as to determine in which system the measurements were actually made.

Potassium chloride

Spectrographically standardized material (supplied by Johnson, Matthey and Co. Ltd.) was examined, nine measurements in all being made between 15° and 25° C., using cobalt, copper and nickel $K\alpha$ radiations. The lattice constant a and the linear expansion coefficient α were found to be

$$\begin{aligned} \text{KCl: } a(25^\circ \text{ C.}) &= 6.2929_4 \pm 0.00008 \text{ \AA.} \\ \alpha(15^\circ\text{--}25^\circ \text{ C.}) &= 3.3_7 \times 10^{-5}/^\circ\text{C.} \end{aligned}$$

Measurements were also made on the sample of Analar material (supplied by The British Drug Houses) used in electron-diffraction experiments by Rymer & Wright (1952), for which $a(25^\circ \text{ C.}) = 6.2930_6 \pm 0.00009 \text{ \AA.}$ The lattice constant therefore does not depend critically on the origin of the material.

Previous measurement of the lattice constant by Kantola (1947) gave $a = 6.292 \text{ \AA.}$

The expansion coefficient has been measured before dilatometrically, giving $2.8 \times 10^{-5}/^\circ\text{C.}$ in the range 0–25° C., and $3.9 \times 10^{-5}/^\circ\text{C.}$ in the range 25°–50° C. (Baxter & Wallace, 1916). X-ray diffraction measurements in the range 25°–100° C. gave $\alpha = 3.8 \times 10^{-5}/^\circ\text{C.}$ (Kantola, 1947).

Potassium iodide

Spectrographically standardized material (supplied by Johnson, Matthey and Co Ltd.) was examined at 25° C., using cobalt, copper and nickel $K\alpha$ radiations. The result of eight measurements of the lattice constant was

$$\text{KI: } a(25^\circ \text{ C.}) = 7.0655_5 \pm 0.0001_5 \text{ \AA.}$$

An earlier measurement by Davey (1923) gave $a = 7.065 \text{ \AA.}$

Connell & Martin (1951), using X-ray diffraction, obtained $\alpha(20^\circ\text{--}100^\circ \text{ C.}) = 4.06 \times 10^{-5}/^\circ\text{C.}$, in close agree-

ment with the value $4.08 \times 10^{-5}/^\circ\text{C.}$ obtained dilatometrically (Gott, 1942). In view of this agreement it was deemed unnecessary to re-determine α in the present work.

Thallic chloride

Spectrographically standardized material (supplied by Johnson, Matthey and Co. Ltd.) was examined at temperatures between 15° and 25° C., using copper $K\alpha$ radiation. Nine measurements gave the result

$$\begin{aligned} \text{TlCl: } a(25^\circ \text{ C.}) &= 3.8427_0 \pm 0.0001_0 \text{ \AA.} \\ \alpha(15^\circ\text{--}25^\circ \text{ C.}) &= 5.3_5 \times 10^{-5}/^\circ\text{C.} \end{aligned}$$

Another sample of TlCl of unknown origin gave the same result.

Straumanis, Ieviš & Karlsons (1939) found $a(25^\circ \text{ C.}) = 3.84246$ and 3.84234 \AA. using Cr $K\alpha$ and Cu $K\alpha$ radiations respectively.

Boswell (1950) has suggested the use of thallic chloride as a standard substance for electron-diffraction work. The large expansion coefficient would present a serious disadvantage should the specimen warm up appreciably when it is irradiated.

The use of potassium chloride as a standard is suggested. The expansion coefficient at room temperature is low, and good quality X-ray and electron-diffraction patterns can be obtained. Moreover, work by Rymer, Wright & Halliday, to be published elsewhere, has shown that the electron-diffraction patterns, unlike those from some other halides, are free from the anomalies found with specimens of gold leaf (Rymer & Butler, 1947) and certain evaporated metals (Williams, 1952).

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