Thermochimica Acta, 91 (1985) 351–355
Elsevier Science Publishers B.V., Amsterdam – Printed in The Netherlands

POSSIBLE TELLURITES IN THE THREE-COMPONENT SYSTEM Sn–Te–O AND THEIR THERMAL STABILITY

G.G. GOSPODINOV

Department of Inorganic Chemistry, Higher Institute of Chemical Technology, Bourgas 8010 (Bulgaria)

(Received 19 March 1985)

ABSTRACT

In order to find out the possible tellurites in the three-component system Sn–Te–O, the system $SnCl_4$–Na_2TeO_3–H_2O was studied at 25 and 100°C and its solubility isotherm was drawn at 100°C. The compound $SnTe_3O_8$ registered over the whole concentration range. Its crystallographic constants were determined and the mechanism of its thermal dissociation was suggested.

INTRODUCTION

The data concerning tin tellurites are rather scarce. Only one publication is available dealing with the synthesis of $SnTe_3O_8$ by sintering SnO_2 and TeO_2 [1]. It is not known whether it is possible to obtain pyrotellurites by the precipitation reaction. No answer is given to the question of the existence of other tellurites. There are no data concerning the thermal stability of the known pyrotellurite.

The present work aims at filling this gap.

EXPERIMENTAL

In order to study the system, pure-for-analysis $SnCl_4 \cdot 5H_2O$ and $Na_2TeO_3 \cdot 5H_2O$ which was obtained for this purpose from high-purity reagents by the technique reported in ref. 2 were used. A thorough study of the system $SnCl_4$–Na_2TeO_3–H_2O was carried out at 25 and 100°C.

Tananaev's method of "residual concentrations" [3] was employed to draw the solubility isotherm. The method is based on the fact that at a solution–precipitate equilibrium the composition of the precipitate being formed is determined by the change in the composition of the solution. In a series of experiments chemical precipitation was accomplished by adding increasing quantities of a precipitator to a constant quantity of the precipitating solution, the volume of the solution remaining unchanged.

0040-6031/85/$03.30

The diagram of the initial composition of the system vs. composition of the mother solutions was drawn according to the data of the chemical analysis of the mother solutions of the remaining unreacted components of the system. Then, the composition of the precipitates formed was determined.

The chemical analysis for tin in the liquid and solid phases was made complexometrically [4] and for tellurium, iodometrically and gravimetrically [5]. The pH of the equilibrium liquid phases was determined by a laboratory digital pH-meter (LP-7).

RESULTS AND DISCUSSION

The experiments carried out at 25°C show that phases having variable composition are formed under these conditions. The solid phases obtained are gels which are difficult to wash, and retain a considerable quantity of water even after being thoroughly dried.

The solubility isotherm of the system at 100°C (Fig. 1) shows that only one phase, namely $SnTe_3O_8$, is formed, the molar ratio of the components being $n = 3$. The same conclusions are made taking into consideration the

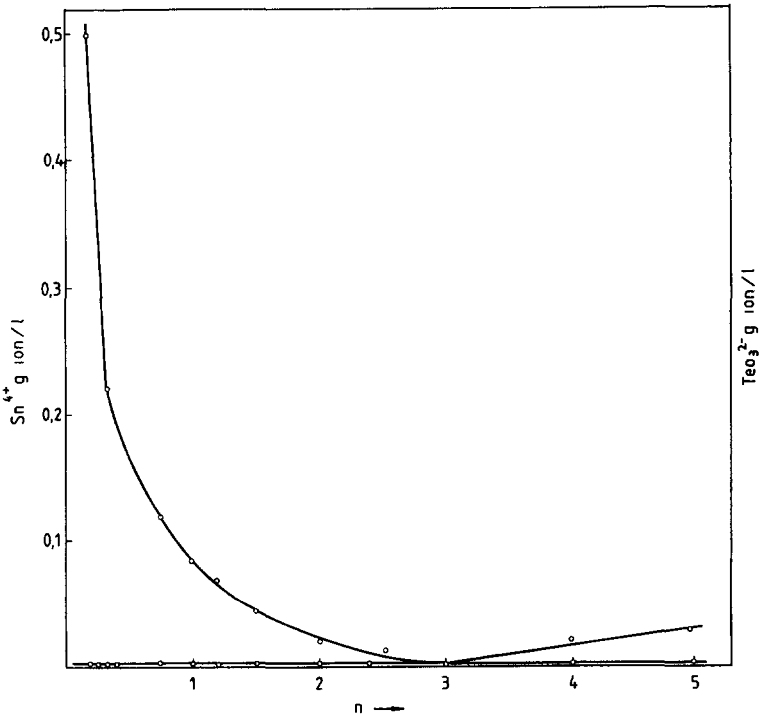

Fig. 1. Solubility isotherm of the system $SnCl_4$–Na_2TeO_3 at 100°C.

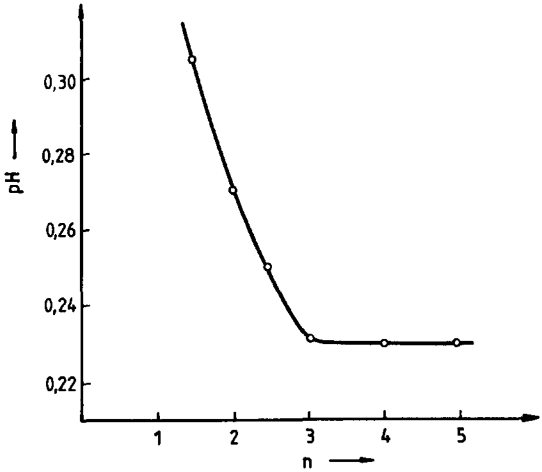

Fig. 2. pH of the equilibrium liquid phases.

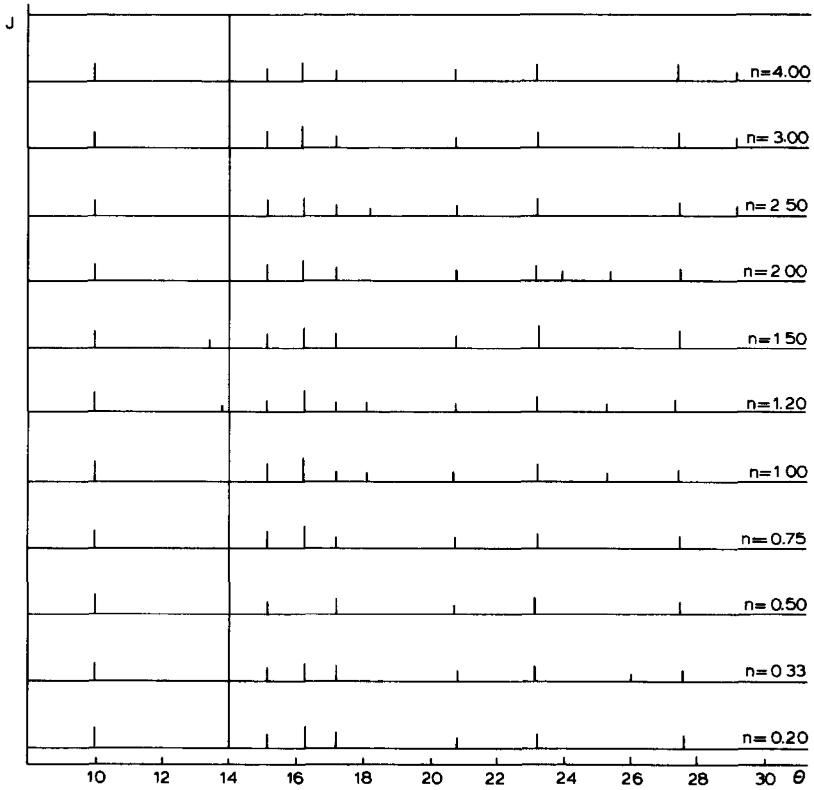

Fig. 3. X-ray pattern of the solid phases of the system $SnCl_4$–Na_2TeO_3–H_2O at 100°C ($n = (TeO_3^{2-}$ g ion/l)/(Sn^{4+} g ion/l)).

TABLE 1

X-ray pattern of $SnTe_3O_8$

J	d_{obs}	d_{calc}	hkl
27	4,506	4,541	111
100	3,198	3,211	222
11	2,969	2,972	321
38	2,779	2,781	400
21	2,614	2,621	411
8	2,488	2,487	420
11	2,181	2,181	510
5	2,027	2,030	521
23	1,965	1,966	440
7	1,910	1,907	530
8	1,804	1,804	611
15	1,759	1,758	620
6	1,719	1,716	541

pH of the equilibrium liquid phases (Fig. 2) and X-ray line patterns of the solid phases (Fig. 3).

The X-ray pattern of $SnTe_3O_8$ is the same as that included in the ASTM card-index where the product was obtained by the solid-phase reaction between SnO_2 and TeO_2 (Table 1).

On the basis of the results obtained here, the parameters of the elementary cell of the compound $SnTe_3O_8$ were calculated. This substance crystallizes in a cubic crystal system, the parameters of the elementary cell being $a = 11.122$ Å. The calculated density is 6.020 ± 0.001 g cm^{-3}.

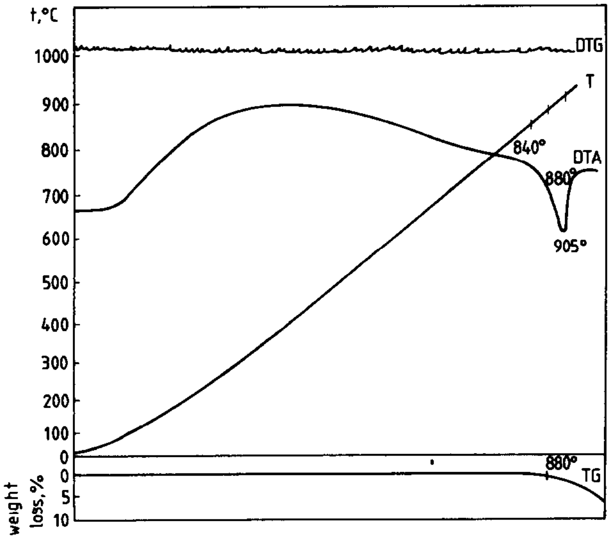

Fig. 4. Derivatogram of $SnTe_3O_8$.

The derivatographic analysis of $SnTe_3O_8$ was made using a MOM derivatograph (D-102, Hungary), the weight of the initial sample being 200 mg. As the derivatogram shows (Fig. 4), $SnTe_3O_8$ starts to dissociate slightly in the solid state at 880°C. At 905°C it melts. The dissociation in the melted state is still negligible. The weight loss of the sample at 950°C is as little as 5%.

REFERENCES

1 G. Bayer, Ber. Dtsch. Keram. Ges., 39 (1961) 535.

2 O.I. Vorobiova and E.A. Lavut, Izv. Vyssh. Uchelon. Zaved., Khim. Khim. Tekhnol., 9 (1966) 336.

3 I.M. Vaserman, Chimicheskoe osajdenie is rastvorov, Khimiya, Leningrad, 1980.

4 J. Umland, A. Janssen, D. Tierg and C. Winsch, Theorie und praktische Anvendung von Komplexbildnen, Frankfurt Am Main, 1971.

5 J.U. Fainberg and N.A. Filipova, Analis rud tsvetnyh metalov, Moscow, 1963, p. 465.