The Ultraviolet Absorption Spectra of the Molten and Solidified Mixed Salt Systems $NaNO_2$-$NaNO_3$, NaCl-$CdCl_2$

By Kaoru Sakai

(Received February 22, 1958)

According to the previous researches[1-3], it was found that the position of absorption edges of aqueous solutions which contain two component salts is shifted toward longer wave length than that of solutions each containing one of the components alone, provided that the two component salts react with each other and produce some kind of complex. Therefore we tried to find out the same phenomena[4,5] in the case of complex formation of the molten salt systems.

The experimental method is the same as that published by the present author previously[6], and the data are shown in Fig. 1 ($NaNO_2$-$NaNO_3$), and Fig. 2 (NaCl-$CdCl_2$), where are given the isotherms showing the relationship between the position of absorption edge and the component.

The phase diagram[7] of the $NaNO_2$-$NaNO_3$ system indicates solid solution over almost the entire range of composition, and the isotherms of its electrical

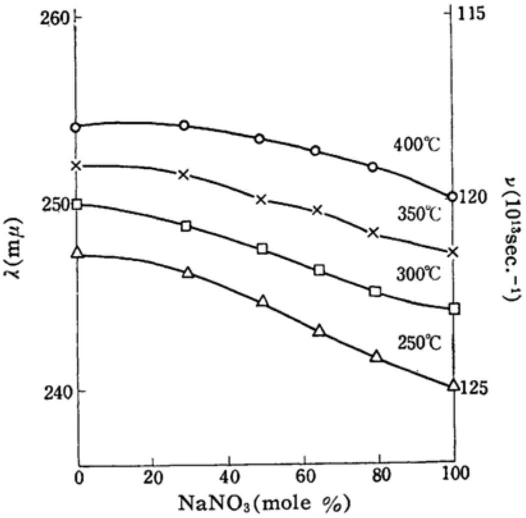

Fig. 1. Isotherms of absorption edges of the $NaNO_2$—$NaNO_3$ system.

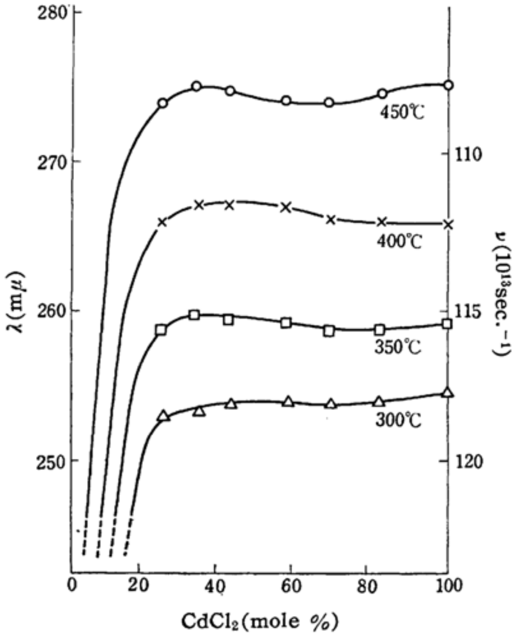

Fig. 2*. Isotherms of absorption edges of the NaCl—$CdCl_2$ system.

---

[1] Y. Shibata, B. Inoue and Y. Nakatsuka, *J. Chem. Soc. Japan, Pure Chem. Sec.* (*Nippon Kagaku Kaishi*), **42**, 983 (1921); Y. Shibata, and B. Inoue, ibid., **43**, 722 (1922).

[2] P. Job, *Compt. rend.*, **180**, 928 (1925); **182**, 1622 (1926); *Ann. chim.*, **9**, 143 (1927).

[3] R. Tsuchida, This Bulletin, **10**, 27 (1936).

[4] K. Sakai, *J. Chem. Soc. Japan, Pure Chem. Sec.* (*Nippon Kagaku Zassi*), **78**, 1108 (1957).

[5] K. Sakai, ibid., **78**, 1257 (1957).

[6] K. Sakai, ibid., **77**, 1731 (1956).

conductance⁷⁾ do not exhibit any appreciable change, i. e., there is no evidence of complex formation. On the other hand, the phase diagram⁸⁾ of the $NaCl$–$CdCl_2$ system shows the formation of one incongruently melting compound $2NaCl\cdot CdCl_2$, and also shows the negative deviation in the neighborhood of 30∼40 mole % cadmium chloride from additivity of electrical conductance⁸⁾, i. e., this system may be considered to exhibit the formation of complex ion $[CdCl_4]^{2-}$.

According to our experimental data shown in Figs. 1 and 2*, the isotherms of absorption edges of the former system show the small deviation from additivity toward longer wave length, but those of the latter system show a large deviation, especially at the neighborhood of 30∼40 mole % cadmium chloride.

This fact shows that in the case of the latter system there is some evidence of complex-ion formation $[CdCl_4]^{2-}$, but not in the former system. In the case of the $NaCl$–$CdCl_2$ system, the deviation of isotherms of absorption edges toward longer wave length is not so distinct as that of the KBr–$CdBr_2$ system⁵⁾ even in the neighborhood of 30∼40 mole % cadmium chloride. This fact may be explained as that the deviation of absorption edges due to the presence of complex ion $[CdCl_4]^{2-}$ is masked by the deviation of absorption edges caused by cadmium chloride which is itself a kind of associated complex⁵⁾.

The author wishes to express his hearty thanks to Professor Ryutaro Tsuchida and Professor Kozo Hirota (Osaka University) for their kind guidance and encouragement throughout this work.

Department of Chemistry
Hitachi Research Laboratory
Hitachi, Ibaragi Prefecture

---

7) H. Bloom, I. W. Knaggs, J. J. Molly and D. Welch, *Trans. Faraday Soc.*, **49**, 1458 (1953).

8) H. Bloom and E. Heymann, *Proc. Roy. Soc. London*, **A188**, 392 (1947).

* Fig. 2 gives no data below 20% cadmium chloride because of the experimental difficulty, i. e., the melting point of samples below 20% cadmium chloride is so high that the cell is occasionally broken and the position of absorption edges of sodium chloride is shifted toward shorter wave length than that of the other component salts of the $NaCl$-$CdCl_2$ system by the previous data (H. Fesefeldt, *Z. Phys.* **64**, 741 (1930).).