BULLETIN OF THE CHEMICAL SOCIETY OF JAPAN, VOL. 48(10), 2999—3000 (1975)

# The Volatilization of Cadmium from Polyvinyl Chloride–Cadmium Mixtures on Heating

Ryoichi TSUNODA

*Industrial Research Institute of Kanagawa Prefecture, Showa-machi, Kanazawa-ku, Yokohama-shi 236*

(Received February 17, 1975)

**Synopsis.** The volatilization of cadmium from a PVC–cadmium stearate mixture on heating was studied by the X-ray diffraction analysis of the products volatilized, which were identified as $CdCl_2$ in air metal Cd and $CdCl_2$ in $N_2$.

In papers dealing with the decomposition of PVC, there have been much discussion of the effects of metal soaps, but no attention has been paid to the volatilization of metal elements from metal soaps in PVC compositions.[1–6)]

About 1.2 mg of cadmium stearate was weighed, sandwich-like, into a platinum sample dish (5 mm $\phi \times$ 5 mm) containing about 40 mg of PVC, mixed well by tapping the bottom and side of the dish lightly, and heated at a heating rate of 5 °C/min in a small electric furnace. The electric furnace, shown in Fig. 1, was a Rigaku Denki Thermoflex, the heating unit of which was employed as the heating apparatus.

The products volatilized after the decomposition of the PVC-cadmium stearate were trapped on the wall of a quartz tube placed in the furnace and were examined by X-ray diffraction analysis by means of an X-ray diffractometer, Rigaku Denki Geigerflex, using Ni filter-CuK$\alpha$ radiation. The residues, heated in platinum sample dishes, were oxidized with sulfuric and nitric acids, and the Cd was determined by atomic absorption spectrometry by means of an atomic absorption spectrometer, Perkin Elmer 403, at a wavelength of 2288 Å.

The percentage of cadmium retained and the X-ray diffraction diagrams of the products volatilized from PVC–cadmium stearate on heating are shown in Figs. 2 and 3 respectively, from which the difference in the volatilization processes of cadmium between that in air and that in nitrogen was observed.

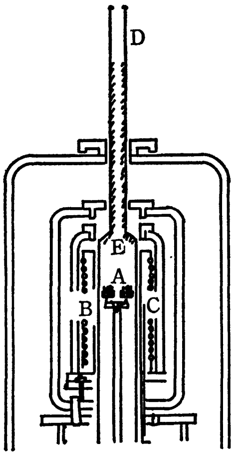

Fig. 1. Electric furnace.
A: Platinum sample dishes, B: heater, C: CA thermocouple, D: Quartz tube, E: Position where volatilized products were trapped.

By the way, the generation of metal chloride by the interaction of metal carboxyrate with pyrolytically eliminated hydrogen chloride was previously reported,[1)] but not that of metal. In order to ascertain the formation and volatilization of metal Cd, the cadmium

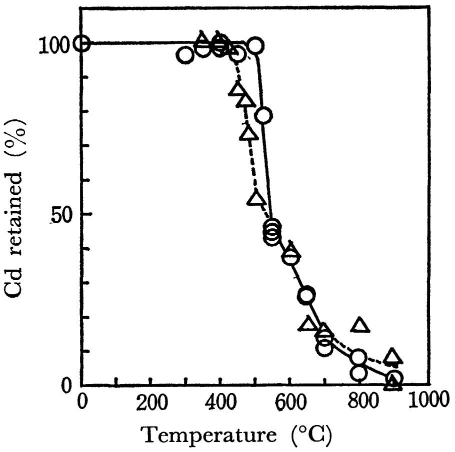

Fig. 2. Percentage of Cd retained in PVC–cadmium stearate on heating.
△: in $N_2$, ○: in air.

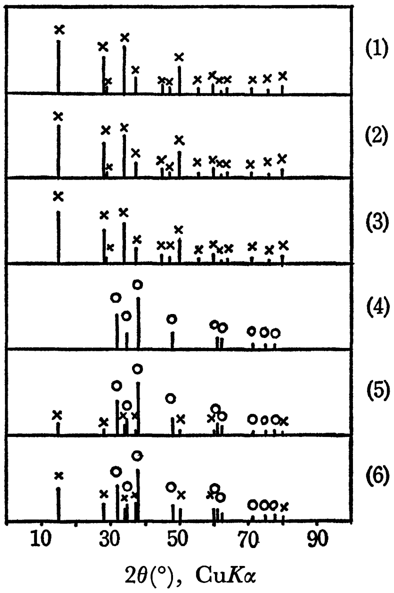

Fig. 3. X-Ray diffraction diagrams of products volatilized from PVC–cadmium stearate on heating up to: (1) 550 °C, (2) 700 °C, (3) 900 °C in air (4) 500 °C, (5) 550 °C, (6) 900 °C in $N_2$
×: $CdCl_2$, ○: Cd.

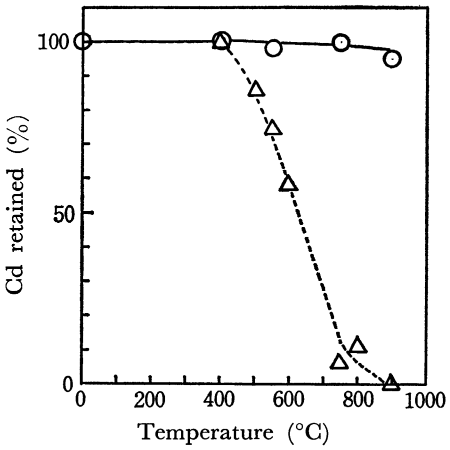

Fig. 4. Percentage of Cd retained on heating of cadmium stearate.
△: in $N_2$, ○: in air.

stearate was heated in $N_2$ or in air and subsequently examined in the same way. This showed the volatilization and existence of metal Cd in the residues heated in $N_2$. The percentage of Cd retained is shown in Fig. 4.

These results show that, in air, the cadmium in PVC–cadmium stearate was volatilized as $CdCl_2$[7] above *ca.* 500 °C, while in nitrogen the cadmium was volatilized as metal Cd[8] above *ca.* 400 °C, and as a mixture of metal Cd and $CdCl_2$ above *ca.* 500 °C.

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