The Effect of Water on the Equilibrium Pressure of Ammonium Carbamate

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In what follows we are concerned with the effect of the initial amount of water on the equilibrium pressure of ammonium carbamate. We discuss this effect in the temperature range only, where the formation of urea is rather large.

There is some discrepancy between the effects observed by various authors. Kawasumi[1] claims that the pressure of ammonium carbamate does not depend of the amount of water included in the initial sample. On the other hand, Krase and Gaddy[2] and independently Błasiak[3] point out, that the pressure increases with the amount of water. We intend to show that this discrepancy does not exist so as in the reality the "water effect" depends strongly on the loading density.

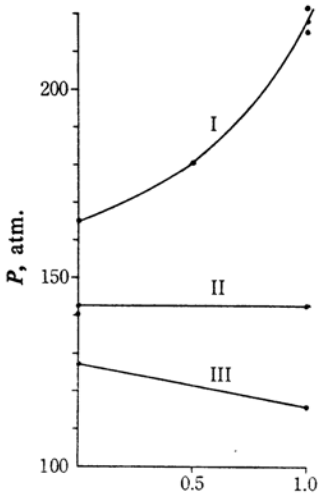

Fig. 1

1) S. Kawasumi, This Bulletin, 26, 218 (1953).
2) N. W. Krase, V. L. Gaddy, *J. Ind. Eng. Chem.*, 14, 611 (1922).
3) E. Błasiak, "Technologia związków azotowych (Technology of Nitrogen Compounds)", Vol. II, Collective Publication, Warsaw, P. W. T. (1956), p. 610.

In the figure we show our results obtained for the system $NH_4CO_2NH_2+wH_2O$ at various loading densities at 181°C. The curves I and III refer to the case $D'=0.92$ g./cm^3 and 0.30 g./cm^3 respectively, the curve II to the case $D=0.60$ g./cm^3.

The symbol D means here the initial loading density of ammonium carbamate and D' means the total loading density including the initial content of water. For a given system D, D' and the molar ratio of water to carbamate w, the equation $D'=D(1+0.2308\,w)$ is satisfied.

We see that curve II agrees with the results given by Kawasumi, $t=160$°C, $D=0.60$ g./cm^3, and that curve I agrees with the results obtained by Błasiak, $t=180$°C, $D'\approx 0.9$ g./cm^3. Krase and Gaddy gave no reference to the loading density.

We note that a similar effect was observed for the urea-water system[4].

The detailed discussion of our results will be published in "Chemia Stosowana".

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4) H. Kinoshita, *Rev. Phys. Chem. Japan*, **21**, 16 (1951).