Note of the Solubility of Calcium Oxide in Sodium Hydroxide and Calcium Chloride.

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DETERMINATIONS have been made of the solubility of freshly ignited calcium oxide in sodium hydroxide and calcium chloride solutions.

There did not appear to be any convenient method of separately estimating free sodium hyroxide and calcium oxide in solution other than by titration of the total alkali present, the calcium oxide being found by difference from the titration figures of the mixed alkali solution and the sodium hydroxide solution. The calcium oxide was added in excess to a quantity of the sodium hydroxide solution, the mixture being frequently shaken throughout the day and then left to stand overnight. A known volume of the filtered solution was titrated with N/2 sulphuric acid. The temperature of saturation was taken as that found just before filtering. In the case of the sodium hydroxide solution the temperature was 13°C. Table 1 gives the data obtained, these being also shown graphically in Fig. 1.

TABLE 1.

Solubility of Calcium Oxide in Sodium Hydroxide Solutions at 13°C.

Sodium Hydroxide.		Calcium Oxide.	
Per cent. by Volume.	Normality.	Grams per litre.	Normality.
5.00	1.250	0.45	0.0160
2.46	0.616	0.16	0.0060
1.61	0.403	0.11	0.0040
1.14	0.285	0.13	0.0045
0.57	0.143	0.28	0.0100
0.30	0.076	0.41	0.0145
0.15	0.037	0.73	0.0260
0.00	—	1.24	0.0445

From Fig. 1 it is seen that a minimum exists in the solubility in about 1.4 per cent. sodium hydroxide (0.35N); the solubility falls rapidly on the addition of small amounts of alkali but increases only slowly after passing the point of least solubility.

In dealing with the calcium chloride solutions the total alkalinity was taken as calcium oxide. For the determination the same

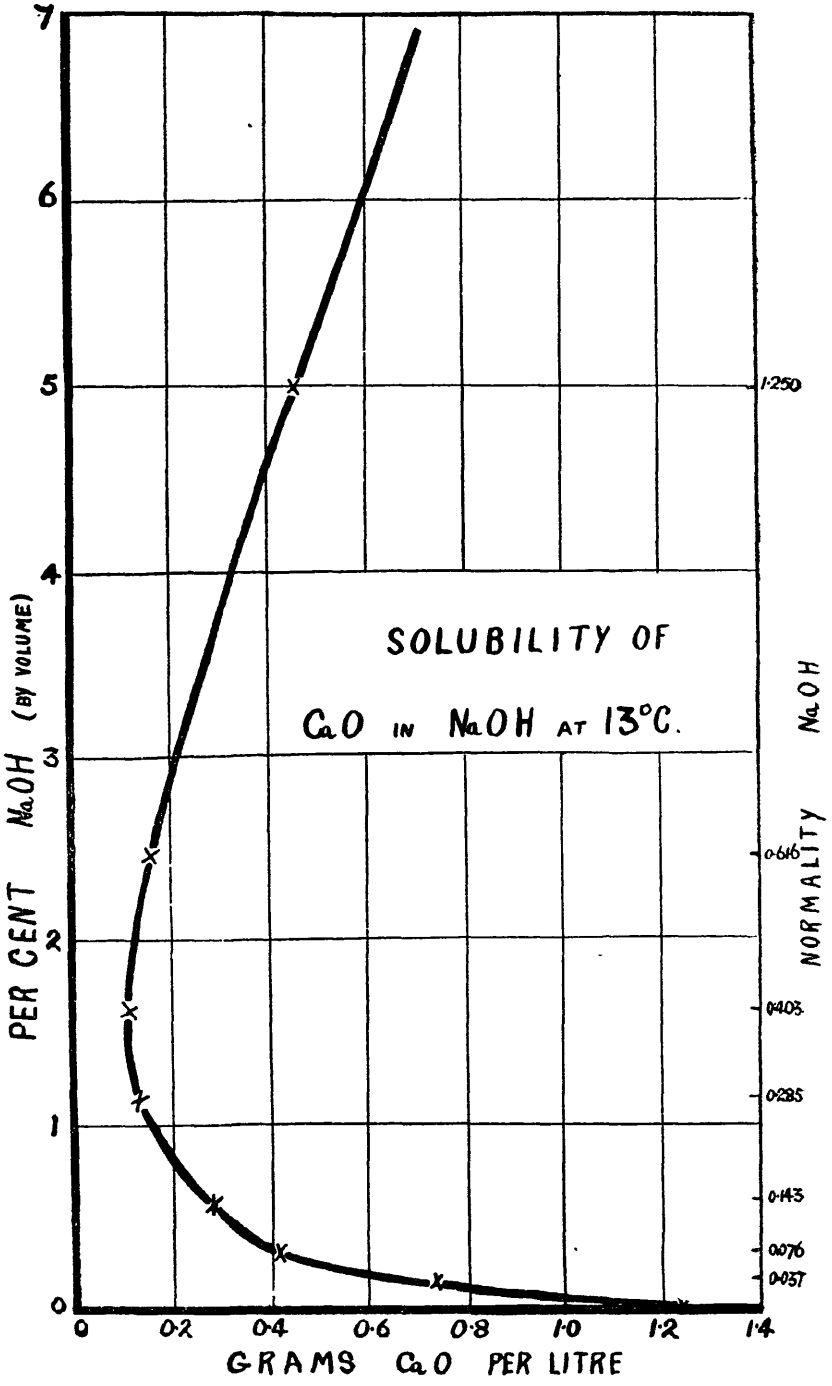
SOLUBILITY OF
CaO IN NaOH AT 13°C.
PER CENT NaOH (BY VOLUME)
NORMALITY NaOH
GRAMS CaO PER LITRE
0
1
2
3
4
5
6
7
0·2
0·4
0·6
0·8
1·0
1·2
1·4
1·250
0·616
0·403
0·285
0·143
0·076
0·057

FIG. 1.

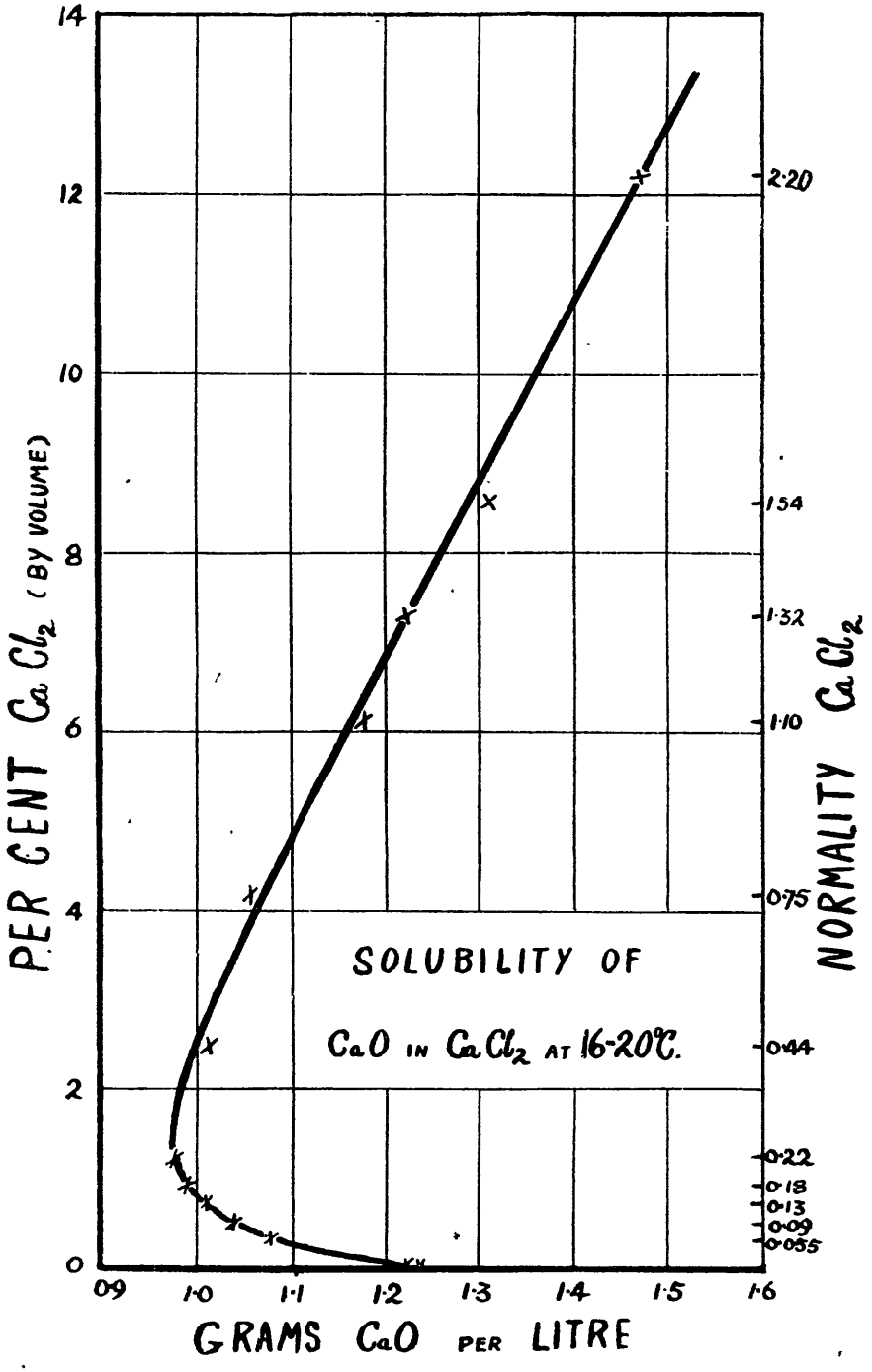
14
12
10
8
6
4
2
0
PER CENT $CaCl_2$ (BY VOLUME)
2·20
1·54
1·32
1·10
0·75
0·44
0·22
0·18
0·13
0·09
0·055
NORMALITY $CaCl_2$
SOLUBILITY OF
CaO IN $CaCl_2$ AT 16-20°C.
0·9
1·0
1·1
1·2
1·3
1·4
1·5
1·6
GRAMS CaO PER LITRE

FIG. 2.

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procedure was employed as with the sodium hydroxide solutions only that an aliquot of the filtered solution was added to an excess of standard acid, the excess acid being then estimated.

In the strong chloride solutions there is some doubt as to the composition of the solid phase, as it has been reported in the literature that an insoluble basic chloride is formed; above a concentration of 6 per cent. calcium chloride it is possible for this compound to be present. No analyses were made in this series of experiments.

The experimental results are given in Table 2, and shown graphically in Fig. 2. The temperature in this series of experiments varied between 16°C and 20°C.

TABLE 2.

Solubility of Calcium Oxide in Calcium Chloride Solutions 16 — 20°C.

Calcium Chloride.		Calcium Oxide.	
Per cent. by Volume.	Normality.	Grams per litre.	Normality.
12.21	2.29	1.47	0.052
8.55	1.54	1.31	0.047
7.32	1.32	1.225	0.044
6.10	1.10	1.18	0.042
4.15	0.75	1.06	0.038
2.44	0.44	1.015	0.036
1.22	0.22	0.98	0.035
0.98	0 18	0.99	0.035
0.73	0.13	1.01	0 036
0 49	0.09	1.04	0.037
0 50	0.055	1.08	0.039
0.00	—	1.24	0.0445

From Fig. 2 it is seen that the solubility curve exhibits a distinct minimum at a concentration of about 1 per cent. (0.19N) calcium chloride.

The data presented here are interesting in that both sets of the data show the existence of a minimum solubility for the calcium oxide. This appears to have been overlooked previously, probably because very dilute solutions do not seem to have been employed for determinations of the solubility.

SUMMARY.

The solubility of calcium oxide in sodium hydroxide and calcium chloride solutions is shown to pass through a minimum value in about 1.4 per cent. (0.35N) and 1.0 per cent. (0.19N) solution respectively.

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