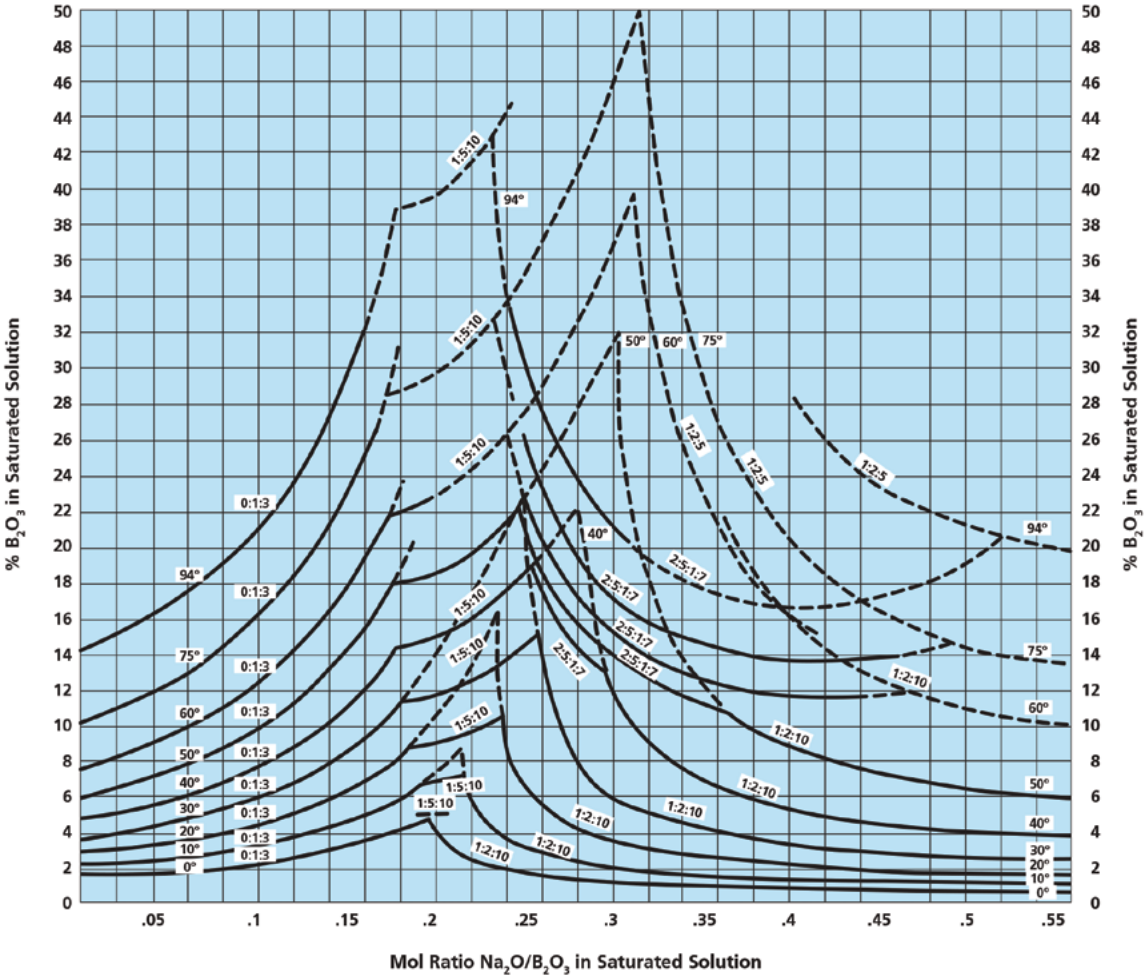
Technical Bulletin

Solubility isotherms in the system Borax - boric acid - water at 0-94°C



Compounds

0:1:3 = H_3BO_3 (boric acid, sassolite)
1:2:5 = $Na_2O \cdot 2B_2O_3 \cdot 5H_2O$ (sodium tetraborate pentahydrate, tincalconite)
1:2:10 = $Na_2O \cdot 2B_2O_3 \cdot 10H_2O$ (sodium tetraborate decahydrate, borax)
1:5:10 = $Na_2O \cdot 5B_2O_3 \cdot 10H_2O$ (sodium pentaborate, sborgite)
2:5.1:7 = $2Na_2O \cdot 5.1B_2O_3 \cdot 7H_2O$ (Suh'rs borate, ezcurrite)

Notes

Broken lines represent compositions of metastable solutions. If such solutions are kept at the indicated temperature for long periods, borates having a somewhat lower solubility, such as the compounds indicated or the 2:9:11, 2:5:5 or 1:2:4 compounds, may crystallize over a period of hours or days. This is more likely to occur at the higher temperatures.

Technical Bulletin

Calculation of Na_2O/B_2O_3 mol ratios

The term "Na_2O/B_2O_3 ratio" means the ratio of the mols of Na_2O to the mols of B_2O_3 present in the material in question.

This may be calculated as follows:

$$\text{mol. ratio } Na_2O/B_2O_3 = \frac{\text{grams } Na_2O}{\text{mol. wt. } Na_2O} \Big/ \frac{\text{grams } B_2O_3}{\text{mol. wt. } B_2O_3} = \frac{\text{grams } Na_2O}{\text{grams } B_2O_3} \times \frac{\text{mol. wt. } B_2O_3}{\text{mol. wt. } Na_2O}$$

$$\text{grams } Na_2O = (\text{Vol. acid})(\text{Normality})(0.03099)$$
$$\text{grams } B_2O_3 = (\text{Vol. acid})(\text{Normality})(0.03482)$$

$$\frac{\text{mol. wt. } B_2O_3}{\text{mol. wt. } Na_2O} = \frac{69.64}{61.99} = 1.123$$

$$\frac{\text{gram } Na_2O}{\text{gram } B_2O_3} \times 1.123 = \frac{Na_2O}{B_2O_3} \text{ mol. ratio}$$

In a specific example of 1.4 grams boric acid to 1 gram *Polybor*® we would have:

$$\text{Boric acid 1.4 grams} = \frac{0.790 \text{ grams } B_2O_3}{\text{zero gram } Na_2O}$$

$$\textit{Polybor}\ 1 \text{ gram} = \frac{0.662 \text{ gram } B_2O_3}{0.147 \text{ gram } Na_2O}$$

$$\frac{B_2O_3}{Na_2O} = \frac{0.147}{0.790 + 0.662} \times 1.123 = 0.114$$

The Na_2O/B_2O_3 mol ratio of this mixture is then 0.114. To check this procedure, one can determine the Na_2O/B_2O_3 ratio of a pure sodium borate.