

# Phase Equilibria and Thermodynamics in the CaO-Al<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> Ternary System in Air

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## ABSTRACT

The CaO-Al<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> ternary system is not well known from the experimental point of view. Two ternary compounds (CaAl<sub>2</sub>B<sub>2</sub>O<sub>7</sub> and CaAlBO<sub>4</sub>) are confirmed. A third ternary compound, the naturally occurring Johachidolite mineral with a nominal chemical composition CaAlB<sub>3</sub>O<sub>7</sub>, could not be reproduced artificially. The only available phase diagram study is the work by Schaefer and Kuzel [Neues Jahrbuch Mineralogische Monatshefte, 131 (1967)]. They established an isothermal section at 800°C in air, synthesized the two ternary compounds and determined their melting behaviour. Experimental work in this system is complicated, because samples show considerable undercooling and glass formation due to the presence of B<sub>2</sub>O<sub>3</sub>. Long annealing times are necessary to establish thermodynamic equilibrium and thermal analysis can only be performed on heating. The CaO-Al<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> ternary system is included in the FTOxid5.3 database as assessed system. The calculated liquidus surface (Fig. 1) shows a very low melting eutectic at 682°C in the lime rich part which seems to be highly unrealistic. The system has apparently been optimised with ternary interaction parameters in the lime-poor part of diagram which strongly impact the equilibria in the other end of the diagram. It has therefore been decided to re-investigate the phase equilibria of this system. An isothermal section at 950°C as well as two T-x sections (Ca<sub>3</sub>Al<sub>2</sub>O<sub>6</sub> – CaB<sub>2</sub>O<sub>4</sub> and CaAl<sub>2</sub>O<sub>4</sub> – CaB<sub>2</sub>O<sub>4</sub>) were studied using standard methods and will be presented. A tentative new thermodynamic modelling using the modified quasi-chemical model was performed in order to better interpret the measured data.

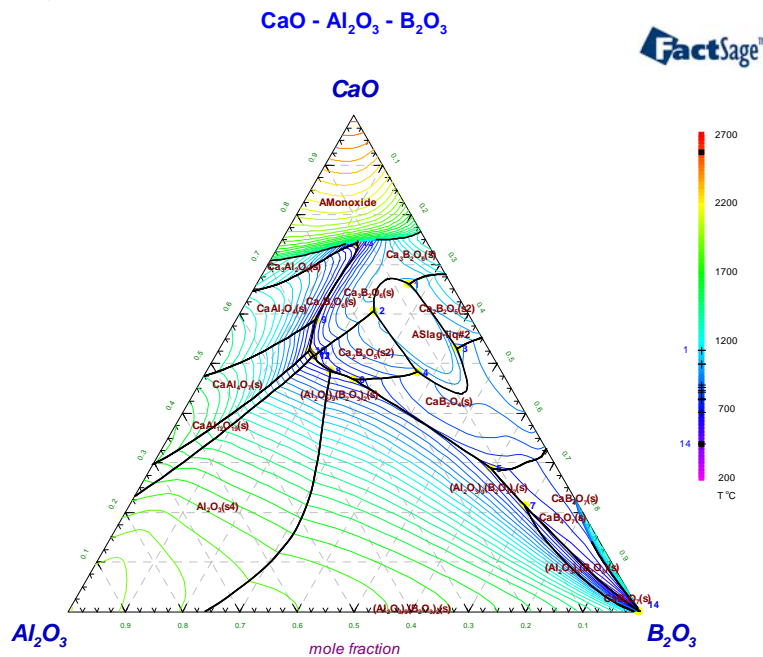


FIG. 1: CALCULATED LIQUIDUS SURFACE OF THE CaO-Al<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> TERNARY SYSTEM USING THE FTOXID5.3 DATABASE