

盐湖硼酸盐化学 XVII. MgO-B<sub>2</sub>O<sub>3</sub>-28%MgCl<sub>2</sub>-H<sub>2</sub>O 体系 20℃ 热力学非平衡态液固相关系研究

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**摘要** 用动力学方法对 MgO-B<sub>2</sub>O<sub>3</sub> 在 28% MgCl<sub>2</sub>-H<sub>2</sub>O 浓盐溶液中形成的过饱和溶液的结晶过程进行研究, 首次得到 MgO-B<sub>2</sub>O<sub>3</sub>-MgCl<sub>2</sub>-H<sub>2</sub>O 体系过饱和区内的液固相关系图, 即热力学非平衡态液固相关系图。该相图有六个相区: H<sub>2</sub>BO<sub>3</sub>, MgO·3B<sub>2</sub>O<sub>3</sub>·7.5H<sub>2</sub>O, MgO·3B<sub>2</sub>O<sub>3</sub>·3.7H<sub>2</sub>O, 2MgO·2B<sub>2</sub>O<sub>3</sub>·MgCl<sub>2</sub>·14H<sub>2</sub>O, 3Mg(OH)<sub>2</sub>·MgCl<sub>2</sub>·2.8H<sub>2</sub>O 和 5Mg(OH)<sub>2</sub>·MgCl<sub>2</sub>·2.8H<sub>2</sub>O。拟合得到各结晶过程的动力学方程, 同时对结晶机制进行了探讨。

**关键词** [水](#) [氧化镁](#) [氯化镁](#) [氧化硼](#) [结晶动力学](#) [相图](#)

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## Chemistry of borate in salt lake brine XVII. study on liquid-solid phase diagram of thermodynamic non-equilibrium of MgO-B<sub>2</sub>O<sub>3</sub>-28%MgCl<sub>2</sub>-H<sub>2</sub>O system at 20℃

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**Abstract** The MgO-B<sub>2</sub>O<sub>3</sub>-28%MgCl<sub>2</sub>-H<sub>2</sub>O supersaturated solutions containing 28% MgCl<sub>2</sub> and different mole ratio MgO:B<sub>2</sub>O<sub>3</sub> were prepared and kept at 20℃. The crystallization processes of Mg borates from the solutions have been studied with the kinetic method. When a solid began to crystallize out for determining their densities, pH values and compositions until the density did not change basically. Finally, the solid phase was separated, washed, dried at room temperature and identified by IR spectra, powder X-ray diffraction, thermal analysis and chemical analysis. With the aid of simplex method and digital integration as well as Runge-Kutta digital solution of differential equation system, we fitted the experimental data and evaluated the kinetic parameters of the chosen models with computer. The crystallization kinetic equations have been given. The calculated results show that when MgO:B<sub>2</sub>O<sub>3</sub> in initial solutions are 1.5:1, 1:2, 1:4, 1:6 and 1:9, the mechanism of crystallization are polynuclear layer controlled growth. When MgO:B<sub>2</sub>O<sub>3</sub> are 3:1 and 2:1, the mechanism of crystallization are mononuclear layer controlled growth. We also discussed the crystallization reaction processes. In this paper, we obtain the liquid-solid phase diagram of supersaturated solutions of MgO-B<sub>2</sub>O<sub>3</sub>-28%MgCl<sub>2</sub>-H<sub>2</sub>O system at 20℃ for the first time and call it a phase diagram of thermodynamic non-equilibrium state. There are six solid phases in the diagram. They are H<sub>2</sub>BO<sub>3</sub>, MgO·3B<sub>2</sub>O<sub>3</sub>·7.5H<sub>2</sub>O, MgO·3B<sub>2</sub>O<sub>3</sub>·3.7H<sub>2</sub>O, 2MgO·2B<sub>2</sub>O<sub>3</sub>·MgCl<sub>2</sub>·14H<sub>2</sub>O, 3Mg(OH)<sub>2</sub>·MgCl<sub>2</sub>·2.8H<sub>2</sub>O and 5Mg(OH)<sub>2</sub>·MgCl<sub>2</sub>·2.8H<sub>2</sub>O respectively.

**Key words** [WATER](#) [MAGNESIUM OXIDE](#) [MAGNESIUM CHLORIDE](#) [BORON OXIDE](#) [CRYSTALLIZATION KINETICS](#) [PHASE DIAGRAM](#)

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