Isopiestic Investigation of the Ternary System ($LiB(OH)_4 + Li_2B_4O_5(OH)_4 + H_2O$)

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Introduction

Lithium borates not only occupy an important position in the modern inorganic salt industry, but also have been widely used in many departments of national economy, national defense industry, high and new technology industry [1]. Salt lake brine resources containing high concentrations of lithium and boron are widely distributed. Studies on the thermochemical properties of lithium borates aqueous solutions in the Qinghai-Tibet Plateau are essential for the comprehensive utilization of salt lake resource.

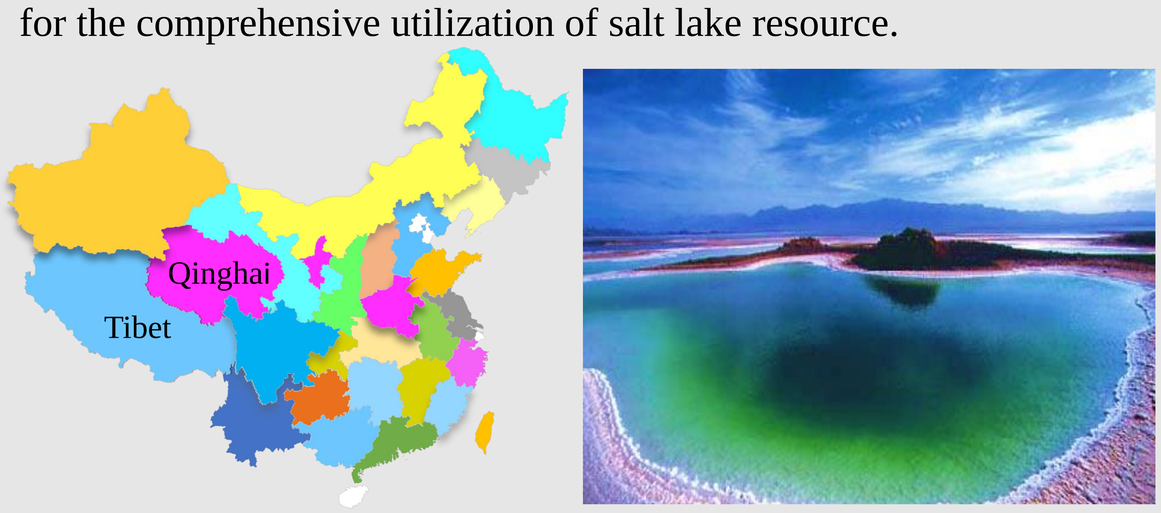
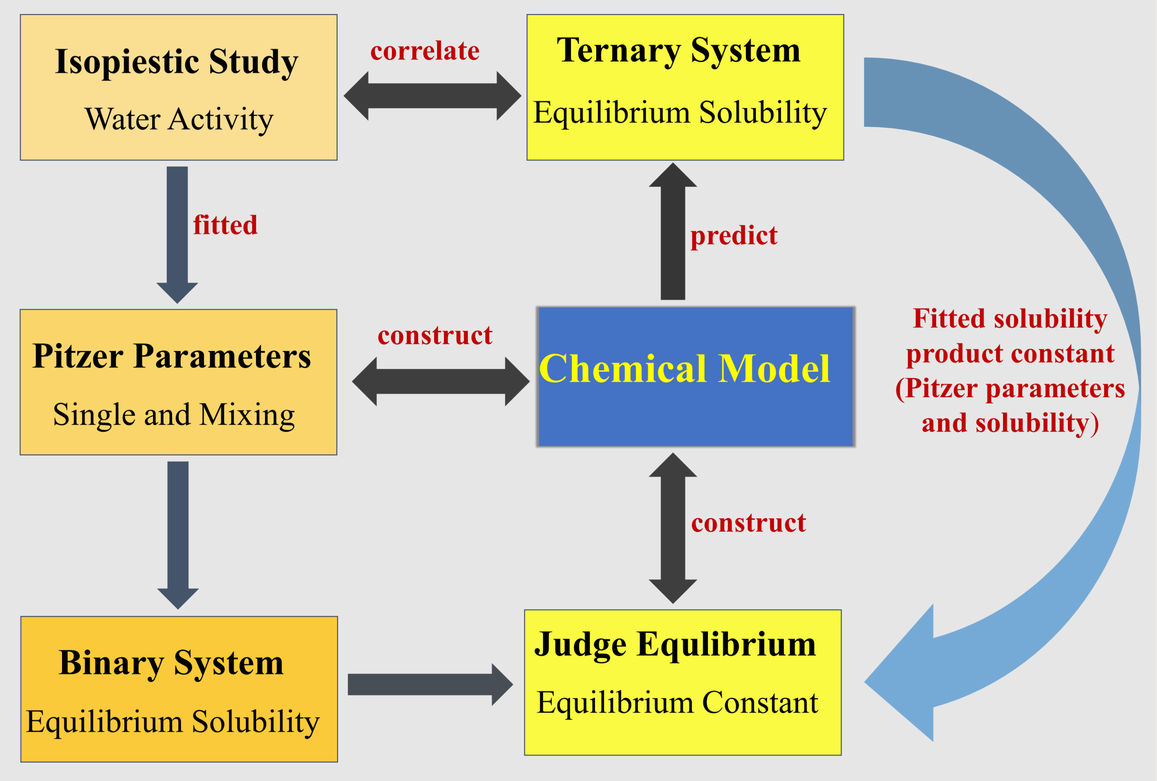


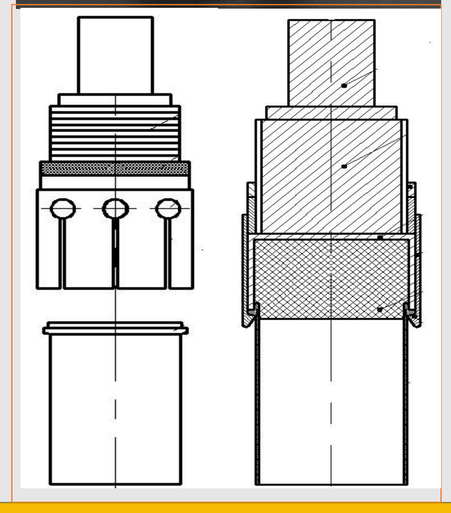
Fig 1. Salt lakes in Qinghai-Tibet Plateau

The isopiestic investigation of aqueous electrolyte solutions plays a very important role in revealing the structural interactions occurring in solution, because they may show us an indirect insight into the conformational feature of the components in solution. Measuring the water activity of lithium borates aqueous solution, and the osmotic coefficients will be calculated by the equation. Meanwhile, some thermal parameters will be obtained.

Experimental Method



Experimental Apparatus



- **Pressure:** 0 ~ 10 bar
- **Precision:** T = 0.01 K
- **Temperature:** 273 .15 ~ 373.15 K

Results and Discussion

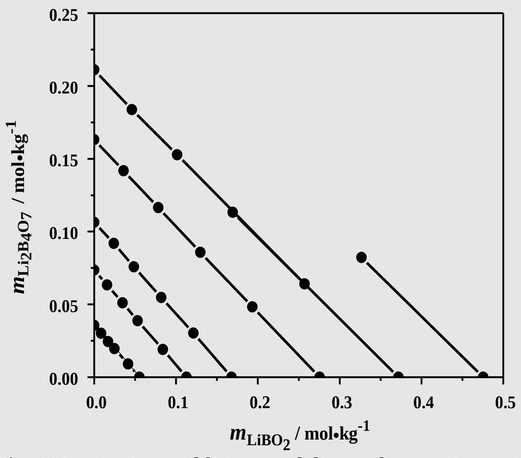


Fig. 2 Isopiestic equilibrium molality and water iso-activity lines of the system ($LiB(OH)_4 + Li_2B_4O_5(OH)_4 + H_2O$) at 288.15 K

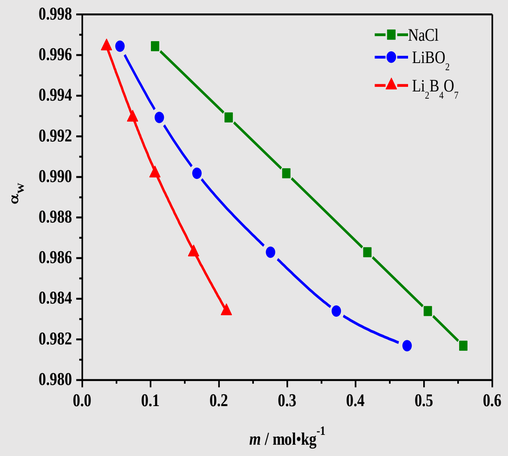


Fig. 3 Relationship of the water activities with equilibrium molalities for the binary systems ($NaCl + H_2O$), ($LiB(OH)_4 + H_2O$) and ($Li_2B_4O_5(OH)_4 + H_2O$) at 288.15 K

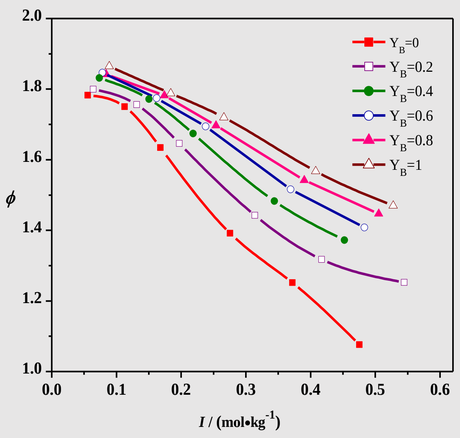


Fig. 4 Plot of osmotic coefficients against ionic strength for the ternary system ($LiB(OH)_4 + Li_2B_4O_5(OH)_4 + H_2O$) at 288.15 K

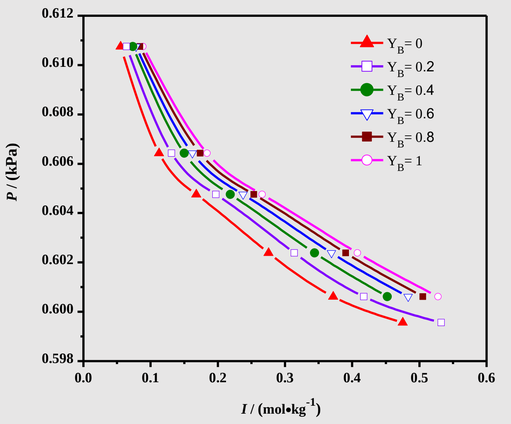


Fig. 5 Plot of osmotic coefficients against ionic strength for the ternary system ($LiB(OH)_4 + Li_2B_4O_5(OH)_4 + H_2O$) at 288.15 K

Conclusion

The water activity, osmotic coefficients and vapor pressure decreases with the increasing of the ionic strength. Applying Pitzer ion-interaction model, the parameters was fitted by the least-square method, meanwhile, the model was constructed, and the water activity was calculated by the fitted parameters, the little deviation showed the model was reliable.

Reference

[1] T.L. Deng, S.Q. Wang, Y.F. Guo. Metastable Phase Equilibria and Phase Diagrams for The Salt Lake Brine System in Qaidam Basin, Beijing: Science Press , 2017.

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