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Solid-liquid Equilibria for the System KBr–K_2SO_4–H_2O at 348 K

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1 Introduction

The underground brine resources distributing widely in Sichuan Basin, China have drawn worldwide attention due to their unusual element abundance and excellent quality. The bittern recently found in the west of Sichuan Basin has high potassium and boron contents, where the potassium and boron concentrations reach up to 53.3 g·L^{-1} and 4994.36 mg·L^{-1}, respectively. Such brines are rare liquid mineral resources in the world, so they have great prospect in exploitation and utilization (Lin et al., 1998; Lin et al., 2008). Multi-temperature phase diagrams are very important for the exploitation of liquid mineral resources (Song, 2000). The ternary system KBr–K_2SO_4–H_2O is a basic subsystem of the underground brines.

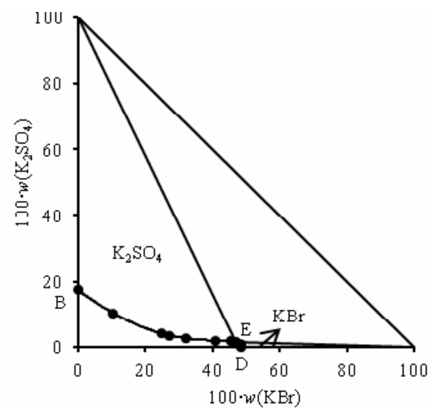

Fig. 1. Equilibrium phase diagram of the ternary system KBr–K_2SO_4–H_2O at 348 K.

2 Results

Solid-liquid equilibria in the ternary system KBr–K_2SO_4–H_2O at 348 K were measured by isothermal solution saturation method. There are one invariant point, two univariant curves and two regions of crystallization in this system. Point labeled as E is the invariant point for the system, and the mass fraction compositions of the corresponding liquid phase is w (KBr) = 0.4675, w (K_2SO_4) = 0.0162. Two univariant curves are BE and DE. The two crystallization regions correspond to the single salts KBr and K_2SO_4. No complex salt and solid solution was found in the ternary system. The crystallization area of K_2SO_4 is larger than KBr, which means that K_2SO_4 has lower solubility in the ternary system KBr–K_2SO_4–H_2O at 348 K.

Key words: Salt-water system, Underground brine, Solubility, potassium, bromine.

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Table 1 Solubilities and densities of solution in the ternary system KBr–K_2SO_4–H_2O at 348 K

No.	Composition of solution w(B)×100		Solid phase
	w(KBr)	w(K_2SO_4)	
1B	0.00	17.25	K_2SO_4
2	10.37	10.45	K_2SO_4
3	24.84	4.25	K_2SO_4
4	27.18	3.44	K_2SO_4
5	31.87	2.71	K_2SO_4
6	40.86	1.92	K_2SO_4
7	45.39	1.72	K_2SO_4
8E	46.75	1.62	K_2SO_4+KBr
9	47.29	1.07	KBr
10	48.12	0.77	KBr
11	48.21	0.76	KBr
12	48.22	0.74	KBr
13	48.33	0.62	KBr
14	48.34	0.56	KBr
15D	48.38	0.00	KBr

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