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论文

$MgSO_4$-K_2SO_4-H_2O三元体系在75 ℃沸腾蒸发非平衡态的成盐特征

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摘要:

采用105 ℃恒温热源, 75 ℃恒温沸腾, 蒸发强度为240～260 g/(h·L)等控制条件, 对$MgSO_4$-K_2SO_4-H_2O体系进行蒸发结晶实验, 研究了该体系在沸腾蒸发条件下的成盐规律, 根据实验现象, 定义并确定了实验条件下的初级成盐区, 扩展成盐区和条件成盐区. 实验结果表明: (1)该体系K_2SO_4, Leonite, langbenite和$MgSO_4·H_2O$等盐能够形成初级晶核的初级成盐区与溶解平衡相区存在明显偏离, 其中K_2SO_4成盐区域缩小, 而Leonite和$MgSO_4·H_2O$结晶区域均有不同程度的增大; (2) 在蒸发结晶过程中, 成盐晶种的存在使该盐的成盐区比初级成盐区有所扩展; (3) 由于成盐区的扩展, 使成盐区域出现不同程度的交错. 在交错区域成盐的种类取决于晶种的种类, 即存在条件成盐区, 这是非平衡态成盐相关系区别于平衡相图和介稳相图的特征区域.

关键词: 相图 沸腾蒸发 非平衡态 成盐特征 $MgSO_4$-Na_2SO_4-H_2O三元体系

Non-equilibrium Behavior of Salt-forming in Boiling Evaporation Process for the System of $MgSO_4$-K_2SO_4-H_2O at 75 ℃

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Abstract:

The behavior of salt-forming under a non-equilibrium status was experimentally determined for the system of $MgSO_4$-K_2SO_4-H_2O during boiling evaporation. The experiments of solution evaporation were carried out at a constant boiling temperature of 75 ℃ by a heating agent with a fixed temperature of 105 ℃. The evaporation intensity used was about 240—260 g/(h·L). The compositions of liquid and solid phase were analyzed at the time when primary nucleation occurs and several points of further evaporation. According to the experimental results the concepts of primary, extend and conditional salt-forming regions were proposed. The experimental results show that: (1) the primary salt forming regions of K2SO4, Leonite, Langbenite and $MgSO_4·H_2O$ were observably different from those in Equilibria Phase Diagram. The width of primary forming region of K_2SO_4 and Langbenite are reduced, and the width of primary forming regions of Leonite and $MgSO_4·H_2O$ are extended in different degrees. (2) Under the condition of having crystal seed, the width of salt-forming region is larger than that of primary salt-forming region in different degrees for different salts. (3) The extend salt forming regions of each salt caused an overlap. In the overlay region, what kind of the salt is formed depending on the seed of crystal. This overlay region is defined as conditional salt forming region, which is a special character in the non-equilibrium state phase diagram, and does not exist in the Equilibria Phase Diagram and Metastable Phase Diagram.

Keywords: Phase diagram Boiling evaporation Non-equilibrium state Behavior of salt-forming $MgSO_4$-K_2SO_4-H_2O system

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