

**PHASE EQUILIBRIA
OF THE SYSTEM $\text{NH}_4^+, \text{K}^+ \parallel \text{SO}_4^{2-}, \text{NO}_3^- - \text{H}_2\text{O}$**

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Nitrates and sulfates of potassium and ammonium are widely used in the chemical industry and agriculture, including the production of fertilizers. Phase diagrams of water – salt systems allows us to reduce the time and material costs in a search for optimal fertilizer composition. Phase composition of a fertilizer affects storage conditions, detonation stability and macronutrient uptake ratios in a soil.

Although data on solubility in all limiting ternary systems ($\text{NH}_4\text{NO}_3 - (\text{NH}_4)_2\text{SO}_4 - \text{H}_2\text{O}$, $\text{K}_2\text{SO}_4 - \text{KNO}_3 - \text{H}_2\text{O}$, $\text{KNO}_3 - \text{NH}_4\text{NO}_3 - \text{H}_2\text{O}$, $\text{K}_2\text{SO}_4 - (\text{NH}_4)_2\text{SO}_4 - \text{H}_2\text{O}$) are available in the literature [1], information about solubility in the reciprocal system $\text{NH}_4^+, \text{K}^+ \parallel \text{SO}_4^{2-}, \text{NO}_3^- - \text{H}_2\text{O}$ at 298.2 K is limited.

Experimental data on solubility of the $\text{NH}_4^+, \text{K}^+ \parallel \text{SO}_4^{2-}, \text{NO}_3^- - \text{H}_2\text{O}$ system were obtained by isothermal solubility method at 298.2 K. The saturated solution was analyzed using classical gravimetry (sulfate ion and water content), flame photometry (potassium content), and potentiometry (ammonium content). Saturated solution compositions form liquidus surface. To verify the obtained results on solubility, the Allan method was used for samples with single solid phase in equilibria with a solution.

Solid phases were separated from a saturated solution, their phase composition was determined by X-ray phase analysis (XRD) using a TongDa TD-3700 diffractometer (China). Phase transition studies in these solid mixtures were carried out on a DSC 204 F1 Phoenix® calorimeter (Germany, NETZSCH) in the temperature range of $-80 - 140^\circ\text{C}$.

Existence of solid solutions requires additional experiment on solidus. Solidus data were obtained by slow evaporation of water from a mixture of a known composition until reaching a dry precipitate at 298.2 K. The resulting solid phase mixtures were analyzed by XRD and DSC.

As a result, a fragment of the liquidus and solidus projection of the $\text{NH}_4^+, \text{K}^+ \parallel \text{SO}_4^{2-}, \text{NO}_3^- - \text{H}_2\text{O}$ system was constructed in Jenneke coordinates at 298.15 K. The stability region of solid solutions based on ammonium nitrate, ammonium sulfate, and the double salts $3\text{AN} \cdot \text{AS}$ and $2\text{AN} \cdot \text{AS}$ was discovered.

1. Kogan V.B. Handbook of solubility, Kogan [In 3 volumes], Vol. 3. Ternary and multicomponent systems formed by inorganic substances L.: Nauka, 1970. 1219 p.

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