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The investigation of uranyl vanadates state in the saturated aqueous solutions

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The state of uranyl vanadates with formula Ak(VUO6)k*nH2O (Ak –elements of the I-III groups of Periodic system) was investigated in aqueous solutions.*
*The study of these compounds are interested because of their low soluble in aqueous solutions and the compounds are likely to form at the contact with the nuclear waste in the environment, therefore Ak(VUO6)k*nH2O can be used to bind uranium. Thereby it is necessary to investigate the state, stability, solubility, conversion of uranyl vanadates in aqueous solutions.
It is shown that pH has the most significant impact on the state of uranyl vanadates in heterogeneous water-salt systems. The pH of the aqueous solution defines the range pH of uranium existence, the type and solubility of the secondary phases. On the whole, it was established that uranyl vanadates are inconvertible at the contact with the aqueous solutions in the wide acid-base range. Their structure and composition preserve in heterogeneous water-salt systems at pH from 1-2 to 11-12. Out of the pointed interval the structure of uranyl vanadates destructs and compounds with another composition and structure form and are in the equilibrium to the aqueous solution. A type of formed compounds depends on pH. In acidic media at pH ≤ 1-2 initial compounds convert into the amorphous V2O5. At pH > 11-12 the equilibrium solid do not contain Ak(VUO6)k*nH2O and consist of the Ak(OH)2 and Na2U2O7 mixture.*
*The solubility products were calculated using the solubility data of the system for the pH intervals, where uranyl vanadates saved their composition and structure. The type of interlayer atom do not significant influence on the solubility of compounds. The solubility of Ak(VUO6)k*nH2O has been determined, it changes on the several orders from 10-6 –10-8M in the subalkali solutions to 10-2 - 10-3M in the acid and the strongly alkaline media. It was established that the solubility products values for all investigated compounds decrease according to the interlayer atoms radius increasing. The solubility products allow to calculate the thermodynamic functions of the heterogeneous system components, to plot speciation diagrams of uranium (VI) and vanadium (V) in the aqueous solution and solid phases. The solid phase and aqueous solutions diagrams and solubility curves of uranyl vanadates at the range pH 0-14 were plotted. This research makes it possible to use experimental data to solve practical problems, and allows to obtain the important information about the state of the saturated aqueous solutions and the secondary phases of studied heterogeneous systems in the isobaric-isothermal conditions.

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