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# THERMOLYSIS OF THE TRANSITION DIVALENT METAL AQUA AMMINE MONOPHOSPHATES AS A METHOD FOR PRODUCING OF NEW MATERIALS

**V.A. Kopilevich, L.V. Voitenko, D.A. Savchenko, N.M. Prokopchuk**
**National University of Life and Environmental Sciences of Ukraine**

Processes of phosphates dehydrating are the important part of the separate steps for the producing of the chemicals, mineral fertilizers, phosphors, pigments, catalysts, special-property cements and glasses, ferroelectrics, and other materials of the up-to-date technique.

The overall goal of this study is to compare the possibilities of the traditional thermal analysis and thermogravimetry for the production of extra pure individual phosphates by the thermolysis of their mixed-cation aqua ammine coordination compounds.

The suggested methodology for detecting of the phosphate chemical transformation content includes i) the differential thermal analysis of the bivalent Co, Ni, Cu, Zn, and Cd aqua ammine phosphates at a heating rate $2.5 \div 5$ deg·min$^{-1}$ in capped platinum crucibles in the DTA/TGA feature points; ii) sampling of the thermolysis intermediates heated to these characteristic temperatures; iii) analysis of the obtained thermolysis intermediates by chemical elemental analysis, X-ray, IR, and the qualitative paper chromatography.

The objects of research were compounds bring the different types of mono-, double and mixed-cation aqua ammine monophosphates.

Comparability of the thermal transformation block diagrams obtained for Cu(II), Zn, Co(II), Ni(II), and Cd aqua ammine monophosphates complexes enables to conclude that their thermal transformation mechanisms as a whole are similar to the processes of water removing of the corresponded bivalent metal hydrated neutral phosphates. It is characterized by the multi-stage elimination of ammonia and water from aqua ammine monophosphate complex compounds which ends by the formation of the final products – neutral phosphates. The temperature intervals of the ending crystallization are a slightly higher or identical to the ones comparing to the processes of the similar product formation through the hydrated phosphates dehydration. There takes place the neutral phosphate intramolecular hydrolysis of a cation and an anion during thermolysis process, that accompanied by the polycondensation of monophosphate anion with its different conversion degree.

It was diagrammatized the thermal transformations of double complex salts - Cu(II), Zn, Co(II), Ni(II), and Cd aqua ammine monophosphates. Basing on it, we concluded, that their thermolysis mechanism in general is close to the dehydration processes of monocation aqua ammine phosphates.

The main regularities of the examined processes are:

i) In the most cases, thermolysis of double aqua ammine phosphates independently of their cation composition ends with the formation of the double monophosphates having stoichiometric cations ratio equal to initial composition;

ii) Thermolysis process is that of $NH_3$ and $H_2O$ step-by-step removing form aqua ammine monophosphates complexes;

iii) The temperature of the final product crystallization (neutral phosphates) depends on the cation composition of the calcined substance.

Analysis of the thermal transformation block diagrams for triple complex aqua ammine Cu(II), Zn, Co(II), Ni(II), and Cd monophosphates shows that the mechanism of their thermolysis is similar in whole to the dehydration processes of double aqua ammine monophosphates. It may be characterized by the next trends:

i) In the most cases, the thermolysis of triple aqua ammine phosphates ends by either the formation the triple monophosphates having stoichiometric cations ratio equal to initial composition, or the formation of double monophosphates mixture where one of three metals was included in composition of both components;

ii) The depth of monophosphate anion condensation in the thermolysis process depends of cation composition of aqua ammine monophosphates complex and, as a result of this one, intensity of donor-acceptor interaction between d-metal cations and ammine and aqua ligands.

Finally, it was investigated the composition and properties of obtained calcined compounds because their structure determines their technical properties.