Investigating the influence of the trivalent and monovalent metals ionic radius on the structure of the synthesized double condensed phosphates

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The purpose of the work was to produce new condensed phosphates with a structure of double inorganic oligomers, cyclic compounds and long chain polymeric composites via condensation of polyphosphoric acids and to reveal the effect of the trivalent and monovalent metal ionic radius on the structure of the product. High temperature synthesis (100-600 °C) was used to produce multi-component phosphates of the general formula $M^{I}_2O-M^{III}_2O_3-P_2O_5-H_2O$ (where M^{I} – Ag and alkali metals, M^{III} – Al, Ga, In and Sc).

Over the last few years, numerous researchers have been paying serious attention to the careful synthesis and investigation of condensed phosphates – so called inorganic polymers. This was possible afterward remarkable development of different fields of new technologies, as well as expanding the research area of nanotechnology and fundamental general researches. By analyzing the crystallization conditions and properties of polymers, the synthesis of new inorganic polymers with targeted properties will be possible, as well as identification of the optimal regimes for formation of mono-crystals and in some cases of nano-composites [1].

Phase composition and the structure of the phosphates obtained were defined. It was found that the stability of highly condensed phosphates of the type $M^{I}M^{III}(PO_3)_4$ and $M^{III}P_5O_{14}$, and the stability of oligophosphates decreases with an increase in the radius of the M^{III} cation. Concerning alkali metals, it was revealed that generally, Li forms long-chain double polyphosphates, Na forms tetraphosphates, K and Rb generate cyclooctaphosphates. Most characteristic feature of cesium is the formation of highly condensed forms such as cyclododecaphosphates [2, 3]. We determined that some inorganic oligomers and polymers can be used in practice as new technological materials, such as binders and cementing compounds, fertilizers, ion exchangers and substances with catalytic activity.

References

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