# SYNTHESIS, PROPERTIES AND STRUCTURE OF INORGANIC COMPOUNDS

## Synthesis and characterization of ammonium-vanadium(III) double cyclophosphates $(NH_4)_2V_2P_8O_{24}$ and $(NH_4)_3V_3P_{12}O_{36}$

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This work continues our systematic research on ammonium-metal(III) double condensed phosphates, which are potential fire retardants for polymeric materials [1]. The aim of this work was to synthesize and characterize ammonium-vanadium(III) double cyclophosphates $(NH_4)_2V_2P_8O_{24}$ and $(NH_4)_3V_3P_{12}O_{36}$. Double cyclooctaphosphate $(NH_4)_2V_2P_8O_{24}$ has been synthesized in the system V–$NH_4PO_3$ at the temperature of 300 ºC and at the molar ratio V : P = 1 : 12. X-ray studies have been performed for powder sample of compound: monoclinic system, S.G. *I*2/*m*, *a* = 16,6604(12), *b* = 12,4435(15), *c* = 5,2205(8) Å; β = 95,518(8), *V* = 1077,28 Å$^3$, *Z* = 2.

Double cyclododecaphosphate $(NH_4)_3V_3P_{12}O_{36}$ has been synthesized in the system $V(H_2PO_4)_3$–$NH_4PO_3$ at 350 ºC and at the molar ratio V : P = 1 : 15.

Main crystallographic data for $(NH_4)_3V_3P_{12}O_{36}$ have been calculated: cubic system, S.G. *Pa*-3, *a* = 14,38841(77) Å; *V* = 2978,78 Å$^3$, *Z* = 4.

A comparison of main crystallographic data of $(NH_4)_2V_2P_8O_{24}$ and $(NH_4)_3V_3P_{12}O_{36}$ with those of $(M^I)_2(M^{III})_2P_8O_{24}$ and $(M^I)_3(M^{III})_3P_{12}O_{36}$ ($M^I$ – monovalent cation, $M^{III}$ – trivalent cation) indicates that they are isotypical, respectively [2–4]. Thermal behavior of the compound has been investigated within the temperature range of 30–1000°C. It was found that both $(NH_4)_2V_2P_8O_{24}$ and $(NH_4)_3V_3P_{12}O_{36}$ demonstrated high thermal stability. They start to decompose at the temperature of about 500 °C. Final crystal products of thermal decomposition of the compounds are $V_4(P_4O_{12})_3$ and/or $V(PO_3)_3$–*C*.

The data obtained allow to conclude that cyclooctaphosphate $(NH_4)_2V_2P_8O_{24}$ as well as cyclododecaphosphate $(NH_4)_3V_3P_{12}O_{36}$ having high chemical and thermal stability may used as fire retardant additives to thermoplastics [5].

**References**

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