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Phosphorus, Sulfur, and Silicon and the Related Elements

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713618290>

Synthesis and Properties of Inorganic Triphosphate Crystal Hydrates

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To cite this Article Prodan, E. A. , Pytlev, S. I. , Galkova, T. N. , Sotnikova-yuzhik, V. A. and Patrovskaya, L. I.(1990) 'Synthesis and Properties of Inorganic Triphosphate Crystal Hydrates', *Phosphorus, Sulfur, and Silicon and the Related Elements*, 51: 1, 451

To link to this Article: DOI: 10.1080/10426509008040975

URL: <http://dx.doi.org/10.1080/10426509008040975>

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SYNTHESIS AND PROPERTIES OF INORGANIC TRIPHOSPHATE CRYSTAL HYDRATES

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The polycrystalline samples and single crystals of crystal hydrates of inorganic triphosphates with ring-like and chain-like anion structured were synthesized: lithium and sodium cyclotriphosphates, sodium and ammonium chain triphosphates, and double salts of chain triphosphoric acid (ammonium-potassium, ammonium-magnesium, ammonium-manganese). The crystallization field of the double salt of variable composition $(\text{NH}_4, \text{K})_3\text{H}_2\text{P}_3\text{O}_{10} \cdot x\text{H}_2\text{O}$ ($\text{NH}_4:\text{K}=0.23-3.60$; $x=0.8-1.5$) from aqueous solutions was established. Synthesis of $\text{Na}_5\text{P}_3\text{O}_{10} \cdot 6\text{D}_2\text{O}$ crystals has been performed by the interaction of the high temperature form $\text{Na}_5\text{P}_3\text{O}_{10}$ (I) with D_2O . At 20°C and relative humidity $\text{RH}<70-80\%$ the $(\text{NH}_4)_5\text{P}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$ crystals lose their transparency and generate different crystalline products depending on RH value: $(\text{NH}_4)_5\text{P}_3\text{O}_{10}$ at $\text{RH}=0\%$ or $(\text{NH}_4)_5\text{P}_3\text{O}_{10} \cdot \text{H}_2\text{O}$ at $\text{RH}=32\%$. The $(\text{NH}_4)_5\text{P}_3\text{O}_{10} \cdot \text{H}_2\text{O}$ crystals are stable at $\text{RH}<60-70\%$, at $\text{RH}=80\%$ they absorb water and transform into $(\text{NH}_4)_5\text{P}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$. In the latter case a characteristic picture is registered: on active sites situated on the $(\text{NH}_4)_5\text{P}_3\text{O}_{10} \cdot \text{H}_2\text{O}$ crystal face the appearance and epitaxial growth of $(\text{NH}_4)_5\text{P}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$ crystals is observed. For some single crystals the character of dehydration localization has been shown to correlate with space arrangement of phosphate groups in crystal structure. On the basis of the obtained results a model of dehydration front propagation in crystals has been suggested.