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Reaction Mechanism in the Mixtures of Calcium Polyphosphate with Apatite and Accompanying Minerals on Heating

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On obtaining defluorinated feeding phosphates from Kovdor apatite the system of $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_{1,4}\text{F}_{0,6}-\text{CaCO}_3-(\text{Ca},\text{Mg})\text{CO}_3-\text{Mg}_2\text{SiO}_4-\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}-\text{Mg}(\text{H}_2\text{PO}_4)_2 \cdot x\text{H}_2\text{O}$ with mole correlation $(\text{CaO}+\text{MgO})/\text{P}_2\text{O}_5=3$ is subjected to thermal treatment. On heating up to 500°C calcium and magnesium hydrophosphates turn into polyphosphates $\text{M}(\text{PO}_3)_2$ which in accordance with the increase of the temperature react with other components of the system. To establish the mechanism and conditions for reactions, thermal interactions in the mixtures of $\text{Ca}(\text{PO}_3)_2$ and $\text{Ca}_2\text{P}_2\text{O}_7$ with apatite, phorsterite, dolomite and calcite when $(\text{CaO}+\text{MgO})/\text{P}_2\text{O}_5=3$ have been investigated. Methods of chemical, thermal, chromatographic, X-ray and IR-spectroscopy analysis were used.

It has been established that on heating these mixtures to more than 600°C a gradual lowering of the content of polyphosphates ($n \geq 3$) and formation of $\text{Ca}_2\text{P}_2\text{O}_7$ and CaMgP_2O_7 take place. At $850-1100^\circ\text{C}$ depending on the kind of the second component, the content of polyphosphates approaches to zero and accordingly the quantity of $\text{Ca}_3(\text{PO}_4)_2$ and $(\text{Ca},\text{Mg})_3(\text{PO}_4)_2$ increases. In succession of interaction with $\text{Ca}(\text{PO}_3)_2$ in accordance with the increase of the temperature these components are arranged in the following way: dolomite-calcite-phorsterite-apatite. Since the speeds of decomposing the carbonates and the binding of formed oxides differ CaO and MgO are present in the mixtures in the intermediate stadium of heating. In the mixture with phorsterite amorphous SiO_2 is formed.

Due to the presence of carbonates and phorsterite in Kovdor apatite $\text{Ca}(\text{PO}_3)_2$ goes to a considerable extent for reacting on them and not with apatite. That is why defluorination of latter is shifted in the direction of higher temperatures.