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PROCESS OF PREPARING POLYPHOSPHATES AND POLYPHOSPHATE MIXTURES

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This invention relates to a new process of preparing polyphosphates and polyphosphate mixtures, characterized by heating the initial components to temperatures essentially beyond the melting temperature with subsequent sudden cooling.

It is well known that polyphosphate of the composition of $Na_5P_3O_{10}$ is forming by slowly cooling adequate melts. Moreover, it can be obtained, among other polymeric phosphates, as described in literature by Gmelin (Handbuch der anorganischen Chemie, 8th edition, volume 21) by heating $Na_3HP_2O_7$ up to 300° C.

The above method, however, is not applicable in industrial preparation (manufacturing on a large scale), where pure polyphosphates of homogeneous character must be obtained in good yields. Therefore different propositions for the manufacture of polyphosphates have been made, partly trying to solve the problem in that manner, that according to the principle of slow cooling they provide a period of tempering of about 5 hours, and partly following the method known from literature, according to which transformation of pyrophosphate into tripolyphosphate is effected by starting from the lower limit of temperature—that is by heating pyrophosphate to 300° C.

The mentioned methods are all not practical and not economical, since they comprise several processes, require complicated apparatus, and above all absorb much heat for tempering. Besides, if good yields shall be realized, continuous working is rendered very difficult, because in this case very long tempering is necessary.

All these processes base on the principle of displacing by tempering the equilibrium of the melting components below the melting point in favour of tripolyphosphate.

We have found another way, being essentially more economical and delivering polymeric phosphates in a better yield. This way comprises heating the melting mass considerably over the melting point, viz. to temperatures situated at least 150° or more beyond the melting point of the reacting mass, and suddenly cooling the molten mass. If for example a mixture of 1 gramme-molecule of metaphosphate and 1 gramme-molecule of pyrophosphate is smelting at 600° C, the reacting components have to be heated to 750° C or 1050° C with immediate cooling to 500° C. In this way are—contrary to the known methods—in a single process always obtained from a melting mass of certain stoichiometrical composition homogeneous polymeric phosphates, having—according to the proportion of the initial components—either homogeneous character, or representing mixtures of different polymeric phosphates. The products forming according to the present invention have an excellent calcium-binding power; they are completely water-soluble, and can without any difficulty be manufactured continually, as tempering now is superfluous.

Example 1.—306 g of sodium metaphosphate and 266 g of sodium pyrophosphate are mixed and heated up to 750° C. Then the molten mass is rapidly cooled by sprinkling or by passing it in a thin layer upon cooling rollers, the speed of rotation being chosen so that the reacting bodies are cooled below 500° C within a few seconds. Thus, an amorphous powder with excellent lime-binding and lime-dissolving power is obtained, the composition of which corresponds to that of sodium pentapolyphosphate.

An especially advantageous form of execution of the present process in the case of low-polymeric phosphates, such as tripolyphosphate, consists in suddenly cooling the molten mass from 1050°C to about 610°C only, and then interrupting cooling, so that the temperature range from 610°C to 550°C is passed slowly. While, when cooling the mass below 500°C, products are forming, the lime-binding power of which corresponds to 88% of $Na_5P_3O_{10}$ and about 3% of $(NaPO_3)_6$, the yield of $Na_5P_3O_{10}$ is raised to about 100%, if cooling time is regulated so that for passing the range from 610°C to 550°C 10 minutes are necessitated.

Example 2.—100 parts of weight of sodium metaphosphate and 260 parts of weight of sodium pyrophosphate are molten in the electric furnace at 1050°C until equilibrium is reached, whereupon the mass is suddenly cooled to about 600°C or 620°C by means of cooling rollers or in a similar way. Then cooling is interrupted and the mass, in layers of 2 cm of thickness, is left to itself. The so-gained product is completely water-soluble and has an excellent calcium-binding power.

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