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REDUCTION OF PHOSPHATIC MATERIALS

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The present invention relates to the reduction of phosphatic materials for the production of phosphorus or phosphoric acid.

The object of the invention is to provide a method of producing a more readily reducible phosphatic material than has heretofore been obtained, suitable for conversion into elemental phosphorus or phosphoric acid.

Another object is to provide a material the phosphate content of which can be reduced to phosphorus more cheaply than has heretofore been possible.

A still further object is to bring about this reduction into elemental phosphorus more quickly and completely than heretofore by providing an intimate contact between the phosphoric material and the reducing agent.

It is well known that in order to efficiently reduce the P_2O_5 content of phosphoric materials to elemental phosphorus it is necessary to bring the phosphatic mineral into contact with elemental carbon at an elevated temperature. The mixing of phosphate rock and silica with relatively large lumps of coke obviously does not bring about the desired intimate contact between the ore and reducing agent and if these materials are used in finely divided form smooth furnace operation is practically impossible and so much dust is carried over in the gases that the gas mains or the auxiliary furnace equipment often become partially clogged and the product seriously contaminated.

To avoid these disadvantages it has been proposed to briquet a mixture of phosphate rock, silica and carbonaceous material and to use such briquets as a furnace charge, but the cost of drying, grinding, mixing and the binder required to produce a briquet capable of being handled without dusting or breakage is such as to render such a charge relatively costly.

We have found that a phosphate charge in even better condition for reduction than briquets may be obtained by sintering the phosphate pebbles or run-of-mine material or débris from the phosphate washers or a mixture of these materials with sufficient silica for subsequent fluxing purposes and incorporating in said sinter enough carbonaceous material to bring about a substantial reduction of its P_2O_5 content.

Not only is the porous nature of the sinter such as to make its ready impregnation with carbon relatively easy but the free movement of the gases through the porous sinter makes it possible to drive off the reduced phosphorus relatively quickly and completely.

The term "impregnate" as used herein is intended to mean the incorporation of carbonaceous material in the interstices of the sintered phosphatic material.

The sinter may be impregnated with carbonaceous material in a variety of ways, all of which are included within the scope of the invention. Among the methods of effecting the impregnation are:

(1) Sprinkling the phosphate sinter with coke braize after the sintering process has been practically completed, the braize being added to the sinter either in dry form or as a suspension in the water used for quenching the sinter.

(2) Admixing finely divided bituminous coal with the sinter while it is still sufficiently hot to coke the coal within the mass.

(3) Spraying oil, tar or other liquid hydrocarbon into the sinter while the latter is still sufficiently hot to drive off or decompose the gaseous or liquid hydrocarbons so that little or no volatile material remains and a substantially dry product is produced.

(4) Drawing or forcing volatile hydrocarbons through a column or mass of the hot sintered product, thereby causing the decomposition of the hydrocarbons and deposition of carbon in the pores or body of the sinter.

In order to illustrate the invention, the following example is given, wherein the impregnation of the sinter is effected by quenching with a suspension of coke braize:

The hot sintered product is discharged from the sintering apparatus onto a chute and a suspension of coke braize in water is allowed to flow over the spillway of a mixing tank suspended above the upper end of the chute in such a manner that the suspension is substantially uniformly distributed over the hot sinter coming from the sintering machine. The concentration of coke in the

suspension and the rate of flow of the slurry onto the hot sinter are preferably so adjusted that the quenched sinter will contain in the neighborhood of 10% of fixed carbon. The amount of carbon with which the sinter is impregnated may, of course, be widely varied according to the amount of phosphorus pentoxide in the sinter, variations in the reduction process used, and other variations in operating conditions.

The production of phosphorus from the carbon impregnated material produced as described above, or in any other suitable way, may be effected by charging the impregnated sinter into a furnace of the blast furnace type either with or without the addition of further coke or other carbonaceous material. The reduction may also be advantageously effected in an electric furnace or in a furnace combining the features of an electric furnace and a blast furnace. Of course in a furnace of the blast furnace type, the temperature necessary for the reduction of the phosphatic charge is obtained by the combustion of excess carbonaceous material in the charge, while in an electric furnace the necessary heat is supplied by means of electrical energy.

The phosphorus-laden gases coming from the furnace may be oxidized for the production of phosphoric acid or the phosphorus may be separated from the gases in the elemental form.

It will be seen that the present invention includes a process for the reduction of phosphatic material which comprises sintering phosphatic material, impregnating the sinter with carbonaceous material and subjecting the impregnated sinter to a temperature at which reduction of the phosphatic material to phosphorus takes place; and a new composition of matter suitable for the production of phosphorus comprising a sintered phosphatic material impregnated with a carbonaceous material.

We claim:

1. A process for the production of phosphorus comprising subjecting phosphatic material to a sintering operation, impregnating the sinter with carbonaceous material, and subjecting the impregnated material to a temperature at which reduction of the phosphatic material to phosphorus will take place.

2. A process for the production of phosphorus comprising subjecting silicious phosphatic material to a sintering operation, impregnating the sinter with carbonaceous material, and subjecting the impregnated material to a temperature at which reduction of the phosphatic material to phosphorus will take place.

3. A process for the production of phosphorus comprising subjecting silicious phosphatic material to a sintering operation, impregnating the sinter with carbonaceous material by contacting the hot sinter with carbonaceous material, and subjecting the impregnated material to a temperature at which reduction of the phosphatic material to phosphorus will take place.

4. A process for the production of phosphorus comprising subjecting silicious phosphatic material to a sintering operation, impregnating the sinter with carbonaceous material by contacting the hot sinter with coke braize, and subjecting the impregnated material to a temperature at which reduction of the phosphatic material to phosphorus will take place.

5. A process for the production of phosphorus comprising subjecting silicious phosphatic material to a sintering operation, impregnating the sinter with carbonaceous material by quenching the hot sinter with an aqueous suspension of coke braize, and subjecting the impregnated material to a temperature at which reduction of the phosphatic material to phosphorus will take place.

6. A process for making a product suitable for the production of phosphorus comprising impregnating sintered phosphatic materail with carbonaceous material.

7. A process for making a product suitable for the production of phosphorus comprising impregnating sintered silicious phosphatic material with carbonaceous material.

8. A process for making a product suitable for the production of phosphorus comprising impregnating sintered silicious phosphatic material with carbonaceous material by contacting the sinter while hot with a carbonaceous material.

9. A process for making a product suitable for the production of phosphorus comprising impregnating sintered silicious phosphatic material with carbonaceous material by contacting the sinter while hot with coke braize.

10. A process for making a product suitable for the production of phosphorus comprising impregnating sintered silicious phosphatic material with carbonaceous material by quenching the sinter while hot with an aqueous suspension of coke braize.

11. A composition of matter suitable for the production of phosphorus comprising sintered phosphatic material impregnated with carbonaceous material.

12. A composition of matter suitable for the production of phosphorus comprising silicious sintered phosphatic material impregnated with carbonaceous material.

13. A composition of matter suitable for the production of phosphorus comprising silicious sintered phosphatic material impregnated with coke braize.

In testimony whereof we affix our signatures.

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