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(54) Title: METHOD AND PLANT FOR MANUFACTURING OF ALUMINA

(57) Abstract: Described is method as well as a plant for manufacturing alumina (Al_2O_3) from raw materials containing aluminium hydroxide ($Al(OH)_3$), by which method the raw materials are preheated in a cyclone preheater (1), calcined in a furnace (3), cooled in a cyclone cooler (5), with dust filtration of process gases being effected in a filter (9). The method and the plant are peculiar in that a portion of the calcined, not completely cooled alumina is extracted from the plant, and that this portion is introduced into a separate processing unit (11) in which it is blended with filter dust which is fed to the processing unit (11) from the filter (9). As a result, final calcination of the filter dust is achieved without increasing the dust circulation in the plant, and without any adverse effect on the capacity of the filter.



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METHOD AND PLANT FOR MANUFACTURING OF ALUMINA

The present invention relates to a method for manufacturing alumina (Al_2O_3) from raw materials containing aluminium hydroxide ($\text{Al}(\text{OH})_3$), by which method the raw materials are preheated in a cyclone preheater, calcined in a furnace, cooled in a cyclone cooler, with dust filtration of process gases being effected in a filter. The invention also relates to a plant for carrying out the invention.

A method of the aforementioned kind is generally known from the literature and from established practice. It has been ascertained that in connection with ordinary, steady-state operation at known plants, 3-5 per cent of the raw materials which are fed to the plant end up as fine dust which is removed in the filter, typically an electrostatic precipitator. Given that the volume of filter dust is so significant as to render a disposal of the dust inappropriate, it would be desirable to provide means for ensuring a trouble-free re-introduction of the dust into the process. The filter dust typically contains large amounts of uncalcined material, often more than 50 per cent, and, therefore, it is not immediately suitable for blending into the finished product. Before the filter dust can be incorporated into the finished product, it must undergo further heat treatment. By a known method for such heat treatment of the dust, the filter dust is re-introduced into one of the first stages of the cyclone cooler; however, this method has proved to generate an excessively high dust circulation, having an undesirable effect on the operating economy of the plant.

It is the object of the present invention to provide a method as well as a plant for manufacturing alumina by which method the filter dust can be fully calcined and subsequently incorporated into the finished product in manner ensuring elimination of the aforementioned problem.

This is achieved by a method of the kind mentioned in the introduction and being characterized in that a portion of the calcined, not completely cooled alumina is extracted from the plant, and that this portion is introduced into a separate processing unit in which it is blended with filter dust which is fed to the processing unit from the filter.

As a result, final calcination of the filter dust is achieved without increasing the dust circulation in the plant, and without any adverse effect on the capacity of the filter. This is due to the fact that the aluminium hydroxide contained in the filter dust is dehydrated/calcined when blended with the extracted portion, relatively hot alumina.

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The plant for carrying out the method according to the invention comprises a cyclone preheater, a furnace, a cyclone cooler and a filter, and it is characterized in that it comprises means for extracting a portion of the calcined, not completely cooled alumina from the plant, a separate processing unit for blending the extracted alumina with filter dust, and means for introducing the extracted alumina and filter dust, respectively, into the processing unit.

In principle, the blending of the extracted, calcined alumina and the filter dust can be done in any appropriate manner. However, studies conducted by the applicant filing the present patent application have indicated that blending should preferably be done in a gas suspension. According to the invention it is, therefore, preferred that blending is done in a processing unit comprising a fluidized bed.

It is further preferred that the volume of the extracted, calcined alumina is adjusted according to the volume and the desired degree of calcination of the filter dust.

By means of independent tests, the lowest reaction temperature at which calcination of aluminium hydroxide is commenced has been determined to be within the range 245-250 °C. Also, operational data from plant have indicated that a temperature of 310-325 °C is sufficient if a sufficient retention time of the material is ensured. According to the invention, it is, therefore, preferred that the temperature in the processing unit is maintained at a level of minimum 310 °C.

According to the invention it is preferred that the blended product is extracted from the processing unit, preferably in suspension, and subject to subsequent cooling. Since the blended product is intended for subsequent incorporation into the finished product of the plant, cooling of the blended product may appropriately be done in conjunction with the final cooling of the finished product in a cooler with a fluidized

bed. Hence it will be possible to obtain a very homogeneous product, while simultaneously providing the option of heat reutilization.

5 The means for extracting a portion of the calcined, not completely cooled alumina from the plant may appropriately comprise a splitter gate. The separate processing unit for blending the extracted alumina with filter dust may appropriately be made up of a reactor with a fluidized bed. The means for introducing the extracted alumina into the processing unit appropriately comprise an inclined duct which terminates in the processing unit, whereas the means for introducing the filter dust, which is
10 typically directed to the processing unit in suspension, may comprise a separation cyclone and a duct which is also terminated in the processing unit.

The invention will now be described in further details with reference to the drawing, being diagrammatical and where the only figure illustrates a process
15 diagram for a plant for carrying out the method according to the invention.

In the figure the plant is seen to comprise a preheater 1, a furnace 3, a primary cooler 5, a secondary cooler 7 and a filter 9. The preheater 1 is typically made up of a cyclone preheater comprising two to three stages to which the raw materials are
20 introduced in suspension from a not shown raw material store via a duct 2 in the first cyclone, and in which the material is preheated by heat exchange with hot gases from the subsequent furnace 3. The gases from the preheater are directed via a duct 10 through to the filter 9. From the last cyclone of the cyclone preheater 1 the preheated material is introduced via a duct 1a to the furnace 3, which typically
25 comprises a calciner which consists of a substantially vertical duct which is swept by hot gases from the lower end and upwards and in which the preheated material and fuel 4 are introduced at the lower end. In the calciner the material is suspended in the hot gas stream and calcined while being transported up through the calciner from which the gas/material suspension is directed to a separation cyclone which
30 divides the suspension into a section of material which is diverted for cooling and a section of gases which is led via a duct 1b to the cyclone preheater 1. Via a duct 3a, the hot, calcined material is subsequently directed to and cooled in the primary cooler 5 which typically comprises a cyclone cooler comprising four stages, and then via a duct 5a to the secondary cooler 7 which typically consists of a cooler with

fluidized bed which is fed with relatively cold air via a duct 8. The actual cooling can be done by using air or a fluid as cooling medium. The finished product is extracted from the secondary cooler 7 via an outlet 7a. The cooling air from the primary cooler 5 is directed to the furnace 3 via a duct 3b, while the cooling air from the secondary cooler 7 is directed to the primary cooler 5 via a duct 5b. The primary cooler 5 is further supplied with relatively cold air via a duct 6.

According to the invention a portion of the calcined not completely cooled alumina material is extracted from the plant and blended with filter dust from the filter 9 in a separate processing unit 11. For the extraction of a portion of the calcined, not completely cooled alumina the plant incorporates a splitter gate 13. The splitter gate 13 may, as shown in the figure, be fitted immediately after the furnace 3, but it may also be fitted after one of the cyclones of the cyclone cooler 5, preferably the first cyclone if such a position is deemed to be necessary due to practical considerations. From the splitter gate 13 the alumina material is directed to the processing unit 11 via a duct 15. The filter dust is transported from the filter 9 to the processing unit 11 via a duct 17. In the preferred embodiment of the invention where the filter dust is transported in suspension, the plant comprises a separation cyclone 18 the material outlet of which is connected to the processing unit 11.

In the preferred embodiment, the separate processing unit 11 for blending the extracted alumina with filter dust is made up of a reactor with fluidized bed which is fed with fluidizing air via a duct 11a.

The volume of the extracted calcined alumina is adjusted according to the volume and the desired calcination degree of the filter dust by means of the splitter gate 13, preferably so that the temperature in the processing unit 11 is maintained at a level of minimum 310 °C.

From the processing unit 11, the blended product is extracted in suspension via a duct 11b and is introduced into the secondary cooler 7 in which it is subjected to cooling in conjunction with the finished product from the plant.

Attention is drawn to the fact that this invention is not limited to the manufacture of alumina, but it can also be used for other calcination processes, such as e.g. the manufacture of burnt lime (CaO) and similar products.

Claims

1. Method for manufacturing alumina (Al_2O_3) from raw materials containing aluminium hydroxide ($\text{Al}(\text{OH})_3$), by which method the raw materials are preheated in a cyclone preheater (1), calcined in a furnace (3), cooled in a cyclone cooler (5), with dust filtration of process gases being effected in a filter (9), characterized in that a portion of the calcined, not completely cooled alumina is extracted from the plant, and that this portion is introduced into a separate processing unit (11) in which it is blended with filter dust which is fed to the processing unit (11) from the filter (9).
2. Method according to claim 1, characterized in that the blending is done in a processing unit (11) comprising a fluidized bed.
3. Method according to claim 1, characterized in that the volume of the extracted, calcined alumina is adjusted according to the volume and the desired degree of calcination of the filter dust.
4. Method according to claim 1, characterized in that the temperature in the processing unit (11) is maintained at a level of minimum 310 °C.
5. Method according to claim 1, characterized in that the blended product is extracted from the processing unit, preferably in suspension, and subject to subsequent cooling.
6. Method according to claim 5, characterized in that the blended product is cooled in conjunction with the final cooling of the finished product in a cooler (7) with a fluidized bed.
7. Plant for carrying out the method according to claim 1, comprising a cyclone preheater (1), a furnace (3), a cyclone cooler (5) and a filter (9), characterized in that it comprises means (13) for extracting a portion of the calcined, not completely cooled alumina from the plant, a separate processing unit (11) for blending the

extracted alumina with filter dust, and means (15, 17) for introducing the extracted alumina and filter dust, respectively, into the processing unit (11).

5 8. Plant according to claim 7, characterized in that the means (13) for extracting a portion of the calcined, not completely cooled alumina from the plant comprise a splitter gate (13).

9. Plant according to claim 7, characterized in that the separate processing unit
10 (11) for blending the extracted alumina with filter dust is made up of a reactor (11) with a fluidized bed.

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