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PROGNOSTICATION OF TECHNOLOGICAL FACTORS OF TWOSTREAM SCHEME FOR PRODUCTION OF ALUMINA

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Influence of initializing relation on the processes of agglomeration on the initial stages of decomposition of aluminate solution is investigated. Dependences for determination of optimal initializing relation, calculation part of the productional stage, and also productivity of decomposing are got.

Keywords: decomposing, twostream scheme, initializing relation, degree of decomposition, productivity

All known technologies of decomposing of aluminate solutions foresee dilution of supersaturated after the oxide of aluminium of soda-aluminate solutions, introduction of inoculating $Al(OH)_3$ and cooling of the prepared pulp. The basic requirements to the decomposing are providing of high degree of decomposition for soda-aluminate solutions, increase of specific output $Al(OH)_3$ and receipt of coarse-grained product with minimum content of admixtures, so-called alumina of sandy type. These facts depend on the caustic module of aluminate and mother water solutions, temperature condition of decomposing, quantity, kind and quality of inoculation, duration of solution decomposition, quantity and types of admixtures which are in aluminate solution, and also technology of decomposing.

We was offered technology of twostream or separate decomposing. It essence consists in that inoculating $Al(OH)_3$ enter in two streams. On I stream or I stage which is carried out at the increased temperature (75-95 °C) during 6-10 hours, a inoculatinge relation (i.r) folds less than 0.5. The degree of decomposition for solution does not exceed 25 %, but here actively there are processes of agglomeration of inoculating $Al(OH)_3$. The degree of agglomeration presents 50-90 %. The hard phase is separated and use as products $Al(OH)_3$. To mother water solution after the separation of hard phase (II stream) there are enter circulating inoculating $Al(OH)_3$ with a inoculating relation 2-4 and lay out for the temperatures 40-50 °C during not less than 40 hours to caustic module higher than 3.0. After the separation of hard phase part of it is used as circulating inoculating $Al(OH)_3$, and mother water solution is given on evaporation.

Unlike the generally accepted method of decomposing for the twostream scheme of decomposing there is a hourly output of products hydroxide of aluminium Q, consists of mass of entered $Al(OH)_3$ as inoculation on I stream m_3 and the masses $Al(OH)_3$, that appears during decomposition of pulp on I stream m_1:

$$Q_{ä.ñ} = \frac{m_ç + m_1}{\tau_1} = \frac{A \cdot (100\,ç.â + \eta)}{100\,\tau_1} , \qquad (1)$$

where i.r, τ_1 are a inoculating relation and duration of decomposition on I stream accordingly.

The use of twostream scheme of decomposing enables to apply small inoculating relations on I stream and to get sandy products $Al(OH)_3$ for short space of decomposition of pulp. General output of products $Al(OH)_3$ aluminiums η_{com} on results previous experiments can arrive (at η_{com} = 81.2 % at i.r = 0.5 and τ_1 = 31.2 %.

Taking into account, that at the industrial terms of decomposing output products $Al(OH)_3$ usually does not exceed 2.0 kg/(m^3·hours), the use of twostream scheme of decomposition for aluminate solutions enables to promote the specific productivity of decomposing in several times.

The quantity of Al_2O_3, which will be distinguished on I stage, presents

$$Al_2O_{3(²)} = \frac{A\cdot(\alpha_{ì\,1} - \alpha_{à})}{\alpha_{ì\,1}}\ , \qquad (3)$$

where $Al_2O_{3(1)}$ is an quantity of Al_2O_3 that will be distinguished on I stage; A is content of Al_2O_3 in aluminate solution; α_a is the caustic module of aluminate solution; α_{m1} is the caustic module of mother water solutione on an output I stage.

The common quantity of Al_2O_3, which will be distinguished on two stages together, presents:

$$Al_2O_{3(çàã)} = \frac{A\cdot(\alpha_{ì\,2} - \alpha_{à})}{\alpha_{ì\,2}}\ , \qquad (4)$$

where $Al_2O_{3(com)}$ is a common quantity of Al_2O_3 that will be distinguished on two stages together; α_{m2} is the caustic module of mother water solution on the output of II stage.

Then quantity of Al_2O_3 that will be distinguished on II stage folds:

$$Al_2O_{3(²²)} = Al_2O_{3(çàã)} - Al_2O_{3(²)} = \frac{A\cdot(\alpha_{à}\cdot\alpha_{ì\,2} - \alpha_{à}\cdot\alpha_{ì\,1})}{\alpha_{ì\,1}\cdot\alpha_{ì\,2}}\ . \qquad (5)$$

Taking into account, that duration of decomposing I and II stages is different, equation must be executed:

$$\frac{Al_2O_{3(çàòð)}}{\tau_1} = \frac{Al_2O_{3(²²)}}{\tau_2}\ , \qquad (6)$$

where $Al_2O_{3(inc)}$, is an quantity of aluminium oxide in incolation, that is brought in on I stage; $Al_2O_{3(2)}$ is an quantity of aluminium oxide, which will be distinguished on II stage; τ_1, τ_2 are duration of decomposition on I and II stages accordingly.

From a formula (6) it is possible to calculate the quantity of Al_2O_3, which is brought in every hour on I stage as inculation, id est inoculatinge relation on I stage (i. r) :

$$ç.â = \frac{Al_2O_{3(çàòð)}}{A} = \frac{Al_2O_{3(\mathrm{II})}\cdot\tau_1}{A\cdot\tau_2}\ , \qquad (7)$$

After putting of value $Al_2O_{3(inc)}$ from a formula (5) to the formula (7) get a formula for the calculations of inoculating relation for the different terms of decomposing:

$$\text{ç.â} = \frac{Al_2O_{3(\mathrm{II})} \cdot \tau_1}{A \cdot \tau_2} = \frac{\left(\alpha_{\grave{a}} \cdot \alpha_{\grave{i}\,2} - \alpha_{\grave{a}} \cdot \alpha_{\grave{i}\,1}\right) \cdot \tau_1}{\alpha_{\grave{i}\,1} \cdot \alpha_{\grave{i}\,2} \cdot \tau_2}\ . \qquad (8)$$

As an analysis of formula (8), value i.r testifies on I stage can be increased with an increase τ_1. Increase of α_{m1} on I stage assists it increase.

Taking into account, that the recommended term of decomposition on I stage folds 8-15 hours and maximal caustic module of mother water solution on II stage 3.5-4.0 at duration 50-60 hours, inoculatinge relation on I stage does not exceed a value 0.15.

As results of calculations show, than greater value of з.в. and caustic module on I stage, the less part is presented by this stage from a general stream. During diminishing of i.r from 0.5 to 0.1 part I stage goes down the from 0.49 to 0.16 at the caustic module $\alpha_{m1} = 1.4$ and from 0.45 to 0.14 at $\alpha_{m1} = 1.7$.

On the parameters of the technological mode, which use in a present tense on OAJ «Nikolaiv aluminous plant», the caustic module of aluminate solution is evened $\alpha_a = 1.5$, concentration of aluminate solution (on Al_2O_3) $A = 150$ kg/m^3.

In accordance with the recommended parameters, at a select optimal inoculating relation (i.r = 0.2) part of stream I stage will be evened 31.4 % from everything to aluminate solution.

Conclusions. There are offered main dependences which allow on the basis of actual facts the depths of decomposition of aluminate solution on I and II stages of twostream scheme of decomposing to define an optimal inoculatinge relation on I stage, part of general stream of alominate solution, which it follows to use on I stage, and also productivity of decomposing.