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PROCESS FOR WORKING UP CRYOLITE

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This invention relates to processes for working up cryolite-bearing rocks and substances which, in addition to cryolite, also contain quartz and substances resembling cryolite, such as hagemannite, pachnolite and thomsenolite. Heretofore it has not been possible to work up such substances to valuable products even only approximately residue-free.

With the process according to the present invention an almost residue-free working up of the cryolite-containing materials is effected by floating the cryolite in such a way that the hagemannite, pachnolite and thomsenolite, deviating from the sequence of their natural wetting or moistening capacities, are left behind together with the quartz in the rock as the tailings or unfloated residue.

Whereas in general with the use of oils of smaller supporting power hagemannite, pachnolite and thomsenolite float before the cryolite, according to the present invention these materials are so affected by the use of appropriate alkaline neutral or acid reagents that render them passive that the said materials pass, together with the quartz, into the tailings, whilst at the same time the cryolite is floated. Suitable passivity-producing reagents for addition to the slime in which the flotation is carried out are for example salts of the alkali or alkaline earth metals such as soda, calcium silicate, or common salt, and in particular substances having an oxidizing character, as for example alkaliperborate or the composition known under the registered trade-mark Persil.

Instead of the salts of alkali or alkaline earth metals being added to the slime a good result can also be obtained if the flotation process be carried out with the aid of sea-water.

Experiments have shown that by the addition of the said salts especial advantages can be obtained. In particular the consumption of the reagents is restricted, and moreover the troublesome odour which results from the addition of oils and which materially impairs the market-value of the cryolite is considerably reduced, whilst at the same time an almost pure white cryolite is obtained.

The white colour, which is also of great importance as regards the market-value of the product, is above all due to the fact that the deviation from the sequence of the natural wetting or moistening capacities of hagemannite, pachnolite and thomsenolite is materially favoured by the addition of the said salts. This effect is especially obtained by the addition of

salts of the alkali or alkaline earth metals in a quantity exceeding that usually required for flotation processes, i. e. in quantities of 5 to 50 kilograms per metric ton.

The removal of hagemannite, pachnolite and thomsenolite is of special importance because their iron or calcium content materially reduces the value of the cryolite products.

The new process according to the present invention involves in effect an extension of processes for the preparation of cryolite even to the treatment of such rocks and materials the working up of which has heretofore not proved profitable. Thus, from materials containing cryolite hitherto not capable of being worked up there were obtained by means of the process according to the present invention concentrates which contained only 0.2–0.3% quartz and 0.06% Fe, whilst only unimportant quantities of cryolite passed over into the tailings from the flotation.

The present process is based upon the following principles:—

Hagemannite, pachnolite and thomsenolite are lyophobic, whereas quartz is lyophilic. Cryolite stands between the two, but inclines however more to the first named group. In consequence of these different characteristics of the minerals, with a flotation carried out in the ordinary manner heretofore usual there would result the following sequence for the natural wetting or moistening capacities. (1) Hagemannite, pachnolite and thomsenolite, (2) cryolite and (3) quartz. By the addition however of the above mentioned passivity-producing reagents a deviation from this sequence is effected in the sense that hagemannite, pachnolite and thomsenolite approach more closely to quartz as regards their capacity for flotation whilst the flotation capacity of the cryolite is changed by these agents either not at all or only to a slight extent—in any case it is not substantially changed in the direction of the wetting or moistening characteristics of quartz. Consequently there results for the minerals influenced by the passivity-producing reagent the following sequence for the wetting or moistening capacities (1) cryolite, (2) hagemannite, pachnolite and thomsenolite and (3) quartz.

It is especially noteworthy that the purity of the cryolite on the one hand and the poorness in cryolite of the tailings on the other hand can be increased to a remarkable extent when the above mentioned passivity-producing reagents are added in a quantity exceeding the amount otherwise usual in flotation processes. Thus for example with the new process quantities of up to

50 kilograms per metric ton of the above mentioned substances are added. The process is not prejudicially affected from the economic aspect by the addition of the passivity-producing reagents as the costs for the extra consumption of these agents are more than compensated for by the higher value of the products which are thus obtained. If the cryolite-bearing rocks or substances also contain metallic sulphides, these are first removed by flotation in a known manner from the rocks or substances, which have been reduced to a degree of fineness suitable for flotation.

Some practical examples of the application of the present process are as follows:—

Example 1

From a cryolite-containing material there were first floated off the metallic sulphides whereafter there was effected the flotation of the cryolite in an alkaline slime with the addition of fatty acids or salts or derivatives of fatty acids and some frothing oil. The following values were obtained:

Product	Percentage weight of the various products	Percentage cryolite in the various products	Percentage distribution of the cryolite
	Percent	Percent	Percent
Metal sulphide concentrate.....	1.49	63.90	1.28
1st cryolite concentrate from the cleaning.....	51.77	99.54	69.26
2nd cryolite concentrate from the cleaning.....	14.91	96.72	19.37
1st medium product.....	2.33	89.00	2.79
2nd medium product.....	5.00	43.92	2.95
Rock.....	24.50	13.20	4.35
Yield.....	100.00	74.41	100.00

Example 2

Upon the flotation of a cryolite-containing material with a high content of cryolite the following values were obtained when the same process was used:

Product	Percentage weight of the various products	Percentage cryolite in the various products	Percentage distribution of the cryolite
	Percent	Percent	Percent
Metal sulphide concentrate.....	1.22	60.9	0.76
1st cryolite concentrate.....	88.33	99.7	89.91
2nd cryolite concentrate.....	0.89	99.0	0.90
Cryolite rock medium product.....	3.21	95.4	3.13
Rock.....	6.35	81.8	5.30
Yield.....	100.00	97.95	100.00

Example 3

From a cryolite-containing material like that in Example 1 there were first floated off the metallic sulphides and thereafter the flotation of cryolite was effected with the addition of common salt and fatty acids or salts or derivatives of fatty acids and some frothing oil. The following values were obtained:

Product	Percentage weight of the various products	Percentage cryolite in the various products	Percentage distribution of the cryolite
	Percent	Percent	Percent
Metal sulphide concentrate.....	5.63	Not analyzed	
1st cryolite concentrate.....	52.25	99.55	73.44
2nd cryolite concentrate.....	16.64		
1st medium product.....	3.81	Not analyzed	
2nd medium product.....	10.75		
Rock.....	10.94	2.50	0.39

What we claim is:—

1. Process for working up cryolite-bearing rocks and substances which, in addition to cryolite, also contain quartz and substances resembling cryolite, such as hagemannite, pachnolite, and thomsenolite; which comprises adding a salt of an alkali metal to render the hagemannite, pachnolite, and thomsenolite passive and alter the ordinary sequence of their natural wetting capacities, and froth-floating the cryolite by means of frothing agents, the hagemannite, pachnolite, and thomsenolite being left behind with the quartz in the rock as the tailings or unfloated residue.

2. Process for working up cryolite-bearing rocks and substances which, in addition to cryolite, also contain quartz and substances resembling cryolite, such as hagemannite, pachnolite, and thomsenolite; which comprises adding, in quantities of 5 to 50 kilograms per metric ton, a salt of an alkali metal to render the hagemannite, pachnolite, and thomsenolite passive and alter the ordinary sequence of their natural wetting capacities, and froth-floating the cryolite by means of frothing agents, the hagemannite, pachnolite, and thomsenolite being left behind with the quartz in the rock as the tailings or unfloated residue.

3. Process for working up cryolite-bearing rocks and substances which, in addition to cryolite, also contain quartz and substances resembling cryolite, such as hagemannite, pachnolite, and thomsenolite; which comprises adding sodium chloride to render the hagemannite, pachnolite, and thomsenolite passive and alter the ordinary sequence of their natural wetting capacities, and froth-floating the cryolite by means of frothing agents, the hagemannite, pachnolite, and thomsenolite being left behind with the quartz in the rock as the tailings or unfloated residue.

4. Process for working up cryolite-bearing rocks and substances which, in addition to cryolite, also contain quartz and substances resembling cryolite, such as hagemannite, pachnolite, and thomsenolite; which comprises adding soda to render the hagemannite, pachnolite, and thomsenolite passive and alter the ordinary sequence of their natural wetting capacities, and froth-floating the cryolite by means of frothing agents, the hagemannite, pachnolite, and thomsenolite being left behind with the quartz in the rock as the tailings or unfloated residue.

5. Process for working up cryolite-bearing rocks and substances which, in addition to cryolite, also contain quartz and substances resembling cryolite, such as hagemannite, pachnolite, and thomsenolite; which comprises adding alkali perborate to render the hagemannite, pachnolite, and thomsenolite passive and alter the ordinary sequence of their natural wetting capacities, and froth-floating the cryolite by means of frothing agents, the hagemannite, pachnolite, and thomsenolite being left behind with the quartz in the rock as the tailings or unfloated residue.

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