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PRODUCTION OF LOW SILICA IRON SUPERCONCENTRATES

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This invention relates to a process for production of low silica iron superconcentrates.

Superconcentrates containing iron oxide in the order of 99% with low silica content are required by the steel industry in direct reduction and pyrometallurgical procedures. They may also be used in the pigment industry and as an alternative feed source in those processes presently employing synthetically produced iron oxides.

Heretofore it has not been possible to produce concentrates of desirably high grade by mechanical means from naturally occurring minerals.

It is an object of this invention to provide a mechanical process for production of superconcentrates containing not substantially less than 99% iron oxide and not substantially more than 0.05% silica.

The process in accordance with the invention employs as the feed material gravity specular hemtatite concentrates containing 1 to 5% silica.

The feed material is ground to a particle size of minus 100 to minus 325 mesh, Tyler standard. Preferably it should be ground wet in a ball mill to minus 150 mesh (Tyler standard).

The ground ore is then subjected to a cationic flotation step, using any suitable cationic collector such as those known under the trade names "Rosin Amine D Acetate" and "Armac C." The flotation step removes a substantial portion of the silica present in the ore but the flotation concentrate still contains silica in the order of 0.10%.

The flotation concentrate is now subjected to a wet magnetic separation in a magnetic field of an intensity of 2000 to 10,000 gauss, preferably 3000 to 7000 gauss. The wet magnetic separator further reduces the silica content in the concentrate to not exceeding 0.05% and to as low as 0.03%.

Tests have shown that the flotation step alone will produce at best a concentrate containing in the order of 0.10% silica. Other tests have shown the highest grade of concentrate produced by high intensity wet magnetic separation alone contained 0.20% silica. Thus, a critical feature of the preesnt invention is the combination of cationic silica flotation and high intensity wet magnetic separation in that order. The flotation process removes some silica, in the form of middlings, which cannot be removed by high intensity wet magnetic separation alone. The latter step improves the flotation concentrate by removing about 75% of the remaining silica.

Test results have shown that a 0.03% silica superconcentrate can only be obtained by high intensity wet magnetic separation of a flotation concentrate containing in the order of 0.10% silica. A flotation concentrate containing more silica will produce a high intensity wet magnetic concentrate with a silica content proportionately higher than 0.03%. Therefore, the final purity of the superconcentrate is dependent upon the removal of as much silica as possible in the flotation stage.

Use of high intensity wet (rather than dry) magnetic separation is also of critical importance. From an economical point of view, it is of course desirable that the wet flotation concentrate need not be subjected to a costly drying step as would be required if dry magnetic separation were employed. More important, however, is the fact that wet, rather than dry, high intensity magnetic separation is much more effective for silica removal.

The following is a specific example of the process of the invention.

A sample of specular hematite gravity concentrate containing about 5% silica is ground wet in a ball mill to minus 150 mesh.

The ground ore is pulped in a flotation cell at 30% solids and conditioned for about 5 minutes with 1 lb. of dextrine per ton of feed.

After conditioning, a cationic collector such as "Rosin Amine D Acetate" or "Armac C" is added as a 1% solution, with a frother, if required. In the case where "Rosin Amine D Acetate" is used, a frother, consisting of 50% pine oil, 2.5% commercial preparation known under the trade name "Aerosol OT," and 47.5% water, by volume, is added. No frother is required when using "Armac C."

An initial float is made after the addition of 0.2 lb. of collector per ton, and most of the silica is floated in a froth containing about 20% of the original feed weight. More collector is added if required until the silica content of the material in the cell is lowered by subsequent flotation to about 0.10% silica.

The flotation concentrate is fed to a Jones high intensity wet magnetic separator in a slurry containing about 20% solids. The magnetic field intensity of the Jones separator is about 5000 gauss, which is determined by setting the amperage at 10 amperes.

The resulting concentrate is filtered and dried.

As previously indicated, the magnetic field intensity may be determined by setting the amperage at the desired level. Thus, a setting of 3 to 12 amperes will result in an intensity of 2000 to 10,000 gauss. While acceptable results are obtainable anywhere in this range, for best results a setting of 10 amperes (corresponding to 5000 gauss) is preferred.

I claim:

1. A method of producing iron superconcentrates which comprises grinding an ore concentrate consisting essentially of specular hematite having a silica content of more than 1%, to a particle size of minus 100 to minus 325 mesh, subjecting said ground ore body to a froth flotation treatment with a cationic collector to remove silica therefrom and produce a wet flotation concentrate containing in the order of 0.10% silica, subjecting said flotation concentrate while still wet to a wet magnetic separation treatment in a magnetic field having an intensity in the range of 3000 to 7000 gauss to produce a magnetic separation concentrate from said one body containing not substantially less than 99% iron oxide and not substantially more than 0.05% silica.

2. A method of producing iron superconcentrates as defined in claim **1**, wherein the intensity of said magnetic field is about 5000 gauss.

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