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METHOD FOR CONCENTRATING ORES

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1 Claim. (Cl. 75—1)

The present invention relates to a method of concentrating ores, especially minette ores (oolitic iron ores) from which the gangue or matrix is substantially eliminated after a crushing operation while separating the hematite content therefrom.

With heretofore known methods for pre-concentrating base or low-grade ores, especially minette ores, the ores are first subjected to a selected crushing operation by means of which the ore is divided into the more concentrated oolite fraction and the gangue. For this purpose, generally autogenous milling methods are employed.

For purposes of further concentrating this pre-concentrate, aside from so-called flotation methods and other separating methods employing a wet process, the method of magnetized roasting has heretofore been employed. According to this last-mentioned method, the pre-concentrate is heated to a temperature of approximately 1,000° C. and is reduced by hydrogen, carbon or methane so as to form magnetite. In order to obtaind as complete a reduction as possible, the goods are subjected for a longer period of time to this temperature. Subsequently, the goods are milled in a wet process and are separated in a low power field magnetic separator.

With this known method the drawback is encountered that in spite of relatively high heat consumption with numerous ores, especially minette ores, only a rather small concentration can be obtained. With minette ores, this is due to the fine granularity and the ultra-fine distribution of the water containing iron oxides, which two factors bring about that with the improvement in the magnetic properties, basically only the high-grade iron particles are separated from the low-grade particles contained in the goods.

Furthermore, various methods of directly reducing minette ores to metallic iron are known. It is, however, doubtful whether these methods are very economical.

It is, therefore, an object of the present invention to provide a method of separating ores, especially minette ores, by means of which it is possible to produce in a very simple manner highly concentrated ores with a very low gangue content.

It is a further object of the present invention to provide a method as set forth in the preceding paragraph by means of which the ores can very easily be separated from the gangue.

The method according to the present invention is characterized primarily in that the ores are, prior to being crushed, heated to a temperature at which on one had a melting phase is formed and at which, on the other hand, the hematite does not yet become decomposed, and in that subsequently, this condition is so-to-speak frozen by means of a fast cooling process.

According to the method of the present invention, very well crystallized idiomorpheous hematites are formed in which practically the entire iron contents of the ore are

concentrated. These hematites are embedded in the melt which approximately represents the entire gangue. In this way, the ultra-fine structure of the ore is destroyed. During the disintegrating process, therefore, a concentrate is obtained which is almost entirely free of gangue.

As will be evident from the above, it is essential for the method according to the present invention, that the gangue melts in a temperature range in which the hematite does not become decomposed or disintegrated. A particularly favorable melt of the gangue is obtained with minette ore mixtures.

The heating of the ores necessary according to the present invention may, for instance, be effected according to the so-called fluidized bed method. However, also various other known methods and devices are applicable. It is not deemed necessary to go into the details of these known methods. The separation to be effected after the freezing of the melt and the subsequent crushing or milling may also be effected in any convenient manner, for instance by means of a high power field magnetic separator.

In order further to clarify the essence of the present invention, the following example may be given:

Example

A minette ore concentrate was heated to slightly more than 1200° C. (The limit in the phase diagram for the CaO/Fe_2O_3 system at 1230° C. is lowered by approximately 30° C. due to the presence of SiO_2 and Al_2O_3.) The thus obtained condition of the minette ore concentrate was frozen by a fast cooling process in which the temperature dropped from 1200° C. to 1000° in a time period of about 3 minutes.

As microphotos show, the iron content of the oolite is practically completely crystallized in perfect hematite crystals in an almost iron-free calcic silicious and almuinous glass phase. Due to the fast cooling process, the melting phase contains hair-like gaps and the original form of the oolites can still be recognized. The length of the edges of the hematite crystals amounts to approximately 25 to 30 microns. If subsequently the obtained product is milled so as to have a mean size of approximately 40 microns, the hematite phase can easily be separated from the remainder.

It is, of course, to be understood that the present invention is, by no means, limited to the particular method described above, but comprises any modifications within the scope of the appended claims.

What is claimed is:

A method of concentrating iron ore including iron oxide which comprises; heating the ore to about 1200° C. for a length of time to cause crystallization of the iron oxide into hematite crystals, quickly reducing the temperature of the heated ore to preserve the crystals, crushing the cooled ore, and separating out the said crystals.

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