V.B. Kuskov, A.V. Kornev
Saint-Petersburg State Mining University (Russia)
opikvb@mail.ru; opiopi@bk.ru

Briquettes for metallurgical industry

It is clear that, good preparation of the ores is pledge of successful and effective metallurgical repartition. In the processes of preparation, the clotting operations of metallurgical raw materials have great value. In connection with perfection of extraction technics and introduction of preliminary deep concentration processes, now relative density of fine particles, sintered ore and concentrates have considerably grown.

Thus, the raw materials are gone to metallurgical repartition, for which it is necessary to apply effective processes of clotting. Now iron ores and concentrates are subjected basically to agglomerations or pelletizing.

However for some types of ores, in particular for rich iron ores with the iron content of 60 % and more, briquetting can be preferable process. Such ores don't need beneficiation and consequently fine grinding, so their pelletizing, which demands preliminary fine grinding it is economically inexpedient. And briquetting is cheaper in comparison with agglomeration, and it's non-polluting process.

Methods of iron ores briquetting can be divided into two groups: with binding substances and without the binding.

As a rule, briquetting without application of binding substances demands more high pressure of pressing and subsequent roasting of a briquette for giving to it necessary durability. For clay iron ores it is possible to use briquetting without the subsequent roasting. For other ores briquetting without binding substances is based on sintering of ore grains at briquette roasting.

Process of briquetting with binding is more flexible and well-regulated than briquetting without binding. Many binding substances, both organic and inorganic are known well [1].

Most often briquetting with inorganic binding (clay, connections of a lime and silica, cement, slags, liquid glass, a metal shaving, etc.) is used for iron ores: However, the listed kinds of the binding have known disadvantages: they reduce iron content in a briquette, don't provide necessary mechanical durability of briquettes during influence of high temperatures and etc.

Organic binding though are used less often, but can be rather perspective because they allow to receive durable briquettes, and at roasting or metallurgical processing they burn out, thereby without reducing the iron content in a briquette.

The technology of briquetting of fine destroyed martit-hydrohematite rich iron ore for the purpose of possible use of it in metallurgical repartition is considered below. The solution of carboxymethyl cellulose has been used as binding substance[2].

Iron ore briquettes were made by the following technology (Fig. 1): feeding ore was gone to preliminary screening directly before metallurgical processing for sifting of a particle with size more then 5 mm.

The class with particle size less then 5 mm after dispensing is mixed up with a solution of carboxymethyl-cellulose and is gone to briquetting. Crude briquettes after sieving of ore fines (which are returned in mixing operation) are gone to drying. After drying briquettes are exposed to control screening and sifting of dry briquettes is returned to mixer. Briquettes were made with various concentration of solution of carboxymethyl-cellulose: 1.0; 2.5 and 4.0 %. Concentration of 2.5 %

Table 1. Relation of durability of briquettes and consumption of binding

Consumption of binding	Compacting pressure, MPa	Durability on uniaxial compression of briquettes, MPa	Average durability on uniaxial compression of briquettes, MPa
1 % solution of carboxymethyl-cellulose	40.01	5.13	5.45
	40.13	5.21	
	40.16	5.23	
	40.25	5.40	
	40.42	5.56	
	40.60	5.74	
	40.95	5.90	
2.5 % solution of carboxymethyl-cellulose	40.04	7.42	7.61
	40.08	7.43	
	40.15	7.50	
	40.21	7.54	
	40.44	7.69	
	40.45	7.71	
	40.75	7.98	
4 % solution of carboxymethyl-cellulose	41.11	8.08	7.97
	40.34	7.99	
	40.21	7.96	
	40.06	7.76	
	40.87	8.12	
	40.32	7.87	
	40.16	8.04	

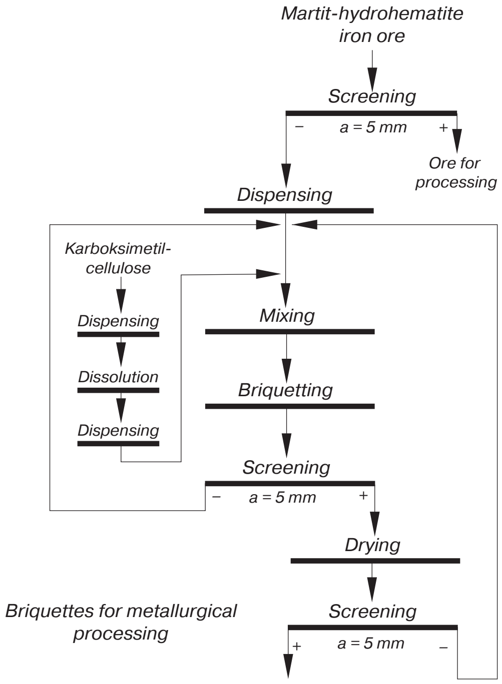

Fig. 1. Flow sheet of iron ore briquetting using carboxymetyl-cellulose

is optimum when concentration of smaller briquettes turned out insufficiently durable, and when it is bigger, durability of a briquette practically didn't raise, and consumption carboxymethyl-cellulose increased. Pressing pressure is varied from 30 to 80 MPa. For receiving of rather durable briquettes, pressure of pressing 40–50 MPa is sufficient. The further increase of pressing pressure is inexpedient, because durability of briquettes grows insignificantly, and expenses increase.

Relation of durability of briquettes (on uniaxial compression) and consumption of binding is resulted in Table 1. Tests for durability were conducted with 7 samples for each series of experiments, and average durability was calculated.

The offered technology of briquetting allows to receive iron ore briquettes with high durability and practically without decreasing of iron content.

Metallurgical properties of the briquettes are examining.

This article was written by results of the work of the Resolution 218 "Development of Cooperation between Russian universities and industrial enterprises."

REFERENCES

1. *V.E. Lotosh, A.I. Okunev*. Annealing-free clotting of ores and concentrates. –M.: Nauka, 1980.
2. Method of preparation of furnace-charge material for metallurgical processing. An application for RF patent. № 2011118712 10.05.2011.