

Sichuan Jianjie provides products and technical solutions as well as expert advice and technical support to metal mineral powder and steel mill solid waste processing sectors in the world. Our team shares a common goal of providing the best sustainable solutions to meet our customers' processing needs. Chengdu Jianjie possesses professional product R&D and technical service teams that offer technical support throughout the globe.

We provide products, equipment, process technology and expertise with a focus on iron ore pelletizing as well as forming and briquetting of solid waste in steel mills.

I. Jianjie pellet binder product series

This product series was specially developed for various iron concentrate powders, with good physical and chemical bonding, and are widely used in the forming of iron ore fines. Jianjie pellet binders have been used in the metal mineral powder forming and pelletizing industry for more than ten years.

This product series is mainly used for the forming of iron concentrate powders such as magnetite powder and hematite powder. The pellets can achieve high resistance to impact, compression and wear at very little dosage.

Jianjie pellet binder product series is compounded with polymeric organic and inorganic substances, and its dosage is 1/2 of that of traditional bentonite binders. Bentonite can be completely or partially replaced to reduce the hazardous elements in the feed, and improve the blast furnace utilization factor.

Table 1 Pellet binder product series

Product series	Application areas	Chemical properties	Status	Dosage	Effects
QK02 Pellet binder QK02	Iron concentrate powders such as magnetite powder and hematite powder	Organic and inorganic composite materials	Light yellow, flowable powder	1.2%~1.5%	Improving the bonding power of iron concentrate powders
QK06 Pellet binder QK06	Iron concentrate powders such as magnetite	Organic and inorganic composite	Light yellow, flowable powder	0.5%~0.8%	Improving the bonding power of iron

	powder and hematite powder	materials			concentrate powders
Pellet organic binder QK08	Iron concentrate powders such as magnetite powder and hematite powder	Multiple polymeric organic composite materials	White, flowable powder	0.1%~0.3%	Improving the bonding power of iron concentrate powders
Bentonite modifier KF08	Bentonite	Multiple organic substances polymerized	Off-white, flowable powder	3%~5%	Improving the bonding power and thermal stability of bentonite

II. Application of pellet organic binders

Pellet organic binders have high water-absorbing swelling and bonding properties. After a small amount of binder is mixed with iron ore fines, the particles will be tightly bonded together under the high bonding power generated by infiltration, penetration and drying and consolidation in the presence of water. Then after being cold pressed, the binder achieves high pellet forming rate as well as good resistance to impact, compression and wear. This reduces the breakage rate of pellets during production, transfer, loading and unloading, the amount of dust, and the rate of return mine. Moreover, the shock temperature will not decrease, and the furnace permeability and roasting speed will be improved, thereby significantly increasing the yield.

Organic binders can completely or partially replace bentonite, thereby reducing the overall dosage of bentonite as well as SiO_2 and Al_2O_3 carried by bentonite, and reducing hazardous elements in the feed. This facilitates blast furnace operation, and can increase the blast furnace utilization factor and reduce energy consumption in production.

III. Use of bentonite as pellet binder

Bentonite is widely used worldwide as an iron ore fine binder.

Advantages: Bentonite's high montmorillonite content and high water absorption capacity can significantly increase the shock temperature of green pellets and improve the permeability of the inner material layer of the roasting furnace.

Disadvantages: The high dosage of bentonite leads to higher pellet SiO_2 and Al_2O_3 content and increased alkaline melt (limestone, white ash, etc.) in the feed, causing higher blast furnace slag-iron ratio, more difficult smelting, higher energy consumption, lower iron grade, and higher pig iron cost.

IV. Experimental data of organic binder and bentonite production

1. Pelletizing test

Pelletizing and roasting tests were performed with 0.2% and 0.3% pellet binder, and compared with pellets with 1% bentonite. The performance of the green pellets is shown in Table 2.

Table 2 Performance of green pellets

No.	binder type	Dosage	Compressive strength/ $\text{N}\cdot\text{P}^{-1}$	Falling strength/time $\cdot\text{P}^{-1}$	Breakage temperature/ $^{\circ}\text{C}$
1]Organic binder	0.2	11.35	8.9	>800
2	Organic binder	0.3	12.82	12.1	>700
3	Bentonite	1	11.17	6.4	>800

As can be seen from Table 2, the pellets with 1% bentonite have poorer green pellet performance; the green pellets with 0.2% pellet binder and those with 1% bentonite have similar performance; the green pellets with 0.3% pellet binder have higher compressive strength and falling strength as well as slightly lower breakage temperature.

2. Roasting test

A roasting test was performed on the pellets. The roasting system is shown in Table 3.

Table 3 Roasting system of pellets

Roasting system	Drying stage	Preheating stage	Roasting stage	Soaking stage	Cooling stage
Time/min	8	10	25	5	
Temperature/°C	400	900	1200 1230	1100	From 200 To 200
Air flow/m ³ ·h ⁻¹	5/40	15/20	20/15	20/15	15/20

Note: Air flow: primary air flow / secondary air flow.

During the roasting process, a roasting temperature of 1200°C was adopted for the preparation of pellets with 0.2% and 0.3% organic binder and 1% bentonite.

The compressive strength of the roasted pellets was measured. The results are shown in Table 4.

Table 4 Compressive strength of the finished pellets

No.	binder type	binder dosage/%	Roasting temperature/°C	Compressive strength of finished pellets/N·P ⁻¹
1	Pellet binder	0.2	1200	2464.7
2	Pellet binder	0.3	1200	2564.7
3	Bentonite	1	1200	2054.9

As can be seen from Table 4, when roasted at 1200°C, the compressive strength of pellets with 0.2% and 0.3% pellet binder is greater than that of finished pellets with bentonite.

V. Advantages of Jianjie pellet organic binders

Comparison of advantages of pellet binder and bentonite

No.	Pellet organic binder	Bentonite
1	Small dosage (generally 0.1%-0.3%)	Larger dosage (generally around 1%)
2	Low handling cost due to small dosage	Higher handling cost due to larger dosage
3	High bonding power, pellet forming	Average forming rate (more than 80%)



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	speed and forming rate (98% or more)	
4	High falling strength of green pellets; remains intact more than 6 times when falling from 0.5 m; high compressive strength of dry pellets, up to 10 kg or more	Low falling strength of green pellets; scatters 2 times when falling from 0.5m; low compressive strength of dry pellets, about 5 kg or more
5	High green pellet forming rate, which leads to reduced amount of powder and returned material, unchanged shock temperature, improved furnace permeability, better reducibility and higher roasting speed, thereby significantly increasing the yield	Low green pellet forming rate, which leads to large amount of powder, more returned material and less furnace permeability, thereby reducing the yield and quality
6	Fired pellets have good thermal stability for furnace feeding, which can reduce SiO ₂ and Al ₂ O ₃ slag amount, facilitate blast furnace operation, improve the blast furnace utilization factor and reduce energy consumption in production.	More SiO ₂ and Al ₂ O ₃ will increase the slag amount and reduce the iron grade. (Since bentonite is mainly composed of SiO ₂ and Al ₂ O ₃ , the burning loss is low and almost all of the bentonite will remain in the pellets after roasting, which increases the slag amount and thereby reduce the iron grade of pellets.)
7	Compared with bentonite, organic binders can improve the iron grade of roasted pellets.	Reduced grade of the roasted pellets. (Production experience shows that 1% (mass fraction) reduction in bentonite added to the pellets corresponds to 0.6% higher pellet iron grade, 1.2% less coke rate and 1.8% more yield.)