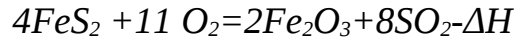


The process is described by the general equation:



where $\Delta H = 3,400$ kJ.

The firing gas also contains a small amount of sulfur trioxide (SO_3), since iron oxide at high temperatures is a catalyst for the oxidation of SO_2 to SO_3 .

Along with FeS_2 and sulfides of other metals contained in pyrites decompose. Their oxides, as well as quartz, some aluminosilicates together with iron oxide and undecomposed FeS_2 form a cinder, which can contain from 0.5 to 3% sulfur.

During the burning of sulphurous iron, a layer of oxides forms on the grain surface, the thickness of which increases as the sulfur burns out of pyrite. The total rate of the process is determined by the rate of diffusion of gases in the pores of the oxide layer. Consequently, the combustion of pyrite proceeds in the intradiffusion region.

The rate of the oxidative firing process is expressed by the general equation for heterogeneous processes:

$$U = dm/dt = K_m \cdot F \cdot \Delta C$$

where: K_m is the mass transfer coefficient, F is the contact surface of the phases (catalyst), ΔC is the driving force of the process.

Thus, the speed of the firing process depends on the temperature (through K_m), the dispersion of the fired pyrite (through F , the concentration of iron disulfide in pyrite and the concentration of oxygen in the air (through ΔC).

The combustion process can be accelerated by increasing K_m , ΔC , and F . To increase the mass transfer coefficient, it is most effective to raise the temperature. However, at 850-1,000°C the material in the furnace is sintered into large agglomerates; this sharply decreases the reaction surface. Therefore, the pyrite can be fired at a very specific temperature, depending, firstly, on the chemical composition and nature of pyrites, and secondly, on the design of the furnace in which the firing process is carried out.

To increase the driving force of the ΔC process, it is necessary to increase the concentration of pyrite in pyrites and oxygen in the firing zone. Flotation enrichment is used to increase the pyrite concentration, and oxygen enriched air blasting can be used to increase the oxygen concentration. However, this method of increasing ΔC is quite expensive and therefore almost never used. Most often, to increase the oxygen concentration, an excess of air is used versus stoichiometric 1.5-2 times.

To reduce external diffusion inhibition, i.e. facilitate the supply of oxygen to the surface of the grain, apply vigorous mixing of the phases. The pyrite combustion process, as already mentioned, is limited by the internal diffusion of oxygen, i.e. supply of oxygen into the grain through its pores. Therefore, a more effective way to increase the burning speed of pyrite is to increase the contact surface of the phases due to fine grinding of the solid component. In practice, finely ground flotation pyrites with a particle size of 0.03 to 0.3 mm are used. Due to such a large difference in particle size, the rate of complete combustion of sulfur from pyrite for particles of different sizes differs tenfold. This leads to the fact that in a highly crushed pyrite remains on average up to 1.5% unburned sulfur. Therefore, despite the fact that the stub contains up to 50% iron, it has not been used for a long time in the blast furnace process for the production of cast iron.