

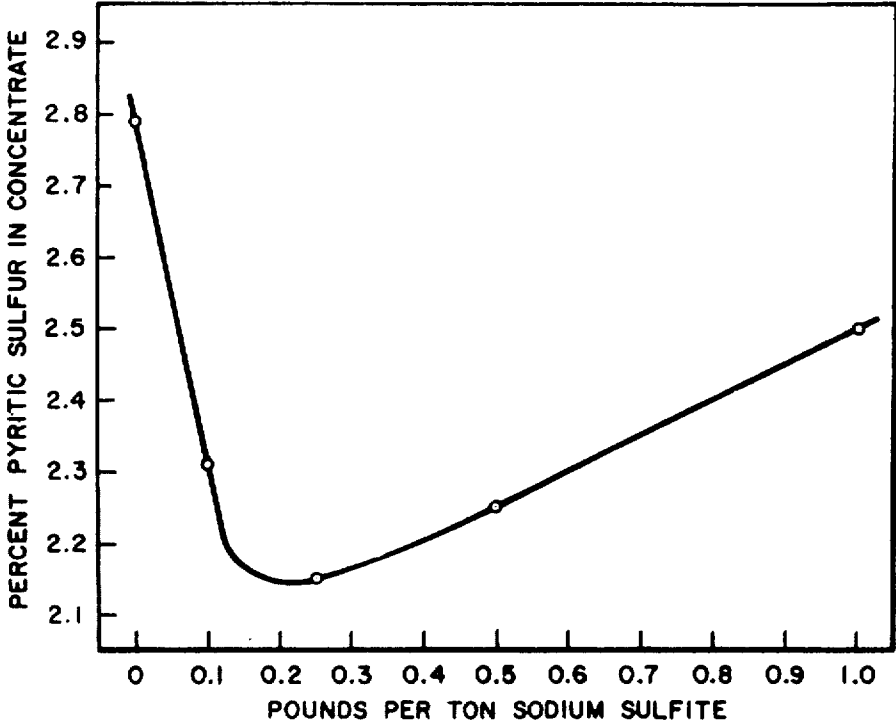
- [54] **PYRITE DEPRESSION IN COAL FLOTATION BY THE ADDITION OF SODIUM SULFITE**
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[58] Field of Search. **209/166, 167**

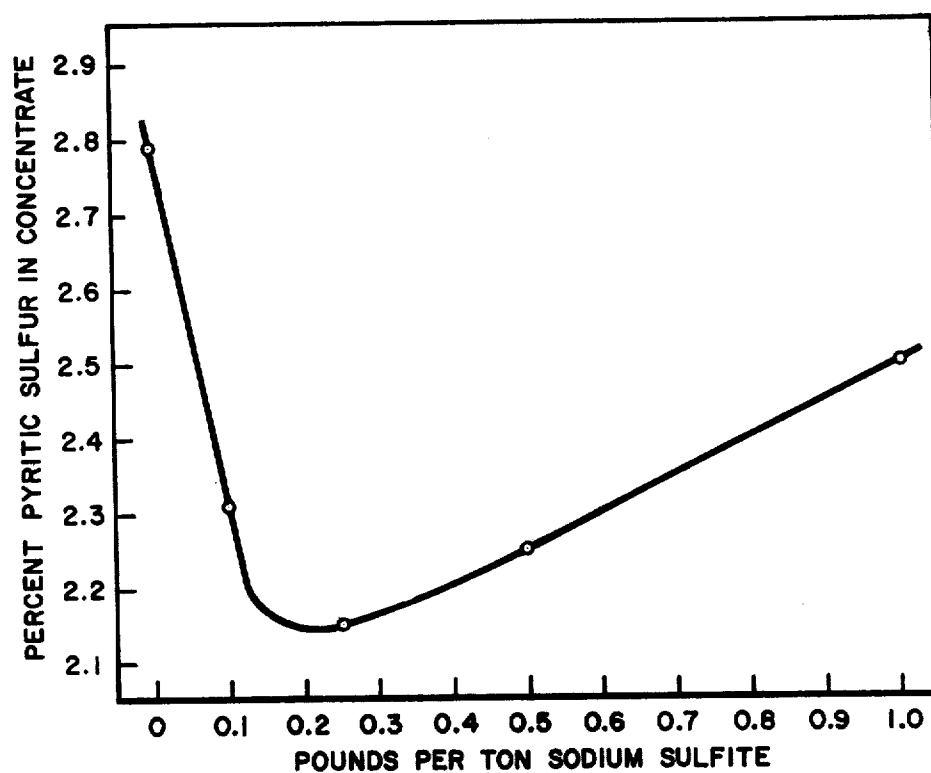
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[57] **ABSTRACT**
Pyritic sulfur flotation is depressed in aqueous flotation of a fine particle size coal fraction by adding sulfite to the flotation pulp.
3 Claims, 1 Drawing Figure





PYRITE DEPRESSION IN COAL FLOTATION BY THE ADDITION OF SODIUM SULFITE

This invention relates to production of coal and especially coal having a low sulfur content.

Various types of coal are produced for use as fuels which have sulfur content that approaches or slightly exceeds the maximum permitted. Several processes have been investigated to reduce the sulfur concentration. These processes include methods similar to those for mineral processing such as the use of cyanide depressing agent, ferrous sulfate (Yancey and Taylor, USBM Report Invest. 3263, 1935), lime and sodium cyanide (Chapman and Jones, Jour. Inst. Fuel, 28, 102, 1955), various hydrolyzed metal ions (Baker and Miller, USBM Report Invest. 7518, 1971) and potassium permanganate with sodium sulfite (Wade, Mining World, Sept., 1960, p. 38). Various flotation systems have also been used (Miller, AIME Trans., March, 1964, p. 7). Each of these processes has its limitations. The process of this invention provides a simple, inexpensive process for reducing the sulfur content of coal and thereby an acceptable low sulfur coal.

According to this invention there is provided a froth flotation process of reducing sulfur concentration of coal comprising mixing in a flotation cell a fine particle size fraction of said coal with an aqueous media and a flotation gas in the presence of a soluble sulfite salt whereby the fine coal particles are removed from the cell in the froth and pyrite is depressed with a substantial portion of the pyrite being removed from the cell in the takings phase and recovering said coal having a reduced sulfur concentration.

The drawing shows the effect of sodium sulfite in depressing the flotation of pyrite.

The process of this invention is readily adapted to conventional coal processing because coal is normally separated into various size fractions during mining and processing. Coarse fractions, if need be, can be pulverized to produce the desired particle size fractions and the proportion of fine particle size coal to be treated by the process of this invention necessary to reduce sulfur concentration to the desired value.

Likewise, present coal processing techniques frequently include hydraulic or even flotation cleaning steps so that the process of this invention can be readily adapted to conventional processing techniques.

The process of this invention is especially advantageous because of two unexpected discoveries. First, it is necessary in some cases to treat only the fine particle size coal fraction in order to substantially reduce the sulfur content of the entire coal stream upon blending. And second, a very small amount of soluble sulfite is required, that is about 0.005–0.05 weight per cent based on treated coal or about 0.1–1.0 pounds of alkali metal sulfite per ton of coal. In fact, higher concentrations did not perform as well as concentrations in this range or a preferred range of up to about 0.8 pounds of sulfite per ton of coal.

Any conventional flotation apparatus and system can be used for the process and to produce low sulfur coal of this process. Any flotation apparatus in which the coal, an aqueous liquor phase and a flotation gas, such as air are vigorously mixed forming a froth which rises to top of the liquor phase can be used. The coal laden

froth is skimmed from the cell and the liquor phase with suspended gangue materials is withdrawn from the lower portion of the cell. Certain suspended coal particles are attached to flotation gas, are lifted to the froth and removed from the trough with the overflow. Various conventional additives such as hydrocarbon oils and surfactants can be used to increase froth formation, increase flotability of particular particles or to modify the process. The flotation cell can have any of various configurations and can be multiple cells with various flow arrangements.

The basic improvement of the process of this invention comprises the addition of sulfite to the flotation pulp to depress flotation of pyrite thereby causing a substantial portion of the pyrite to be removed from the cell in the liquor phase and from the coal in the froth. Substantially or a substantial portion is used herein to mean a significant reduction of the pyrite that would otherwise be floated in the fine particle fraction. The sulfite used in the process of this invention can be any compound or salt which forms a soluble sulfite ion in the flotation cell. In fact, the sulfite ion is preferably formed in or added to the flotation cell immediately prior to its use to prevent oxidation of the sulfite ion so that it is no longer effective. Soluble sulfide forming compounds can also be used. Preferred sulfites and sulfides are salts of a soluble alkali metal, an alkaline earth metal (especially sodium and potassium) and mixtures thereof. Obviously, additives which interfere with the sulfite or sulfide ion should be avoided and conventional additives that do not interfere can be used. Reference herein to sulfite includes sulfide and equivalents.

The fine particle size coal fraction which can be treated by the process of this invention is limited only by the flotation ability of the particular apparatus and system used. In other words any fine particle size coal fraction can be treated which is suitable or amenable to flotation. A preferred particle size consists of particles that will pass through a screen having about 28 U.S. Tyler Sieve Size opening. This size fraction can be separated from coarser fractions by hydroclassification to give a fraction of about 28 mesh.

The following examples illustrate the process of this invention with parts, percent, ratio and concentrations given by weight unless indicated otherwise.

EXAMPLE 1

Two types of –28 mesh fractions of partially oxidized middle Eagle strip coal and a high pyrite coal from Rowland Div. mine of Consolidation Coal Company are thoroughly blended and divided into ten samples. Each sample has 8.17 percent total sulfur and 5.82 percent pyrite sulfur. Each sample is added to the liquor of a Wemco Fagergren flotation cell with an agitator rotation of 1,500 RPM at 8 percent pulp density and agitated for three minutes. Flotation reagents, kerosene and isohexanol, are added and agitated for 30 seconds before air is added to the cell. Sulfite is added as sodium sulfite at four different concentrations giving 5 pairs of samples at 0, 1.0, 0.25, 0.5 and 1.0 pound of sulfite per ton of coal. Each sample is subjected to flotation until the froth contains no coal. The results are given in Table 1 and the average pyrite concentration versus pound of sulfite per ton is shown in the drawing.

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Table I

Sample	Sodium Sulfite (Lbs./Ton)	Percent Recovery	Percent Pyrite	Average
1	0.0	79	3.15	2.79
2	0.0	76	2.42	
3	0.1	75	2.42	2.31
4	0.1	75	2.20	
5	0.25	73	2.08	2.15
6	0.25	74	2.21	
7	0.5	74	2.21	2.25
8	0.5	74.5	2.29	
9	1.0	76	2.33	2.50
10	1.0	74.5	2.67	

I claim:

1. A froth flotation process for reducing sulfur concentration of a coal containing pyrite comprising mix-

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ing in a flotation cell a fine particle size fraction of said coal with an aqueous media and a flotation gas in the presence of a soluble salt of a metal cation and an anion capable of forming sulfite in an aqueous media
5 whereby the fine coal particles are removed from the cell in froth and pyrite flotation is depressed with a substantial portion of the pyrite being removed from the cell in the liquor phase and recovering said coal having a reduced sulfur concentration.

10 2. A process of claim 1 in which the metal is an alkali metal or an alkaline earth metal.

3. A process of claim 1 wherein the soluble salt is added to the aqueous media in the ratio of about 0.1-1.0 lb/ton of coal and the soluble salt is capable of
15 forming in an aqueous media an alkali metal or an alkaline earth metal cation and a sulphite anion.
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