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PROCESS OF CONCENTRATING ORES AND MINERALS BY FLOTATION.

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This invention relates to the concentration of ores, minerals and the like, by differential flotation, and is more particularly adapted to the separation of lead sulfide and zinc sulfide from each other and from other substances in the ores or minerals containing same.

It is known that the thiazoles are valuable as flotation reagents, and their use has been attended with notable success. Many other substances or combinations have been used as flotation reagents and, in some of the combinations used, a soluble sulfite has been included.

It has been found, according to the present invention, that the use as a flotation reagent, of a thiazole compound with the addition of a soluble sulfite gives excellent results not attained by the use of either of the substances alone or in other combinations.

This invention is for a process of concentrating, by flotation, ores and minerals containing lead sulfide with or without zinc sulfide, and comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a thiazole compound and a soluble sulfite.

As a specific example of carrying out the flotation operation according to the present invention, the following procedure may be used: Using Sullivan Mining and Concentrating Company ore, I grind 500 grams of the ore with 350 cc. of water and .75 grams of sodium carbonate in a ball mill for one-half hour. The mixture is then diluted to 40% solids, and to this pulp is added a sodium salt of mercapto-benzo-thiazole (.03 pounds per ton of ore), pine oil (.08 pounds per ton), and sodium hyposulfite (.40 pounds per ton). The entire mixture is preagitated or conditioned for one minute. Following this the pulp is diluted to allow circulation and froth formation. A lead rougher concentrate froth is removed for three minutes. At the end of the lead period copper sulfate is added in the proportion of one pound per ton, and the agitation is continued for one-half minute. Additional sodium salt of mercapto-benzo-thiazole is added in the proportion of .12 pound per ton and the flotation operation is continued, removing the zinc froth for ten minutes. The results obtained are given in column 1. Column 2 represents an identical treatment of the same ore, with the exception that the flotation operation is carried out without using the hyposulfite.

	Column 1. With sulfite.	Column 2. Without sulfite.
Lead rougher concentrate:		
Per cent weight of heads	8.4	13.7
Per cent Pb	54.5	37.0
Per cent Pb recovery	77.7	86.4
Per cent Zn	12.1	20.1
Per cent of total Zn	13.0	35.4
Zinc rougher concentrate:		
Per cent Zn	46.0	38.3
Per cent of total Zn	76.5	60.5

It will be evident from the above results that the sodium hyposulfite has a pronounced depressing effect on the flotation of the zinc sulfide during the lead flotation period. It is also found that by using the sulfite in the flotation operation the lead concentrate is much cleaner in that it contains much less foreign matter than is the case when the sulfite is not used.

The following thiazole compounds are some which have been found of value in carrying out the flotation operation of the present invention: mercapto benzo thiazole, 1-mercapto-3-methyl-benzo thiazole, mercapto naphthyl thiazole, benzo thiazole disulfide, zinc mercapto benzo thiazole, sodium mercapto benzo thiaole, potassium mercapto benzo thiazole, calcium mercapto benzo thiazole, zinc mercapto-3-methyl benzo thiazole and benzo thiazole mono-sulfide.

It has been found that a frothing agent is generally necessary in carrying out the flotations according to the present invention. The flotation process may be carried out according to the present invention in any of the usual circuits, but has been found to be particularly adapted to use in alkaline and neutral flotation circuits.

In carrying out my flotation operation with ore from the Bingham property of the U. S. Smelting Refining & Mining Company, the same general procedure was carried out

as just described using sodium mercapto benzo thiazole and sodium sulfite. The results obtained were as follows:

Lead rougher concentrate.

Na M. B. T. lbs. per ton	Per cent wt.	Per cent Pb.	Recovery		Ratio Pb:Zn.	FeS₂+ Gangue per cent by weight
			Pb.	Zn.		
.067	34.5	68.9	87.0	54.6	9.7:1	11.0
.100	30.7	64.0	94.3	53.2	10.8:1	17.1

The last column represents that part of the lead rougher concentrate which is not galena or sphalerite. Examination shows that it consists very largely of pyrite.

After removal of the lead sulfide, the zinc sulfide can, in general, be floated by adding to the pulp copper sulfate or some other agent which destroys the deadening action of the sulfite. It is also usually necessary to add more of a collecting agent and a frothing gent.

In the case of ores containing, in addition to the sulfides of lead and zinc, iron sulfide, the latter may be floated by a further addition of a collecting agent and a frothing agent to the tailings from the zinc sulfide flotation.

The amounts of flotation agent and soluble sulfite which are required to obtain the best differential flotation results will depend largely upon the character of the ore treated, and may vary within wide limits.

Any suitable soluble sulfite may be used in carrying out the process but it has been found that the alkali metal sulfites, and particularly sodium sulfites such as sodium hyposulfite are valuable because of their ready availability and comparative cheapness.

Any suitable and desired variations may be made in details of the process, or in the specific substances used and the conditions under which they are used, without departing from the spirit and scope of the present invention.

I claim:

1. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a thiazole compound and a soluble sulfite.

2. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of an aryl thiazole compound and a soluble sulfite.

3. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a benzo thiazole and a soluble sulfite.

4. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a sodium salt of a benzo thiazole and a soluble sulfite.

5. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a mercapto benzo thiazole and a water-soluble sulfite.

6. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a sodium salt of a mercapto benzo thiazole and a water-soluble sulfite.

7. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a sodium salt of a mercapto benzo thiazole and a sodium sulfite.

8. In the process of concentrating ores and minerals by flotation, the step which comprises subjecting the ore in the form of a non-acid pulp to a flotation operation in the presence of a thiazole compound and a soluble sulfite.

9. The improvement in a process for separating lead sulfide and zinc sulfide from ores containing same and from each other by flotation, which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a thiazole compound and a soluble sulfite, thereby removing the lead sulfide and leaving a residue containing the zinc sulfide, mixing with the residue additional flotation reagent and a substance capable of counteracting the depressing effect of the sulfite upon the zinc sulfide, and recovering the zinc sulfide by subjecting the mixture to a further flotation operation.

10. The improvement in a process for separating lead sulfide and zinc sulfide from ores containing same and from each other by flotation, which comprises subjecting the ore in the form of a pulp to a flotation operation in the presence of a thiazole compound and a soluble sulfite, thereby removing the lead sulfide and leaving a residue containing the zinc sulfide, mixing with the residue additional flotation reagent and copper sulfate, and recovering the zinc sulfide by subjecting the mixture to a further flotation operation.

In testimony whereof I affix my signature.

CARROLL C. SMITH.