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## FLOTATION RECOVERY OF MOLYBDENITE

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This invention relates to the separation of molybdenite from flotation concentrates containing small amounts of molybdenite and larger amounts of the sulfides of other metals.

The major source of the metal molybdenum is the mineral molybdenite ( $\text{MoS}_2$ ) which occurs frequently as a minor constituent of ores containing copper, iron and other sulfides. Such ores are usually treated by flotation to concentrate the mineral content, and various methods have been proposed for separating the molybdenite from the other metal sulfides in these concentrates.

The other methods heretofore known, however, have involved procedures which are not entirely satisfactory for one reason or another. For example, some procedures involve steaming or roasting of the flotation concentrate, which is a difficult and unduly expensive operation unless the amount of molybdenite to be recovered is quite substantial. Other methods involve depressing the molybdenite into the tailing, but in general these methods do not produce an efficient recovery of this mineral.

One object of our invention is to provide a process of recovering molybdenite from mixed sulfide flotation concentrates by a simple economical procedure that does not require steaming, roasting or the use of large amounts of fresh water for repulping the concentrate.

A further object of our invention is to condition a mixed sulfide flotation concentrate by treatment with an oxidizing agent and to recover molybdenite from the conditioned material by selective flotation.

Other objects and advantages of the invention will be explained or will be apparent from the following description.

It is recognized that mixed sulfide flotation concentrates are not readily susceptible to selective flotation treatment for separation of one sulfide mineral from another without some subsidiary treatment. In the production of the mixed sulfide concentrate by flotation, the collector and frother added to the original ore pulp tend to accumulate in the concentrate, and their adverse effect must be prevented in some way before a controlled selective flotation treatment can be applied successfully to the concentrate. Steaming or roasting of the concentrate is helpful in preventing this adverse effect, but involves necessarily the use of large quantities of heat expensively applied and therefore is not economical if the amounts of molybdenite to be recovered are relatively small. These reagents can be eliminated to some extent by repulping the entire concentrate with fresh water, but such

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a procedure obviously is not feasible in many localities where the ores and concentrates have to be treated, and where fresh water is at a premium.

We have found that a more economical but still efficient method of preventing the adverse effect of the collector and frother in such a mixed sulfide concentrate is to condition the mixed sulfide concentrate with an oxidizing agent. In many cases it is desirable to use along with the oxidizing agent an activated carbon, or a similar material, to reduce the active excess frother, so that in subsequent selective flotation treatment froth can be maintained appropriate for the flotation of the molybdenite when the sulfides of other metals such as copper and iron are being depressed. In general, best results are obtained if the oxidizing agent is added and allowed to condition the concentrate before the selective flotation treatment actually commences.

The particular oxidizing agent used may be any material which acts as an oxidizing agent for the collector under the conditions of application or treatment. For example, certain compounds may require an alkaline or neutral medium in order to be most effective as an oxidizing agent, while other compounds are more effective in an acid medium. For example, hypochlorites and peroxides are very effective in an alkaline medium such as is usually maintained in the treatment of pulps of many copper ores or concentrates. In this connection, the hypochlorites are also economical to use and appear to have a strong and relatively permanent depressing action on the copper and iron sulfides, permitting good separation and recovery of the molybdenite in the froth. Permanganates are also effective in an alkaline medium, but in general such oxidizing agents as dichromates and permanganates are more effective when used in an acid medium. It is also possible to condition an alkaline concentrate by adding to it an oxidizing agent such as potassium dichromate, together with sulfuric acid, and after a suitable conditioning time, such as 5 to 10 minutes, neutralizing the material with soda ash or the like to restore it to the alkaline condition.

It should be kept in mind that in all of these treatments where excess frother is present, it may be desirable, along with the other reagents, to add a sufficient quantity of activated carbon to reduce the frother content.

We have found, for example, that sodium hypochlorite and activated carbon produce good results in the treatment of an alkaline concentrate containing large amounts of copper and iron sulfides with less than 1% molybdenite.