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FROTH FLOTATION

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The present invention relates to froth flotation of minerals like ores, coal or similar matter, during the separation of which one component of the conglomerate is prevented from getting into the concentrate by the addition of depressants. There are various known depressants, as e. g. zinc sulfate, cyanides of alcali or earth alcali metals, sulfites or sulphur dioxide for zinc sulfide minerals, calcium oxide for iron sulfide ores, sodium carbonate, sodium silicate, calcium oxide and iron cyanide for copper ores, bichromates, phosphates or arsenates for lead sulfide ores, citric acid, copper sulfate, lead nitrate or sodium silicate, sodium carbonate and monosodium-ortho-phosphate for quartz.

It is further known to use several depressants simultaneously. When working up, e. g., lead-sulfide-zincsulfide-ores the main components of which are galena and zinc blend, the former is separated by floating with xanthates in the presence of suitable frothers, whilst the zinc sulfide is depressed by the addition of sodium cyanide and zinc sulfate. The use of the mixture of several depressing agents is based on the fact that these depressants react with each other under the formation of reaction products which exert an especially strong depressing effect. In the example as above the two soluble compounds sodium cyanide and zinc sulfate are converted into soluble sodium sulfate and insoluble zinc cyanide. This zinc cyanide precipitates superficially at the zinc blend which is to be depressed, preventing this from getting into the concentrate.

According to the present invention it has been found that the separation of the compounds of the minerals to be floated with the help of cyanides of alcali or earth alcali metals as depressants together with one or more other depressants is much improved, if the two or more depressing agents are added not at the same time but one after the other.

According to my invention the cyanide is added to the pulp only after the flotation, for which sofar the other depressants have been employed, has advanced to such a degree that a considerable quantity of the concentrate has already separated. Preferably the cyanide is added when the concentrate is beginning to contain essential quantities of the components to be depressed.

When working up lead-zinc-sulfide ores by frothing, at the beginning of the flotation process zinc sulfate is added in order to depress zinc sulfide. During flotation the amount of zinc sulfide contained in the lead concentrate is observed. This contents having increased noticeably sodium cyanide is added and the flotation process is continued. Thus separation of the two components in a high percent concentrate and with excellent yields is guaranteed.

The new process is especially suitable for working up ores the separation of which is difficult, as e. g. lead-zinc-ores containing copper with a high content of zinc. A further advantage of my process consists in a considerable amount of flotation agents being saved. It hitherto being necessary to increase the depressing effect by a considerable increase in concentration of the depressants simultaneously used, according to the invention only smaller quantities of the depressants, which are to be employed successively, suffice to obtain the same effect. At the same time such high concentration of the depressants is avoided, as will cause as well depressing of the ore component to be floated out.

Furthermore I may first use a mixture of two or more depressants and afterwards a mixture of the same depressants, chosing, however, different proportions. In the first mixture the one depressant, in the second mixture the other depressant is predominant. Of course only such depressants are to be employed, which, by mutual reaction, do not become inactive.

Examples

1. A copper-lead-zinc-ore containing 16% lead, 13% zinc and 4.5% copper was ground to 0.1 mm and then suspended and floated with water in the ratio of one part solids to 4 parts liquid. The flotation was performed with potassium xanthate as collector for the galena and a mixture of pine oil and tar oil as frother. Zinc sulfate and sodium cyanide were added in order to depress the zinc blend. In one case the two depressants were added simultaneously, whereby a mixture of 4 kg zinc sulfate and 0.5 kg sodium cyanide per 1000 kg ore was used. In a second case the depressants were, according to my invention, added one after the other, viz. firstly 1.5 kg of zinc sulfate and afterwards 0.1 kg sodium cyanide.

The zinc concentration thus obtained in the first case contained 51.2% zinc and 9.5% lead, whilst in the second case, in which the depressants were added successively, in spite of the remarkably decreased quantities of the depressants the contents of the zinc concentrate increased up to 56.2% zinc and the contents of lead decreased to 4.5%. This excellent separation according to my invention requires only 0.14 kg potassium xanthate per 1000 kg ore, compared with 0.2 kg potassium xanthate which are re-

quired in case of the two depressants being added at once in the usual manner.

2. A zinc-copper-ore is wet ground to 200 mesh and then floated in usual manner, whereby 200 g zinc sulfate and 150 g. sodium cyanide per 1000 kg ores are added simultaneously as depressants for the zinc blend. At first a copper concentrate is floated out with the help of sodium-ethyl-xanthate and pine oil, whereupon, after the addition of copper sulfate for the reactivation of the zinc blend, a zinc concentrate is floated out. There are obtained, firstly a copper concentrate containing 20.13% copper and 10.7% zinc and secondly a zinc concentrate containing 43.8% zinc and 1.82% copper.

According to the invention in a second case the same pulp was floated by adding first 200 g zinc sulfate per 1000 kg ores, in order to depress the zinc blend, floating out a part of the copper concentrate, then—before the flotation of copper has been completed—adding 150 g sodium cyanide per 1000 kg ores, subsequently completing floating out of the copper and finally floating out the sulfide component, which has been reactivated by adding copper sulfate. The copper concentrate obtained by this improved proceeding assayed 21.4% copper—that is an increased contents of copper—and 8.6% zinc, that is an decreased content of zinc. Further there is obtained a zinc concentrate containing 46.7% zinc, that is an increased content of zinc—and 1.75% copper—that is a decreased content of copper.

3. An ore comprising the sulfides of lead and iron is floated, similarly to Example 2, with sodium ethyl xanthate and pine oil, 1.4 kg lime and 100 g sodium cyanide being employed as depressants for pyrite. In one case the depressants were added at the same time. In this case a lead concentrate was collected containing 72.54% lead and 4.21% iron, and a pyrite concentrate, containing 40.23% iron and 2.10% lead. When working according to the invention the depressants were added one after the other. The lead concentrate contained 73.61% lead, that is more lead, and 2.82% iron, that is less iron, whilst the pyrite concentrate contained 42.40% iron, that is more iron, and 2.07% lead, that is less lead, compared with the first case.

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