

The Influence of Certain Inorganic Salts on the Flotation of Lead Carbonate

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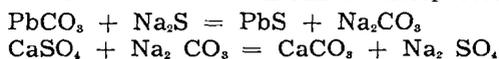
IT is found when floating oxidized lead ores by sulphidization, that the presence of calcium salts in the water, is usually detrimental and lowers the recovery.

This effect is particularly marked in dry countries such as North Africa, where the waters often carry large amounts of calcium sulphate and where the ore may even contain gypsum.

The effect of calcium salts is readily visible. Whereas in their absence cerussite is quickly stained brown and then black by sodium sulphide, in their presence the mineral remains very light in color. A similar effect is produced when barium sulphide is used as a sulphidizing agent instead of sodium sulphide. Magnesium salts have little or no effect and even tend to reduce the detrimental effect of calcium salts.

A study of this phenomenon indicates that it is due to the precipitation of calcium or barium carbonate in contact with the mineral simultaneously with the formation of lead sulphide.

The chemical reactions can be interpreted as:



They might also be written:



The precipitation of calcium carbonate can be followed by the lowering of the pH with which it is accompanied. Magnesium carbonate is more soluble than calcium carbonate and usually does not precipitate under the conditions prevailing.

It is interesting to note that calcium salts have no effect on anglesite (lead sulphate) because calcium sulphate is soluble, but barium salts hinder the sulphidization of anglesite because of the precipitation of barium sulphate.

Remedies

When calcium sulphate is present in large amounts, the softening of the water with soda ash is usually too expensive to be considered, but the precipitation of the objectionable calcium carbonate can be prevented in two different ways.

One is the use of sodium hydrosulphide instead of sodium sulphide. This salt gives a lower pH than sodium sulphide and does not bring about the immediate precipitation of the calcium which remains in solution as calcium bicarbonate.

The other procedure is to add ammonium salts such as the sulphate or chloride which have the property of increasing markedly the solubility of calcium carbonate. Ammonium salts have other

effects such as cutting down conditioning time and accelerating flotation. They should be added to the flotation cells rather than to the ball mills.

Table I. Effect of Sodium Hydrosulphide and/or Ammonium Sulphate on the Flotation of Two Oxidized Lead Ores

| Reagents | Mibladen Ore ^a | | La Plagne Ore ^b | |
|--|-----------------------------|-------------------------|-----------------------------|-------------------------|
| | Con- centrate Pb, Pct | Tail- ing Pb, Pct | Con- centrate Pb, Pct | Tail- ing Pb, Pct |
| Without addition of CaSO ₄ | | | | |
| Na ₂ S | 56.0 | 0.68 | 43.4 | 0.65 |
| NaSH | 56.2 | 0.60 | 40.4 | 0.50 |
| Na ₂ S + (NH ₄) ₂ SO ₄ ^c | 54.6 | 0.56 | | |
| NaSH + (NH ₄) ₂ SO ₄ ^d | | | 43.0 | 0.66 |
| With addition of 40 lb/ton CaSO ₄ | | | | |
| Na ₂ S | 39.4 | 3.85 | 34.0 | 3.21 |
| NaSH | 49.1 | 0.70 | 49.6 | 0.88 |
| Na ₂ S + (NH ₄) ₂ SO ₄ ^c | 53.9 | 0.85 | | |
| NaSH + (NH ₄) ₂ SO ₄ ^e | 51.0 | 0.45 | 41.1 | 0.78 |

^a Mibladen ore, 7 pct Pb, 80 pct of which is oxidized. Flotation of galena with 0.1 lb per ton amyloxanthate. Flotation of cerussite with 7 lb per ton Na₂S; 60 pct or the equivalent amount of NaSH. Four additions of 3.0, 2.0, 1.0, 1.0 lb per ton; and 0.5 lb per ton amyloxanthate in two stages.

^b La Plagne ore, 6 pct Pb, mainly oxidized. Flotation of galena with 0.08 lb per ton amyloxanthate. Flotation of cerussite with 7 lb per ton Na₂S; and 60 pct or the equivalent amount of NaSH; 2 lb per ton sodium silicate; 0.32 lb per ton amyloxanthate.

^c 12 lb per ton. ^d 4 lb per ton. ^e 8 lb per ton.

In table I are given the results of representative tests on two different oxidized ores. They show that the strongly detrimental effects of calcium sulphate can be offset by the two procedures outlined above.

Sodium hydrosulphide is now used regularly on a mill scale on certain ores.

Tests are being carried out with ammonium salts.

It should be noted that malachite is subject to influences similar to cerussite.

One final word of caution—when the ore is rich in primary slime, which is flocculated by the calcium salts, it may be indispensable to remove these by washing or precipitation with sodium carbonate instead of keeping them in solution by the above methods.

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