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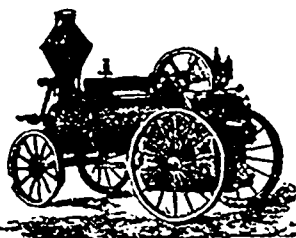
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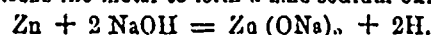
THE CHEMISTRY OF THE CYANIDE PROCESS.

Written for the Engineering and Mining Journal by Chas. Butters, Ph. B.,
and John Edward Clennel, B. Sc.

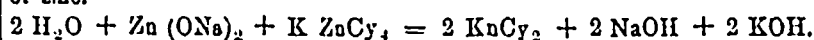
(Continued.)

There are reasons for believing that the black deposit formed on the zinc shavings is an actual chemical compound of gold and zinc, which acts as the negative element in the electric couple, the undecomposed zinc forming the positive element.

When strong solutions of caustic acids have been used for neutralizing the acid salts of the ore a white deposit is frequently observed on the zinc. The alkali first attacks the metal to form a zinc-sodium oxide:



This then reacts on the double cyanide of zinc and potassium always present in the solution, and precipitates the white insoluble simple cyanide of zinc.



This reaction is of some importance as affording one means by which the excessive accumulation of zinc in the solutions is avoided.

Affinity of Zinc for Cyanogen.—Potassium auric-cyanide (KAuCy_2) appears to be one of the most stable of the salts of gold, but the reaction in the zinc boxes shows that the affinity of zinc together with potassium for cyanogen is greater than that of gold with potassium for the same radicle. Hence a solution of potassium cyanide cannot dissolve gold which is in contact with zinc; neither can gold replace zinc in a solution of the double cyanide of zinc and potassium. So long as any zinc is present, therefore, we need not fear that the precipitated gold will redissolve in the excess of potassium cyanide flowing through the boxes.

It is evident also that the cyanogen contained in the double cyanide of zinc and potassium is not available for dissolving gold, and when a solution charged with zinc is employed in the treatment of a fresh lot of tailings it is only effective in so far as it contains a certain quantity of simple cyanide of potassium or other alkaline cyanide.

New Methods of Precipitation.—The cyanides of sodium and ammonium, and those of the alkaline earth metals (calcium, barium, etc.) will dissolve gold, as well as potassium cyanide. Sodium cyanide is more difficult to manufacture than the potassium compound, but a given weight of it should be more effective than the same weight of potassium cyanide, since 49 parts of the former are equivalent to 65 parts of the latter.

The advantage of Molloy's process and others which employ sodium or potassium amalgam was pointed out in our previous paper. The alkali metal is obtained by the electrolysis of the carbonate between electrodes of lead and mercury:

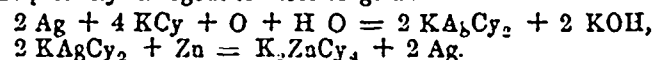


The sodium forms an amalgam with the mercury. Sodium amalgam may also be manufactured direct from its elements. It is claimed for this method of precipitation that the whole of the cyanogen is restored to a condition in which it is available for dissolving gold, as shown by the reaction:



Composition of the Zinc Slimes.—Any base metals which happen to be in solution in the cyanide liquor are liable to be precipitated by the zinc along with the gold. Hence the "zinc slimes" are found to contain a certain percentage of copper as well as traces of arsenic and antimony. Moreover, any impurities in the zinc will also find their way into the slimes, as zinc will be dissolved by the cyanide in preference to any less oxidizable metals (e. g., tin and lead.)

Silver is dissolved by cyanide and reprecipitated by zinc by a set of reactions precisely analogous to those of gold:



It has been observed that the proportion of silver to gold is greater in the "cyanide bullion" than in the gold from the batteries, and this is explained by supposing that the loss of silver in amalgamation is greater than that of gold.

Treatment of Zinc Slimes.—The removal of the zinc is a troublesome operation and is only very partially carried out in smelting the dried slimes. The admixture of sand is made for the purpose of forming a fusible silicate of zinc. A portion of the zinc is volatilized, and burns at the mouth of the crucible with a greenish flame, producing the white oxide ZnO , which is found incrusting the flues, and doubtless carries with it no inconsiderable quantity of gold and silver. The most promising method of treating these slimes appears to be that suggested by Mr. Bettel, of fluxing with acid sulphate of soda and fluor spar.

Attempts to remove the zinc prior to smelting have been only partially successful, as all such methods involve the filtration of a slimy mass which retains soluble salts with great tenacity.

The slags from the fusion of the zinc-slimes contain a considerable amount of gold, some of which is in the form of round shots, and may be removed by pounding up the slag, passing through a coarse sieve and "panning off." The residue from the first fusion should always be fused again, with addition of lead, to form an alloy with the gold. The same lead-bars may be used for a number of successive fusions of the slag, and when sufficiently enriched the gold may be recovered from them by cupellation.

(To be concluded.)

If you are at all curious to try something new, write Percy J. L. Lear, Atlantic City Manufacturing Association, 221 Barrington St., Halifax, for particulars.