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METHOD OF ROASTING REFRACTORY MANGANESE-PRECIOUS METAL ORES

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This invention relates to the treatment of refractory manganese ores and more particularly is concerned with an improved method of treating such ores so as to make the precious metal content thereof amenable to cyanidation.

The refractory nature of manganese ores containing gold and silver values is well known and it is also known that such ores when subjected to certain specific heat treatment operations make the precious metal content thereof amenable to cyanidation.

It has heretofore been proposed to roast such ores in the presence of a reductant as coking coal. While this treatment is effective in the case of some ores in increasing the recovery of the precious metal content by a subsequent cyanidation step, other ores do not respond well to this method of treatment. There remains, therefore, a need for an improved means for recovering precious metals in refractory combination with manganese permitting a high recovery of the precious metal content. In accordance with the present invention, we have discovered that a cellulosic-type material such as wood products and woody materials such as wood sawdust, green wood chips, small wood blocks, wood tar, etc. when used as a reductant in the roasting process effects a greatly increased recovery of the precious metal values, usually averaging better than 80% recovery. The mechanism that takes place when wood is used as a reductant in this type of reducing roast is not fully known and, therefore, the present invention is not limited to any theory of action. It is possible, however, that the volatile products resulting from the destructive distillation of the wood is responsible in some not well understood manner for reducing the manganese ore to a lower oxide so as to make the reduced ore especially amenable to cyanidation, with the result that the recovery of the precious metal content is increased considerably over that obtained when the reductants of the prior art are used.

In carrying out the present invention, it is necessary only to charge the ore to a suitable furnace, add thereto the desired quantity of cellulose material such as wood either in the form of wood chips, wood blocks, wood tar, sawdust, etc. and heat the charge in the absence of air to a temperature at which the wood is destructively distilled. The reduced ore is thereafter cyanided in the usual manner.

Roasting temperatures ranging upwards from about 400° C. have given satisfactory results. In general, however, it is rarely necessary to roast the charge much above 450° C., because at this temperature the volatile products from the destructive distillation of the wood have been driven off and which reduce the ore so as to make it amenable to subsequent cyanidation. The length of time the charge is heated is not unduly critical and need not be beyond the minimum time required to complete the reaction.

The amount of wood used as a reductant in the roasting process is also not unduly critical, although sufficient wood must, of course, be present so that the required

amount of volatile products are released to effectively reduce the manganese minerals. Satisfactory results have been obtained when the weight of the wood amounts to from about 1% to about 10% of the weight of the ore, depending on the type of wood and the manganese content of the ore.

After the charge has been heated sufficiently to effect the desired reduction of the ore, the charcoal is preferably removed by screening or other suitable means and recovered as a by-product. The reduced ore is then subjected to cyanidation in the usual manner. Any fine, abraded charcoal not removed prior to cyanidation may be recovered following cyanidation if the charcoal is found to contain adsorbed precious metal values.

It is also within the scope of the present invention to destructively distill the wood in a separate chamber, and conduct all of the distillation products to the furnace in which the ore is to be reduced. This procedure may be preferable in cases where the danger of loss of values by adsorption on charcoal presents a problem.

The invention will be described in greater detail in conjunction with the following specific examples.

Example 1

A manganese-silver ore assaying 51.2 oz. silver and 21.4% manganese was ground to 7.8% plus 100 mesh. The ore was cyanided at a solution strength of between 0.075% and 0.1% NaCN equivalent in the form of commercial grade calcium cyanide, and 0.019% to 0.022% CaO for a period of 48 hours at a pulp density corresponding to 25% solids with the usual aeration. At the end of 24 hours of cyanidation 17.5% silver was recovered and at the end of 48 hours an additional 3.7% silver was recovered making a total silver recovery of only 21.2%.

Example 2

The same manganese-silver ore described in Example 1 was crushed to minus 10 mesh and charged to a rotary kiln-type furnace modified to exclude outside air. 10% by weight of fine wood dust was added to the charge and the charge was heated at 700° C. for 2 hours. The charcoal was not removed from the ore. The reduced ore was cyanided as described in Example 1. At the end of 24 hours of cyanidation, 71.3% silver was recovered and at the end of 48 hours an additional 10.3% silver was recovered bringing the total silver recovery to 81.6%.

Example 3

For comparative purposes, a second portion of this same ore was reduced at 700° C. with 10% by weight of coking coal and the residue cyanided as above. The total silver recovered after 24 hours of cyanidation amounted to only 36.3%.

Example 4

A refractory manganese-silver ore from a third source crushed to minus 10 mesh and assaying 46.5 oz. silver and 2.9% manganese was charged to the previously described furnace. 10% by weight of pine wood blocks about ¾" x ¾" x 1½" in size were added to the charge and the ore was reduced at 700° C. as in Example 2. The reduced residue was cyanided as in Example 1 and after 24 hours of cyanidation the silver recovery amounted to 58.9% and after 48 hours an additional silver recovery of 22.2% was obtained giving a total silver recovery of 81.1%.

Example 5

Another sample of the ore as described in the preceding example was charged to a suitable furnace. 1% by weight of wood as used in Example 4 was added to the charge and the ore was reduced at 700° C. as in the preceding

example. After 48 hours of cyanidation, the total silver recovery amounted to 78.8%.

Example 6

A refractory manganese-silver ore crushed to minus 10 mesh and assaying 27% manganese and 30.0 oz. silver was charged to a suitable furnace. 5% by weight of pine wood tar was charged to the ore and the ore was reduced at 500° C. for 2 hours. The reduced residue was cyanided as in Example 1 and after 24 hours of cyanidation 62.6% silver was recovered and after an additional 24 hours of cyanidation an additional silver recovery of 14.2% was obtained, giving a total silver recovery of 76.8%.

Example 7

Another sample of the ore as described in Example 6 was charged to a suitable furnace. 5% of pine wood blocks were added and the ore was reduced at 450–500° C. for 2 hours. The reduced residue was cyanided for 48 hours and gave a silver recovery of 77.2%.

We claim:

1. In the process of roasting refractory manganese-precious metal ores in the presence of a reductant which serves to reduce the ores under non-chlorinating conditions so as to permit the recovery of the precious metal content thereof by cyanidation, the improvement which comprises forming a mixture consisting essentially of said ores and a reductant selected from the group consisting of wood and the wood tar resulting from the destructive distillation of wood, heating said mixture in the substantial absence of air at a temperature of from about 400° C. to about 700° C., the volatile products from said reductant serving to reduce said ores in a manner so as to make the precious metal content thereof more amenable to recovery by cyanidation.

2. The process according to claim 1 in which the manganese-precious metal ore is a manganese-silver ore.

3. The process according to claim 2 in which wood tar is used as the reductant in the reducing roast.

4. The process according to claim 2 in which pine wood is used as the reductant in the reducing roast.

5. The process according to claim 4 in which the reductant is present to the extent of from about 1% to 10% by weight of said ores.

References Cited in the file of this patent

UNITED STATES PATENTS

43,016	Stevens	June 7, 1864
52,120	Absterdam	Jan. 23, 1866
205,536	Fryer	July 2, 1878
229,509	Williams	June 29, 1880
900,452	Wadhams et al.	Oct. 6, 1908
900,453	Wadhams et al.	Oct. 6, 1908
1,232,216	Caron	July 3, 1917
1,234,426	Vermaes	July 24, 1917
1,864,222	Swainson et al.	June 21, 1932
2,200,563	Simpson	May 14, 1940
2,234,378	Loring	Mar. 11, 1941

FOREIGN PATENTS

531,118	Great Britain	Dec. 30, 1940
635,904	Great Britain	Apr. 19, 1950