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PROCESSING ISSUES WITH HIGH SILVER GOLD ORES

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ABSTRACT

Merrill Crowe preceded Carbon In Pulp (CIP) technology and is now only used for very high grade gold projects or where the silver to gold ratio exceeds ten to one. CIP technology is generally more efficient and cost effective for lower grade ores whereas Merrill Crowe is superior for high grade silver ores.

Gravity processes are not as efficient for high silver ores as for gold. Metallic silver or electrum can be recovered at modest recoveries whereas acanthite (Ag_2S) exhibits poor gravity recovery even with centrifugal concentrators.

Leaching of high silver ores requires significantly higher cyanide (>1500 ppm) and oxygen levels and extended leach times (>72 hours). Usually the recovery is lower than for gold.

The adsorption capacity needs to be higher for high grade silver ores with a larger inventory of carbon and more carbon movement. Carbon activity and solution loss become more critical with a general requirement for more adsorption stages in order to achieve equilibrium.

Silver elutes first from the carbon and at a lower temperature. These conditions are at odds with the gold elution. Generally, operations optimise to maximise gold recovery from the carbon. The silver cyanide complex ($Ag(CN)_2^-$) is less stable than gold cyanide ($Au(CN)_2^-$) and breaks down at the lower temperature and forms metallic silver which remains on the carbon. This has a negative impact on carbon activity and hence solution loss.

Where high silver values are present during electrowinning, the cathodes can be washed with high pressure water and the electrowon gold and silver comes off very easily. In adition high sludging of the cell is not uncommon as the dendrites are loosely held. Some designs exploit this feature in self sludging cells.

Conventional processing of silver-bearing materials containing gold group metals involves smelting the material to bullion and purification of the silver by electro refining, along with recovery of gold and platinum group metals from the slimes generated by the electro refining process. An alternative process has been developed that allows extraction of the silver from such residues using a combination of chloride and nitrate chemistry. An advantage of the process is the production of very high-purity silver. A number of examples are cited with the good design aspects highlighted.

Keywords: Silver ores, Gold ores, Precious metal ores, Cementation, Merrill Crowe, acanthite, cyanide leaching, Misima, Waihi, CoO, Kelian.