METHOD FOR PROCESSING RESISTANT GOLD-CONTAINING ORES AND CONCENTRATES

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The invention relates to hydrometallurgical methods for processing refractory gold-bearing ores and concentrates, sludge, in which precious metals are associated with oxides of manganese, copper, lead, nickel. The method consists in processing the initial crushed material with acids (hydrochloric, sulfuric, nitric, hydrobromic, hydroiodic) with the introduction or maintenance of the total concentration of manganese oxides in terms of manganese dioxide 3 - 6 wt % in the presence of a complexing agent (chlorine ion, bromine ion, iodine ion) at T:W=(4-5) at a temperature of 343 – 363 K and a time of 30 - 90 minutes with the transfer of gold and silver into solution. the source material containing manganese of the lowest oxidation states is preliminarily calcined in air at a temperature of 800–825 K, and when processing gold and silver-containing concentrates with a silver content of more than 1 kg/t, selective leaching of silver, the remaining solid phase, is first carried a silver without concentration of less than 1 kg/t is sent for hydrometallurgical processing. To simplify the separation of the solution from the solid phase, ion-exchange sorbents are introduced into the pulpthe technical result of the invention is the creation of an environmentally friendly process for extracting gold and silver from ore, ore concentrates and other refractory materials by replacing the traditional cyanide leaching process with the use of mineral acids, in particular hydrochloric, sulfuricor nitric acids, as well as improving the technical and economic indicators of the process by reducing technological operations and reducing energy intensity.

The technical result of the invention is to simplify the process, reduce energy consumption, eliminate the use of toxic cyanide reagents, as well as increase the extraction of gold and silver from poor ores and concentrates containing refractory oxidized, for example, manganese minerals associated with gold and silver. This is achieved by the fact that in the method of processing refractory silver-gold-bearing materials, ores and concentrates, including hydrometallurgical processing of crushed material with the transfer of gold and silver into solution, separation of the solution from the solid residue, extraction of gold and silver from solution in the form of a commercial product, according to the invention, the initial crushed material is subjected to hydrometallurgical treatment with the introduction or maintenance of a total concentration of manganese oxides in terms of manganese dioxide (pyrolusite) 3-6 wt and hydrometallurgical processing lead with a solution of mineral acid containing a complexing agent with a concentration of 70-150 g/dm^3; while the hydrometallurgical treatment is carried out with a solution of hydrochloric acid containing chlorine ion as a complexing agent; hydrometallurgical treatment is carried out with a solution of sulfuric acid containing as a complexing agent chlorine ion; hydrometallurgical treatment is carried out with a solution of nitric acid; containing as a complexing agent chlorine ion; hydrometallurgical treatment is carried out with a solution of hydrobromic acid containing as a complexing agent bromine ion; hydrometallurgical treatment is carried out with a solution of hydroiodic acid containing iodine-ion as a complexing agent; in addition, hydrometallurgical processing is carried out at T: W equal to 1: (4-5), at a temperature of 343-363 K and a time of 30-90 minutes, and when processing the starting material, containing oxide compounds of manganese with an oxidation state below three, pyrolusite or other natural or synthesized manganese compounds with an oxidation state above three are introduced to maintain the required concentration of manganese oxides in terms of manganese dioxide (pyrolusite) and as natural manganese compounds are used psilomethan, manganite, brownite, hausmanite, kveselite, coronadite, cryptomelan, todorokite, franklinite, also in the processing of the source material containing predominantly manganese oxide compounds of lower oxidation states, the material is

preliminary processed before the transfer of lower oxide compounds to higher ones until the total concentration of higher oxides is reached 3-6 wt. in terms of pyrolusite, and the treatment is carried out by firing in air at a temperature of 800-825 K, to simplify the separation of the solution from the solid residue hydrometallurgical processing is carried out with the introduction of ion-exchange sorbents or activated carbon into the pulp; when processing gold and silver-containing materials with a silver concentration of more than 1 kg/t, preliminary selective leaching of silver with a solution of sulfuric acid to a residual content is carried out silver in the solid phase is not more than 1 kg/t, and then the solid phase is sent to hydrometallurgical processing to extract gold and residual silver. The essence of the method on the example of the use of hydrochloric, sulfuric, nitric acids containing chlorine ion as a complexing agent is as follows. when processing the crushed initial gold and silver-containing material (ore or concentrate), in which the specified (3-6 wt in terms of pyrolusite) concentration of manganese oxides with an oxidation state above three, is maintained with a mineral acid containing a complexing agent, occurs decomposition of manganese oxides and the oxidizing agent molecular chlorine is released, which, in combination with the complexing agent chlorine ion in solution, transfers gold and silver into solution. since the process of decomposition of higher oxides of manganese occurs in time, the resulting oxidizing agent, molecular chlorine, is also released evenly and is also evenly absorbed by the solution, ensuring the transfer of gold and silver into the liquid phase. In other words, the rate of decomposition of higher oxides of manganese in a mineral acid solution is comparable to the rate of assimilation of gaseous chlorine by the solution according to the reaction:

$$Au+3/2Cl_2+Cl\rightarrow AuCl_4$$

The claimed method, instead of highly toxic cyanide reagents, uses solutions of mineral acids with a complexing ion, in addition, significant factors that increase technical and economic performance are that when gold is dissolved in cyanide solutions the concentration of Au in 1 l is not more than 0.001 g, and in the resulting chloride solutions the concentration of gold is up to 1 g/l, i.e. three orders of magnitude higher; gold can be precipitated from cyanide solutions with either zinc

dust or aluminum, but when processing poor ores, an Au-Zn alloy with a gold content of not is obtained as a result more than 5% and further refining has low efficiency rates. The advantage of the claimed method applied to these objects is that the destruction of the refractory components of the ore for the opening of finely dispersed gold is carried out using the oxidizing properties of the refractory components of manganese oxides themselves. according to the claimed method, the obtained gold-silver-containing solutions are much more contaminated with impurities than with the cyanide selective dissolution of gold, but when extracting gold from the solutions richer in gold obtained by the claimed method, precipitation of gold occurs selectively since impurities that have passed into solution during treatment with mineral acids do not precipitate with gold. this reduces the volume of processed solutions by 3-4 times. The method allows to reduce energy consumption, replace toxic cyanide reagents, increase the extraction of gold and silver from low-grade ores and concentrates, together with gold and silver to extract platinum group metals.

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