FLOTATION SELECTION OF ELEMENTARY SULFUR FROM AUTOCLAVE CAKES AFTER LOW-TEMPERATURE LEACHING OF THE STEERING OF THE PYRINT GOLD-CONTAINING CONCENTRATE

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In recent decades, there has been a trend in the gold mining industry - involving in processing poor and, at the same time, quite difficult to dissect stubborn gold-bearing raw materials, including pyrite ores and concentrates. Processing of ores and concentrates in which finely divided gold is associated with sulphide minerals, for example pyrite or arsenopyrite, requires significantly more complex proceses, including operations of gravity and flotation enrichment, roasting, leaching, melting. At present, the possibility of reducing the oxidation parameters of sulphide materials and the use of technology based on low-temperature leaching are being considered. The leaching of sulphide minerals, such as pyrite and arseno-pyrite in an acidic medium, can proceed according to two competing reactions: with the formation of a sulfate ion or with the formation of elemental sulfur. The relatively low temperature of the leaching process (110-120˚C) implies the formation of a significant amount of elemental sulfur, which is highly undesirable, because at temperature above 112˚C, sulfur melts, enveloping particles of fine-grained sulphide minerals (primarily pyrite) in gold, not allowing them to completely pass through the process of oxidation, forming an insoluble residue. If a significant amount of gold is associated with sulphides, it will not be opened during the leaching process and will not be extracted further into the cyanide solution. Also, the entry of sulfur into the cyanidation cycle is accompanied by its interaction with cyanide, which increases the consumption of the latter several times. It is possible to use flotation isolation of elemental sulfur from autoclave cakes after low-temperature oxidative processing of pyritic concentrate in order to obtain dumps for elemental sulfur content, and to reduce the quantity of equipment in subsequent operations.

The flotation process, as well as its results, largely depend on the mineralogical composition, the fineness of the impregnation, the granulometric characteristics of the solid phase, the pulp density and temperature, the composition of the aqueous phase, and the reagent regimen and design characteristics of the flotation machine. Mineralogical composition of cakes after low-temperature autoclave oxidation leaching: 44% quartz, 17% hydrojarosite, 2-3% sulphide minerals (chalcopyrite, galena, stibnite), there are individual grains of pyrite, muscovite and kaolinite. The content of elemental sulfur is in the range from 6 to 7%, represented, in part, by round granules measuring 15-40 μm and lumpy precipitates up to 50 μm in size, some part of elemental sulfur is in submicroscopic state and in mixture with jarosites, clayey substance and residual sulphides. Studies on the flotation processing of autoclave cake after low-temperature oxidative leaching of the persistent pyrite gold-bearing concentrate were carried out according to a single technological scheme, shown in Fig. 1, with varying process parameters.

Technological parameters of conducting a series of experiments on the flotation of elemental sulfur from autoclave cakes: the solid content in the initial pulp is 15%; Flotation reagents-methylisobutylcarbinol or MIBK (collector and foaming elemental sulfur), liquid glass (the depressor of the bulk of nonmetallic minerals), a solution of potassium permanganate KMnO4 (depressant of rutile, titanium, stibnite), a mixture of lime CaO and sulfuric sodium (In the ratio of 2: 1); The total consumption of reagents in the flotation cycle is 200-600 g / t methylisobutyl carbinol, 250-525 g / t liquid glass; The pH of the initial pulp is 2-12. A series of flotation studies were carried out in a laboratory machine of the pneumo-mechanical type of FMZ brand with a chamber of 0.75 liters capacity, the rotor speed of the machine was about 2000 rpm, air was supplied to the flotation machine chamber.

As the studies have shown, gold is distributed among the flotation products in proportion to the distribution of elemental sulfur, although its extraction in the total concentrate is less important than the elemental sulfur. Dependences of gold extraction depending on the distribution of elemental sulfur on flotation products are presented in Figures 2 and 3. During the studies, the dependence of gold losses on extraction and content of elemental sulfur in flotation dumps was established. These dependencies are shown in Figures 4 and 5.

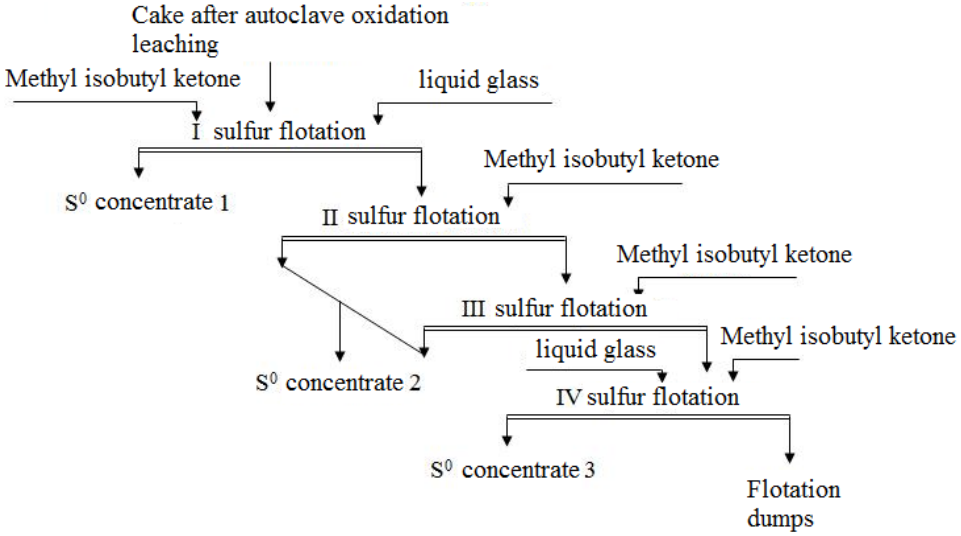

Fig. 1. Technological scheme of flotation of elemental sulfur from autoclave cakes after low-temperature oxidative leaching of pyrite concentrate

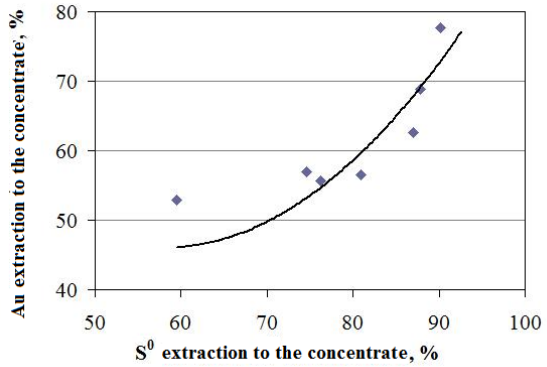

Fig. 2. Dependence of gold extraction in the concentrate from extraction of elemental sulfur in the concentrateт

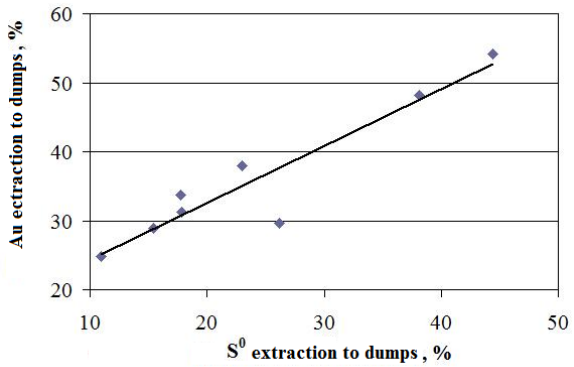

Fig. 3. Dependence of gold extraction in tails from extraction of elemental sulfur in dumps

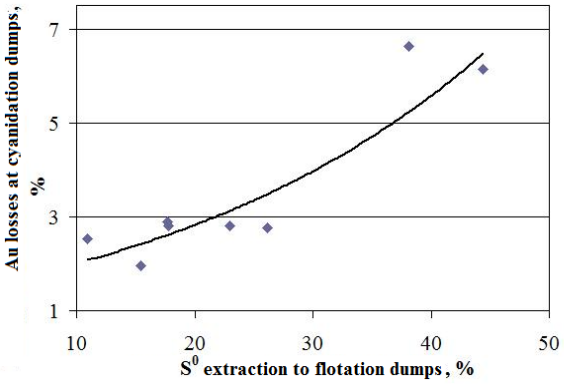

Fig. 4. Dependence of gold losses on cyanidation tails on the extraction of elemental sulfur in dumps of flotation

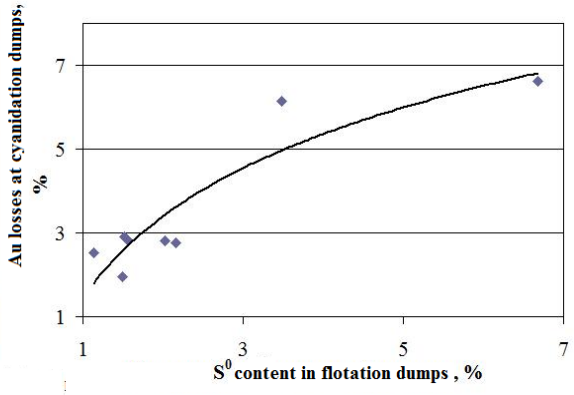

Fig. 5. Dependence of gold losses on cyanidation tails on the extraction of elemental sulfur in dumps of flotation

Thus, an increase in the consumption of reagents at a higher pH of the pulp leads to a decrease in the elemental sulfur content in the dumps of flotation to 1.13 %, but in the total flotation concentrate the sulfur content is low and amounts to only 15.2 %. As a result of the series of flotation treatment of the auto-cake, it was possible to reduce the content of elemental sulfur in flotation tailings from 6 to 3.5 %, which makes it possible to carry out the subsequent cyanidation process with acceptable parameters, while the gold content in the tailings after the cyanidation process Is about 1 g/t.