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(54) Titre : PROCEDE DE TRAITEMENT DE MATIERES PREMIERES MINERALES
(54) Title: METHOD OF MINERAL RAW MATERIALS PROCESSING

(57) Abrégé/Abstract:
The invention relates to methods for extracting noble metals from raw material containing chlorides of alkali metals, for example slurries. The method involves processing cinder in two stages, secondary enrichment by flushing with water at a solid-to-liquid ratio of 1:0.7—2.5 being carried out in the first stage, and then the washed cinder being leached using hydrochloric acid at a solid-to-liquid ratio of 1:2—3.

Translation of Abstract of PCT/RU2009/000458

ABSTRACT

The invention relates to methods of precious metals recovery from raw materials containing chlorides of earth metals, for example slimes. This method consists of the following: the cinder processing is carried out in two steps; at the first step a secondary enrichment by water washing is carried out with the ratio (S:L) = 1:0.7-2.5, then the washed cinder is leached by hydrochloric acid with the ratio (S:L) = 1:2-3.

Translation of Specification of PCT/RU2009/000458

METHOD OF MINERAL RAW MATERIALS PROCESSING

The invention relates to methods of mineral raw materials processing and may be applied to the recovery of precious metals (platinum, palladium, gold, etc.) from various types of mineral raw materials containing chlorides of alkali and earth metals, like slimes of potassium production.

The method of mineral raw materials processing known from a reference book "Technological evaluation of mineral raw materials" (edited by doctor of engineering sciences P.E. Ostapenko, Moscow, publisher "Nedra", 1990, p.98) includes a process of ores enrichment by disintegration (loosening, dispersion) of a clay material which is the part of ores.
The enrichment may be executed either solely by the help of water, or by water and mechanical action of apparatus, or by water and compressed air with the subsequent removal of dispersed portion in the form of slimes. The slimes contain the clay dispersed in water and small ore particles. After the slimes removal the washed product is a granular (loose) material consisting of the ore mineral grains and non-ore mineral grains. Washing is the process of ores enrichment and washing is applied to manganese ores, brown iron ores, chromium ores, etc.

As the disadvantage of this method there is the impossibility of palladium and silver recovery.

The method of potassium production slimes processing (Russian Federation Patent #2132398 RF, published on June 27, 1999) is known.

According to this method, gold-containing slimes are cleaned of salts with the help of water, after which the salt water formed during cleaning, is removed, then fresh water is added to the slimes, and then the produced pulp is chlorinated by chlorine gas while care is taken to ensure that active chlorine content in leaching solution is maintained within 0.3-2.0 g/l. After the leaching process is completed, gold is recovered by a sorption process.

The disadvantages of this method include the need to thoroughly clean the chlorides and use elemental chlorine, a high toxic substance, for gold recovery, and the impossibility of palladium and silver recovery.

From the technical viewpoint, the closest to this invention is the method of precision metals recovery from mineral raw materials (Russian Federation Patent #2291907 RF, MPK7 S228 11/00, published on January, 2006). According to this method the mineral raw materials are cleaned of excess chlorides with the help of water until the chlorides content is within 7-13%, after which the cleaned pulp undergoes concentration and then the concentrated product is dried and roasted at the

temperature of 600-700°C. The precious metals are leached from the cinder using diluted solution of aqua-regia and then recovered from produced pulp by means of sorption.

Disadvantage of this method consists of the following: exclusion (in order to avoid palladium loss with washing solutions due to considerable solubility of its compounds) of washing off operations to remove chlorides leads to the necessity of processing mineral row materials with the high content of chlorides of alkali and earth metals which must be dissolved for precious metals recovery.

As a result, for the cider leaching it is necessary to use high solid-to-liquid (S:L) ratio in order to avoid the chloride crystallization during solutions cooling, and therefore the amount of the equipment for leaching processes and subsequent sorption of metals from the pulp increases considerably.

The said disadvantage is eliminated by means of using the proposed method.

The technical result achieved according to the proposed method consists of decreasing volume of the pulps produced during leaching and therefore the scope of hydraulic-metallurgical equipment decrease for the pulps' processing, and also of increasing recovered precious metals percent, and returning to production process considerable part of the potassium chloride which is lost with the slimes.

To achieve the said technical result in the method of processing mineral raw materials (containing precious metals and chlorides of alkali metals), including enrichment and roasting of the materials, the cider processing is carried out in two steps. At the first step a secondary enrichment with the help of water washing is carried out with the ratio (S:L) = 1:0.7-2.5, then the washed cinder is leached by hydrochloric acid with the ratio (S:L) = 1:2-3.

The distinctive features which make the proposed method different from the method earlier described as "the closest", are the following: the cinder processing is carried out in two steps; at the first step a secondary enrichment with the help of water washing is carried out with the ratio (S:L) = 1:0.7-2.5, then the washed cinder id leached by hydrochloric acid with the ratio (S:L) = 1:2-3.

The method is carried out in the following way.

After the roasting of granules they are unloaded from the furnace into the reservoir of water and the ratio (S:L) is changed from 1:0.7 to 1:2.5 depending on the chlorides content. Then the chlorides of alkali and earth metals are dissolved, after which the washed cider is leached by

hydrochloric acid with the ratio (S:L) = 1:2-3 and then the precious metals are recovered from the produced pulp by sorption.

Example 1.

A batch of insoluble residue was divided into 5 parts, which were washed off to remove chlorides up to various ratios. Then each sample of insoluble residue was separated from excessive solution, roasted and then the precious metals were recovered from the produced ciders (Table 1).

Table 1. Leaching of ciders by mixture $HCl+HNO_3$

Lump size of the cider: 2 mm

Leaching parameters: ratio (S:L) = 1:4

Temperature: 90°C

Time: 4 hours

Cl content, %	Recovered, g/t from insoluble residue			
	Pd	Pt	Au	Ag
11.8	1.71	0.17	0.06	0.72
14.1	1.8	0.23	0.04	0.73
15.1	2.3	0.13	0.29	11.3
15.4	4.66	0.73	0.10	1.62
16.2	4.89	0.76	0.27	3.84

Table 1 shows that excessive washing off to remove insoluble residue (decreasing of its Cl content) is followed by considerable decrease of palladium content in the obtained product and therefore by decrease of its recovery.

Example 2.

Insoluble residue was roasted and after cooling and mincing it was leached by 10% solution of aqua-regia with the ratio (S:L) = 1:4. The pulp was produced with the KCl content of 43.6 g/dm^3, NaCl content of 19.8 g/dm^3, and Pd content of 1.05 g/dm^3.

Example 3.

Two samples of insoluble residue were roasted under the same conditions as in the example 2. The ciders were washed off to remove chlorides by means of water with the ratio (S:L) = 1:2 and with the ratio (S:L) = 1:3. The results achieved are shown in Table 2.

Table 2. Content of washing solution

Ratio (S:L)	Content in solution, of:		
	Pd g/dm^3	KCl g/dm^3	NaCl g/dm^3
1:3	not detected	57.9	25.3
1:2	not detected	84.0	37.1

The table shows that palladium doesn't transfer to the solution during washing because its chloride decomposes with the palladium transferring in a water-soluble form due to the high temperature of roasting. The cider mass decreases by 24-25% after washing, the palladium concentration in the samples increases approximately 1.3 times.

After the leaching of the washed cider with the ratio (S:L) = 1:2 the solution contains 3.0 g/dm^3 of KCl, 1.8 g/dm^3 of NaCl, and the palladium content increases up to 2.7 g/dm^3.

The technical effectiveness of the proposed method of processing mineral raw materials containing chlorides of alkali and earth metals consists of the fact that due to decreasing volume of the pulps produced during leaching and therefore due to decreasing the scope of hydraulic-metallurgical equipment for the pulps' processing, the process economy and also the recovered precious metals percent increase considerably.

Translation of Claim of PCT/RU2009/000458

CLAIM

Method of processing mineral raw materials containing precious metals and chlorides of earth metals; the method consists of enrichment and roasting, with the following **distinctive features**: the cinder processing is carried out in two steps; at the first step a secondary enrichment by water washing is carried out with the ratio (S:L) = 1:0.7-2.5, then the washed cinder is leached by hydrochloric acid with the ratio (S:L) = 1:2-3.