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Investigation of the Possibility of Extraction of Valuable Components From Stale Tailings of Hydrometallurgical Plants

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ABSTRACT: We have developed a method for processing gold-containing raw materials, including opening the tailings at a temperature of 170-190 ° C with ammonium fluoride with the formation of fluoroammonium complexes of silicon and impurity metals, sublimation separation of HFSA at a temperature of 350-390 ° C, adsorption of ammonia from the gas phase desublimation of HFSA by cooling the process gas, dissolving it and treating with ammonia water to obtain silicon dioxide, filtering silica from the pulp, drying and calcining it to obtain the finished product in the form of a powder, ammonia mother liquors evaporation, crystallization of ammonium fluoride, which is then returned to the stage of fluorination.

KEY WORDS: component, toxin extraction, solution, tail, regeneration, precious metals analysis, silver, gold, useful components, departure.

I.INTRODUCTION

The requirements of the present day development of efficient methods for recycling of mineral resources and ores, the extraction of all useful components, development of low-waste and non-waste technology, the involvement of all man-made structures mining (mining wastes, processing plants, liquid and solid wastes from hydrometallurgical and pyrometallurgical processes) in production, development of technology of separation of multicomponent silicate systems (which are metallurgical slags and tailings) for the individual oxides, obespechivaushyi the extraction of useful components return process additional chemicals for additional extraction of valuable components, is an urgent task in this field. [2]

We have developed a method for processing gold-bearing raw materials, including the autopsy of tailings at a temperature of 170-190°With the ammonium fluoride with the formation of torontonian complexes of silicon and impurity metals, sublimation separation of GFSA at a temperature of 350-390°C, the adsorption of ammonia from the gas phase, desublimation of GFSA by cooling the process gas, dissolving it and handling ammonia water for obtaining a silicon dioxide, filtration of the pulp of silicon oxide, the drying and calcination of obtaining finished products in powder form, ammonium opercu the mother liquor, the crystallization of ammonium fluoride, which is then recycled to the fluorination stage. The extraction of gold and silver from spent residues by cyanidation.The method is characterized in that the treatment is carried out with ammonium fluoride in a stoichiometric ratio with respect to the silicon oxide of the mixture and the separation of silicon oxide in one stage at a relatively low temperature, and the transfer of gold into the solution is carried out by cyanidation.[4]

II. SIGNIFICANCE OF THE SYSTEM

Laboratory studies were carried out at the Department of Metallurgy of the Almalku branch of Tashkent State Technical University on a specially manufactured installation for desiliconization of the studied object. The calculation of the material balance of the proposed technology was made using the example of 100 kg of secondary cakes. The yields of silicon dioxide and the regeneration of ammonium fluoride were determined by regeneration by 97.8% with repeated use in production.

Cyanide secondary cakes. After desiliconization, this product underwent cyanidation in order to isolate precious metals from it.

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The essence of the cyanidation process lies in the fact that the crushed ore material containing gold is brought into contact with a solution of sodium cyanide, under the action of which gold passes from the ore into solution [79; S.-122-147]. In the presence of oxygen, dissolution proceeds according to the following reaction:

$$2Au + 4\ NaCN + O_2 + 2H_2O = 2NaAu\ (CN)_2 + 2NaOH + 2H_2O \quad (1)$$

$$Na\ Au\ (CN)_2 \leftrightarrow Na^+ + \{Au\ (CN)_2\}^- \quad (2)$$

III. METHODOLOGY

Experiments on cyanidation of secondary cakes were carried out in the laboratory of the Chadaksky Mill, in bottles with a closed-type mixer with a capacity of 0.75 liters. The concentration of sodium cyanide and protective alkali was determined by titration with a solution of silver nitrate in the presence of indicators. Mixing was carried out on a mechanical mixer with air from the compressor.

The conditions for cyanide cakes:

- sample of 100 g,
- ratio T; W 1: 2,
- cyanide concentration of 0.4%,
- residual concentration of lime (Ca (OH) 2) 0.02%,
- duration of cyanide 18 hours.

Due to the lack of lamps designed to determine the silver content, silver data are not available in solutions. The results of cyanidation of secondary cakes are given in table. 1.

Based on the results of the study, a technological and apparatus scheme for processing the tailings of gold recovery factories using a fluorine-ammonium technology was proposed. (fig. 1).

Table 1. Secondary cake cyanidation results.

Sample No. 1 Lab. No. 947

Name product	Weight. g/ml	Content Au, g/t.	Content Ag, g/t.	Extraction Au, %	Extraction Ag, %
Source	100	1,2	13,0	99,9	99,9
Cake	100	сл	сл	99	99
Solution, mg / l		0,29			

Sample No. 2 Lab. No 948

Name product	Weight. g/ml	Content Au, g/t.	Content Ag, g/t.	Extraction Au, %	Extraction Ag, %
Source	100	1,2	17,0	99,9	99,9
Cake	100	сл	сл	99	99
Solution, mg / l		0,26			

For laboratory testing selected samples of 100 kg of gold and dumps Mardjanbulak extraction site (MZIU) and Chadak gold-mining mine (CHGMM) point method, chemical and material composition of the sample of which is shown in the Table. 1. Material composition MZIU tailings samples was studied using a complex of modern methods, including semi-quantitative, spectral, mass spectrometry, fire assay Au, Ag, and some other types of tests.

Assay Analysis for Au and Ag was carried out in the laboratory of NMMC and AMMC and spectral and mass spectral analyzes carried out in the central laboratory of the Institute of Geology and Geophysics of the Academy of Sciences of the Republic of Uzbekistan, which resulted in the technique of the experiments.

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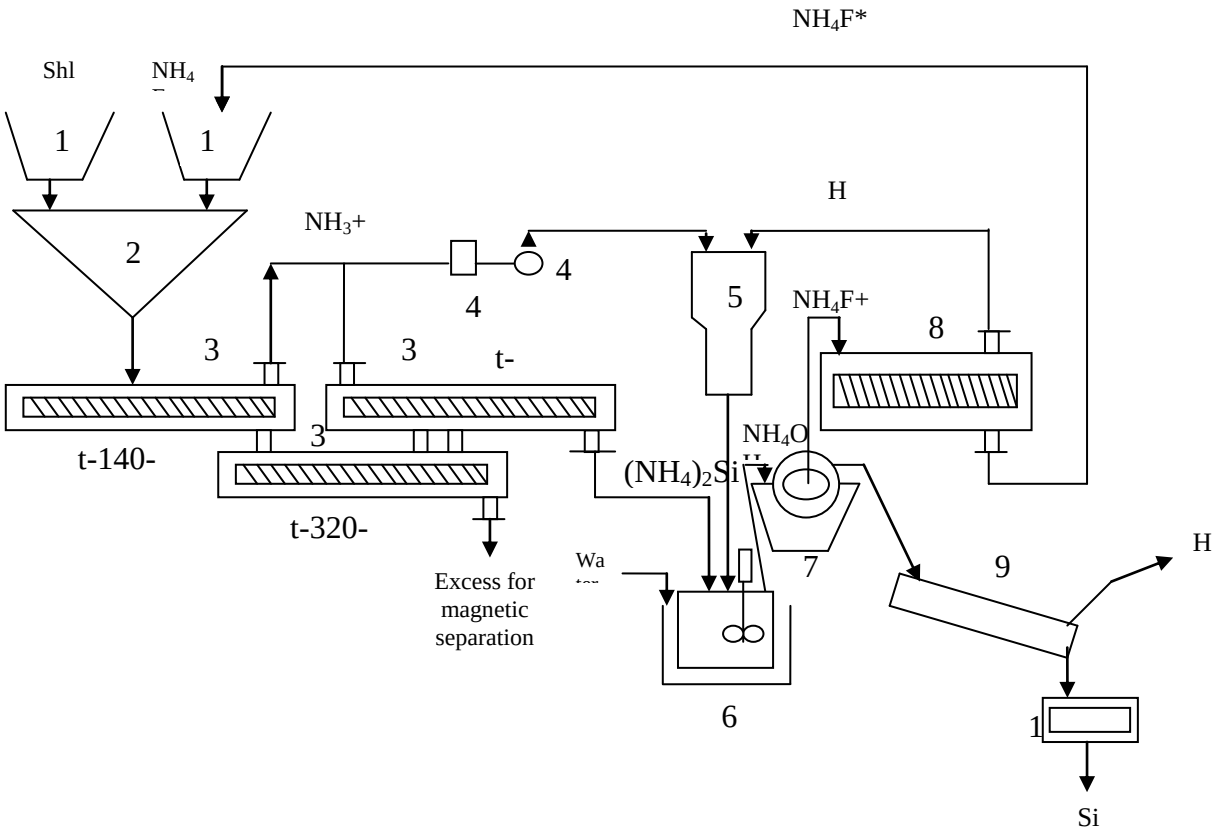
Table. 2 shows the content of silica and other impurities after the desilication in Table. 3 and 4 - the material balance obtaining silica and ammonium bifluoride. The chemical composition of old tailings gold processing plants

Name	Chemical components,%									
	Cu	Pb	Zn	Al	Au, г/т	Ag, г/т	Fe	Mo	SiO_2	S
Tailings MZIU (NMMC)	0,006	0,02	0,019	13,7	0,36	1,7	4,46	Сл.	60,0	0,71
Tailings CHZDR (AMMC)	0,007	0,03	0,02	15,0	0,15	0,63	3,00	0,005	59,0	0,6

Prepared ammonium bifluoride, which was used to re-fluorination. In the fourth chapter, «Development of methods for extraction of gold, iron, and silicon dioxide from industrial waste» lists developed methods of processing technogenic formations of mining and smelting industry.



1-Bin for receiving slag ;
1a – Bin for receiving NH_4F;
2 – Mixer;
3 - t-140-170^{0}C furnace;
3a - t-140-170^{0}C furnace;
3б – desublimation capacity;
4 – Filter;
4a – Exhaustion ventilator;
5 – Absorber;
6 – Apparatus for mixing;
7 – Filter;
8 – Crystallizer;
9 – Apparatus for drying;
10 – Burning furnace.

Fig. 8. Driving circuit devices developed technological scheme of recycling waste slag AMMC

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A method of refining gold ores, tailings comprising opening at 170-190°C to form ammonium fluoride complexes ftoroammonium silicon and impurity metals separation GFSA sublimation at 350-390 ° C, the adsorption of ammonia from the gas phase by cooling GFSA desublimation process gas , dissolution and processing it with ammonia water to obtain a silicon dioxide filtration silica slurry, drying it and calcination to obtain the finished product in the form of powder, uparku ammoniacal mother liquor, crystallization of ammonium fluoride, which is then recycled to the fluorination step.

Extraction of gold and silver from the residues was performed by cyanidation. The method is characterized in that the ammonium fluoride treatment is carried out in a stoichiometric ratio with respect to silicon oxide and conduct charge separation of silicon oxide in a single step at a relatively low temperature, and translation into a solution of gold by cyanidation is carried out,

A method for producing metallic iron by purifying it from the other components by calcining and melting. Extraction was carried out iron from slag by calcining ammonium fluoride with the addition of salt. Ammonium fluoride, interacting with silicon formed volatile compounds that sublime at temperatures 320-340ºC. The amount of ammonium fluoride was selected stoichiometrically so that there is only sufficient for decomposition of silicon oxide. Equipment for the firing slag was completely sealed.

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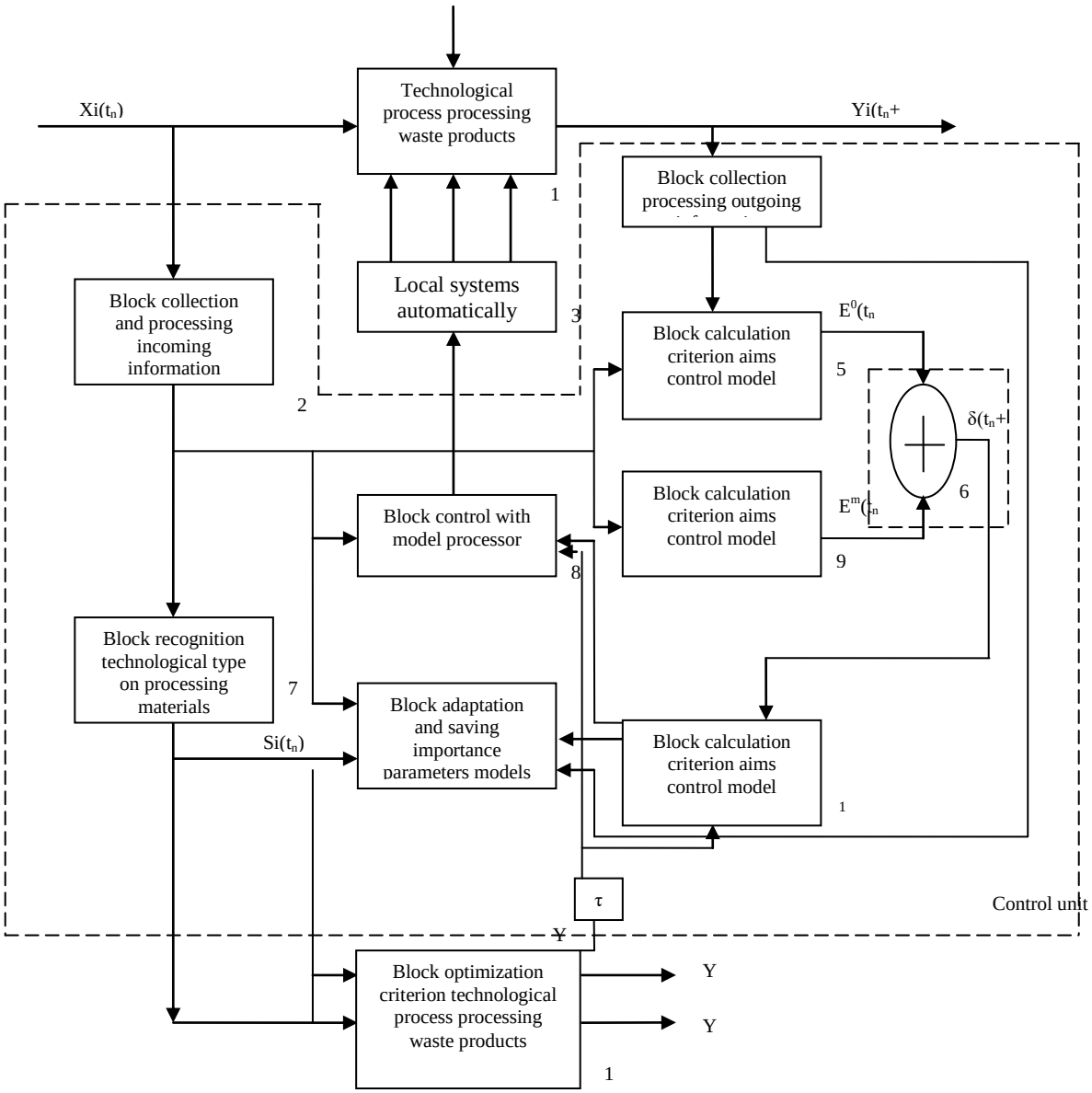

τ_1-discrete observation time; δ (tn + τ) is the difference in between the actual and forecast values of the output quantity; Si-i-th type known recoverability; tn-time parameters

A method for extraction of iron and silicon dioxide from industrial waste. was treated with ammonium hexafluorosilicate solution of 15% ammonia water, which is formed by reacting the starting silica with ammonium fluoride according to the reaction (2) and in an aqueous alkaline solution (NH4) 2SiF6 is hydrolyzed with more heat. The precipitate was filtered, washed, dried and calcined at a temperature 8000S obtain silica 99.9%. Thus precipitates SiO2, the precipitate was filtered, washed, dried and calcined at a temperature 8000C to yield silica 99.9%. Branch of silicon dioxide in the form of the final product resulted in the product to import substitution.

In the fifth chapter of the thesis «Process control processing technogenic formations of mining and smelting industry,» the results of the analysis system positions the current state of industrial automation problems and study the functional structure of the recycling process. A complex system of automation of technological processes, departments and enterprises automation systems on the recommended technology of complex extraction of valuable components from man-made structures. At the same time revealed the following features of mineral processing:

- a large inertia of the processes and a high level of interference;

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Vol. 7, Issue 4 , April 2020

- a significant number of series-connected and inter-related processing operations (stages, sections, stages);
- the continuity of the course of individual operations;
- a substantial length of the processing operations (up to several hours);
- a large number of parallel processing units of the same type (lines) at different sites;
- a lot of connectivity process variables;
- a variety used in the processes of energy, raw materials and output products. A mathematical model and a block diagram of a technogenic waste processing subsystem of the process control system of mining and metallurgical production

In the sixth chapter «Evaluation of economic efficiency and the prospects for processing technogenic formations of mining and metallurgical industries» are the results of calculation of economic efficiency of the developed technological schemes, capital expenditures, costing processing mill tailings and the main technical and economic indicators. With the introduction of the developed method of processing on the developed technological scheme increased the recovery of valuable components and obtained an annual economic impact of $ 730.54 thousand.. On the 10 th. Tons of gold-bearing tailings Mill. The questions of occupational safety and health, safety and environmental issues arising in the implementation of the recommended technology for the processing of technogenic raw materials halogenammonium method.

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