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Abstract

Possessing high electrical and thermal conductivity, copper today is one of the strategically important valuable non-ferrous metals, ahead of silver in terms of the first index. It is because of this that it plays an important role in the development and design of electrical systems, heat removal parts of various installations, and other processes. Such demand creates a need to obtain more raw materials, however, the extraction of copper ore and the subsequent production of copper concentrates are labor-intensive processes, since the copper content in the ore usually does not exceed 10 %. Another problem in obtaining finished copper concentrates is that copper is often found in combination with zinc, lead, gold, silver and other metals, which also affects the complexity of the copper ore beneficiation process. Nevertheless, the demand for copper remains, as do its high prices. The Russian copper industry, which is considered quite developed, can strengthen its position on the world stage – according to the Ministry of Industry and Trade, in 2025-2030 non-ferrous metallurgy will experience rapid growth, possible only with an intensive increase in non-ferrous metals production, processing volumes and exports. The transition to “green” energy will just strengthen the position of domestic industry – for example, an increase in copper consumption will be observed in the production of electric vehicles (batteries, windings), solar panels, wind generation and other areas.

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Geological exploration and engineering geology

Russia has some of the largest copper reserves in the world. The main copper deposits are located in the Urals, Siberia and the Far East (Nizhny Tagil, Bashkortostan, Khabarovsk and Chita territories, and the others). In recent years, the Russian copper industry has stable performance in terms of copper mining and processing, despite various economic difficulties. Copper production in Russia is ensured by a high level of domestic demand and constant exports. Copper from Russia is valued on the international market for its high quality.



*Copper nugget The Bear Skin. Eastern Kazakhstan.
Height is over 2 m, weight is 842 kg.
The gift of Alexander II, the Emperor of Russia.*

Pashkevich M.A., Alekseenko A.V., Nureev R.R. Environmental damage from the storage of sulfide ore tailings. Journal of Mining Institute. 2023. Vol. 260, p. 155-167. DOI: 10.31897/PMI.2023.32



Abstract. The mining industry is one of the most challenging in ensuring environmental safety. During the last century, the Karabash Copper Smelting Plant was processing sulfide ores and depositing the tailings into storage facilities that now occupy an area of more than 50 hectares. To date, abandoned tailings are a significant source of natural water, air, and soil pollution in the Karabash city district. The article comprehensively examines the environmental impact of the Karabashmed copper smelter, one of the oldest metallurgical enterprises in Russia. The effects of seepage from the two Karabashmed tailings facilities on water resources were assessed. We revealed that even outside the area of the direct impact of processing waste, the pH of natural water decreases to values 4-5. Further downstream, the infiltration water from the tailings pond No. 4 reduces the pH of river water to 3.0-3.5. The presented results of environmental engineering surveys are derived from sampling water and bottom sediments of the Ryzhiy Stream and the Sak-Elga River, sample preparation, and quantitative chemical analysis. The study revealed significant exceedances of the maximum permissible concentrations for a number of chemical elements in the impact zone of the copper ore processing tailings.

Zubkova O.S., Pyagay I.N., Pankratieva K.A., Toropchina M.A. Development of composition and study of sorbent properties based on saponite. Journal of Mining Institute. 2023. Vol. 259, p. 21-29. DOI: 10.31897/PMI.2023.1



Abstract. The development of a comprehensive approach to preventing the pollution of natural objects is necessary due to the high requirements of environmental legislation for the discharge of industrial wastewater. Adsorbents are used in various industries to extract heavy metals from wastewater. In this study the possibility of using saponite clay as a raw material for the production of sorbent for the extraction of copper ions Cu^{2+} from industrial wastewater is considered, a recipe and technology of sorbent production are developed, and its chemical composition is established. It has been established that the optimum temperature for heat treatment of the sorbent corresponds to 550 °C, since at this temperature saponite extrudates acquire strength (strength 34.1 kg/mm²) and textural properties (specific surface area of pellets 22.803 m²/g), allowing them to be used as sorbents. The kinetics of molecular adsorption was studied using model solutions of copper (II) sulfate. The extraction efficiency of copper (II) ions from the model solutions is 93 %. Extraction efficiency of copper (II) ions from copper plating wastewater reaches 94 %. SEM results confirm the presence of metal on the sorbent surface.

Lutskiy D.S., Ignatovich A.S. Study on hydrometallurgical recovery of copper and rhenium in processing of substandard copper concentrates. Journal of Mining Institute. 2021. Vol. 251, p. 723-729. DOI: 10.31897/PMI.2021.5.11



Abstract. Over the past decade, there has been a steady growth in demand for rare metals, with rhenium being one of the most highly demanded, but also one of the most expensive and difficult to obtain. The high demand for rhenium is due to its use as a key component of metallurgical alloys or as a component of catalysts used in the oil refining industry. The aggregate of facts causes profitability of processing of the rhenium-containing mineral resources, which are also the copper substandard concentrates obtained at processing of the Zhezkazgan sandstones. The study focuses on the processes of extraction of copper and sorption recovery of rhenium from solutions of ammonia leaching of copper substandard concentrates. Model solutions similar in the elemental composition to solutions of ammonia leaching solutions of copper substandard concentrates obtained during the processing of Zhezkazgan sandstones were used as an object of the study. The paper estimates extraction characteristics of copper recovery using LIX 84-I solution in kerosene, as well as sorption characteristics of the rhenium recovery process using the Purolite PPA100 anion exchanger. Based on the obtained characteristics the possibility of hydrometallurgical processing of ammonia leaching solutions of substandard copper-sulfide concentrates, and recovery of the obtained commercial products is shown.

Novakov R.M., Kungurova V.E., Moskaleva S.V. Formation conditions of noble metal mineralization in sulfide cobalt-copper-nickel ores of Kamchatka (on the example of Annabergitovaya Shchel ore occurrence). Journal of Mining Institute. 2021. Vol. 248, p. 209-222. DOI: 10.31897/PMI.2021.2.5



Abstract. The authors present research results, the purpose of which is to study the specifics of noble metal mineralization and its genesis in sulfide cobalt-copper-nickel ores of the Kamchatka nickel-bearing province. The paper is dedicated to one of its many ore occurrences called Annabergitovaya Shchel (Annabergite Gap). The material composition of platinoid, silver, gold, bismuth and tellurium minerals, as well as sulfarsenides in the ores of this occurrence was investigated. Based on the data of mineral formation sequence and the use of geosensors, conclusions were drawn regarding the genesis of noble metal mineralization. Formation of platinoid minerals, silver and gold at the Annabergitovaya Shchel ore occurrence is mainly associated with the epigenetic effect of post-ore granitoids on ore-bearing intrusion rocks of the Dukuk complex of the cortlandite-norite formation and on syngenetic ores. An early association of noble metal minerals is represented by sperrylite, irarsite, and rare unnamed phases of Pt + Ir + Te. Irarsite and Pt + Ir + Te phases were formed at the contact-metasomatic stage. Sperrylite can be assumed to be of magmatic origin. Silver sulfides and tellurides, silver and palladium bismuth tellurides, and native gold were formed at the late, hydrothermal-metasomatic, stage. The occurrence conditions of mineral parageneses, associated with noble metal mineralization, correspond to the formation of shallow-depth metasomatic rocks (≤ 5 km). Sub-developed

quartz-feldspar metasomatites, associated with the formation of early platinoid arsenides and sulfarsenides, are in equilibrium with circumneutral solutions (pH of 4.5-6.5) at temperatures of 350-600 °C. Late hydrothermal association with Pd, Ag and Au minerals is close to propylites and was formed at pH values of 4.5-6.5 and temperature of 150-350 °C.

Altushkin I.A., Levin V.V., Sizikov A.V., Korol Y.A. Experience of development of porphyry copper type deposits in the Urals. Journal of Mining Institute. 2017. Vol. 228, p. 641-648. DOI: 10.25515/PMI.2017.6.641



Abstract. Russian copper company was the first in Russia to start developing porphyry copper deposits. In 2013 the Mikheevsky mining and processing plant with the annual production capacity of 18 mln t of ore was put into exploitation. The use of innovative approaches regarding choice of the technology, high-performance equipment and organization of construction allowed to bring the enterprise to a full capacity and to achieve expected results within three years. Based on the experience obtained during design, construction and exploitation of the Mikheevsky mining and processing plant in 2017 the company has started the construction of a new mining and processing plant in the Tominskoye deposit. The first stage anticipates the enterprise production capacity to be equal to 28 mln tons with the possibility of its increase up to 56 mln tons. The development of porphyry copper deposits in the Urals will allow to provide copper plants with the raw materials over the next 80-100 years.

Stepanov V.A., Melnikov A.V. Deposits of gold-quartz formation in the Priamur province. Journal of Mining Institute. 2017. Vol. 223, p. 20-29. DOI: 10.18454/PMI.2017.1.20



Abstract. A description of gold-quartz formation deposits in the Priamur gold province is presented. Prevalence of gold-quartz deposits defines metallogenic profile of the province and presence of numerous rich placers. Deposits are attributed to frontal, middle and near-bottom parts of the ore pipe. Frontal part of the ore pipe contains a major part of the deposits. They are small and consist of scattered quartz, feldspar-quartz and carbonate-quartz veins. The ore is characterized by erratic percentage of gold, bonanzas can be found. Gold is free, ranging from fine to big grains and small nuggets. It is associated with arsenopyrite, galenite, sometimes with antimonite. Among trace elements can be copper, mercury, antimony and arsenic. Prevalence of frontal deposits in the province points to significant prospects of finding a rich deep mineralization in the middle part of ore pipe. Middle part of the ore pipe contains intermediate and small deposits. Ore bodies are often represented by veined and veinlet-disseminated zones, sometimes zones of metasomatites. For gold-quartz ores, free native gold can commonly be found, usually of fine and very fine grain size. Among ore minerals, apart from arsenopyrite, pyrite and galenite, scheelite is frequently observed. Small deposits of near-bottom ore pipe are quite rare. Ore bodies are represented by quartz veins and zones of metasomatites. Gold is mostly free, of fine and super fine grain size. The prevailing trace element is mercury. Attribution of gold-quartz deposits to a certain part of ore pipe can facilitate more precise estimation of their prospects. In its own turn, this will allow to choose more favorable objects for further evaluation.

Opekunov A.Y., Opekunova M.G. Technogenic geochemistry in the development of Sibai chalcopryrite field. Journal of Mining Institute. 2013. Vol. 203, p. 196-204 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5637>



Abstract. Complex of geochemical studies in developing of Sibai chalcopryrite deposits are conducted. The peculiarities of the chemical composition of natural waters, the specificity of technogenic migration of ore elements in river sediments and soils, as well as the involvement of heavy metals into the biogeochemical cycle are established. The extent of transformation of natural geochemical processes in technogenesis is revealed. Approximate dimensions of man-made streams and scattering halos of ore metals are determined. The recommendations at reducing anthropogenic migration of elements are aimed.



Quartz and chalcopryrite streaks inside chlorite shale. The Urals. Item belongs to the Mining Museum.

Orekhov A.N. Geophysical survey results in a copper-porphyre deposit (Republic of Tuva). Journal of Mining Institute. 2011. Vol. 194, p. 197-199 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6185>



Abstract. The complex copper-porphyre deposits constitutes the significant portion of the World's and Russian gold reserves. The application of petrophysical and physico-geological models can increase the interpretation efficiency of data obtained in prospecting and exploration for copper-porphyre deposits. The paper presents the results of Ak-Sugskoe field geophysical survey and final conclusions based on the result analysis.

Petrov D.A. Peculiarities of the structure of ores of Rubtsovskoe sinter-polymetallic deposit (Ore Altai). Journal of Mining Institute. 2006. Vol. 167(2), p. 40-42 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7953>



Abstract. The results of studying the structure of ores of the Rubtsovskoe smelter-polymetallic deposit are presented. The material for the research were polished slides of lead-copper-zinc ores. The mineral composition of ores was studied, the order of crystallization of ore minerals was established. Differences in the structure and mineral composition of ores from different parts of the ore body were found and described. The granulometric analysis of mineral grains was carried out on a personal computer using VideoTest and Excel-98 software packages. Chalcopyrite inclusions in sphalerite were studied by electron microscopy. Conclusions were made about the conditions of ore formation and their technological properties.

Korsakov A.K. Development of the theory of ore genesis and prognostic and prospecting models for gold, platinum, copper, and nickel for greenstone complexes of Karelia. Journal of Mining Institute. 2004. Vol. 158, p. 191-193 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8830>



Abstract. The spatial and genetic relationship of mineral deposits and ore occurrences with the geodynamic complexes of the Late Archean and Early Proterozoic greenstone belts of Karelia are considered. On this basis the place of ore-forming processes at certain stages of formation of greenstone belts is determined.



Chalcopyrite, pentlandite, pyrrhotite. The Talnakh field. Norilsk. Item belongs to the Mining Museum.

Petrov D.A. Using fractal analysis to characterize the structure of the Alexandrinskoye ore deposit (Southern Urals). Journal of Mining Institute. 2004. Vol. 159(1), p. 26-28 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8706>



Abstract. A method for characterizing the structure of copper-zinc sulfide ores by means of fractal dimensionality is presented. Fractal dimensionality allows to quantify the complexity of mineral grain boundaries in ore. This information can be the basis for predicting the disintegration of ores during concentration. The material for the research was polished thin sections of copper-zinc ores from the Alexandrinskoye deposit (Ural). Measurements of fractal dimensionality were carried out by the step method on a personal computer using the programs Adobe Photoshop 7.0 and FractShop. This method is used for sulfide ores for the first time.

Metallurgy and enrichment

The Russian copper industry is actively investing in new technologies and research. The use of advanced mining and enrichment methods allows us to increase production efficiency and reduce the impact on the environment.



The collection of first products of metallurgical processes and concentrates from Norilsk fields, produced by the nickel group, L.M.I. Item belongs to the Mining Museum.

Duryagina A.M., Talovina I.V., Lieberwirth H., Ilalova R.K. Morphometric parameters of sulphide ores as a basis for selective ore dressing. Journal of Mining Institute. 2022. Vol. 256, p. 527-538. DOI: 10.31897/PMI.2022.76



Abstract. To assess the possibility of selective disintegration and reduction of overgrinding of hard-to-reproduce ores, optical microscopic and X-ray microtomographic studies were carried out and quantitative characteristics of morphological parameters of disseminated and rich cuprous ore samples from Norilsk-type Oktyabrsky deposit were identified. Among quantitative morphological parameters the most informative are area, perimeter, edge roughness, sphericity, elongation and average grain spacing for disseminated copper-nickel ores; area, perimeter, edge roughness and elongation for rich cuprous ores. The studied parameters are characterized by increased values and dispersion in ore zones, which is especially important for fine-grained ores, which are difficult to diagnose by optical methods. Three-dimensional modelling of the internal structure of sulphide mineralisation samples was carried out using computed X-ray microtomography, which allows observation of quantitative parameters of grains, aggregates and their distribution in the total rock volume and relationship with each other. The evaluation of rock pore space by computer microtomography made it possible to compare the results obtained with the strength characteristics of rocks and ores, including those on different types of crushers. The obtained quantitative characteristics of structural-textural parameters and analysis of grain size distribution of ore minerals allow us to evaluate the possibility of applying selective crushing at various stages of ore preparation.

Soe K.M., Ruan R., Jia Y., Tan Q., Wang Z., Shi J., Zhong C., Sun H. Influence of jarosite precipitation on iron balance in heap bioleaching at Monywa copper mine. Journal of Mining Institute. 2021. Vol. 247, p. 102-113. DOI: 10.31897/PMI.2020.1.11



Abstract. Ferric iron is an important oxidant in sulfide ore bioleaching. However, recirculating leach liquors leads to excess iron accumulation, which interferes with leaching kinetics and downstream metal recovery. We developed a method for controlling iron precipitation as jarosite to reduce excess iron in heap bioleaching at Monywa copper mine. Jarosite precipitation was first simulated and then confirmed using batch column tests. From the simulations, the minimum pH values for precipitation of potassium jarosite, hydronium jarosite, and natrojarosite at 25 °C are 1.4, 1.6, and 2.7, respectively; the minimum concentrations of potassium, sulfate, ferric, and sodium ions are 1 mM, 0.54, 1.1, and 3.2 M, respectively, at 25 °C and pH 1.23. Column tests indicate that potassium jarosite precipitation is preferential over natrojarosite. Moreover, decreased acidity (from 12 to 8 g/L), increased temperature (from 30 to 60 °C), and increased potassium ion concentration (from 0 to 5 g/L) increase jarosite precipitation efficiency by 10, 5, and 6 times, respectively. Jarosite precipitation is optimized by increasing the irrigating solution pH to 1.6. This approach is expected to reduce the operating cost of heap bioleaching by minimizing the chemicals needed for neutralization, avoiding the need for tailing pond construction, and increasing copper recovery.

Kioresku A.V. Intensification of Bacterial-Chemical Leaching of Nickel, Copper, and Cobalt from Sulfide Ores Using Microwave Radiation. Journal of Mining Institute. 2019. Vol. 239, p. 528-535. DOI: 10.31897/PMI.2019.5.528



Abstract. Currently, Russia and other countries display a steady tendency to decrease the amount of high grade and free- milling ore reserves. In this regard, the attention is being paid to the technology of bacterial-chemical leaching (BCL), which, unlike traditional pyrometallurgical enrichment methods, is well applicable for processing low-grade mineral raw materials. However, this technology has a significant drawback, which is the inability of microorganisms to create sufficiently aggressive conditions for the effective destruction of mineral complexes, which negatively affects the duration of the processes. The article presents the results of an experiment, the purpose of which was to study the multiple short-term effects of microwave radiation on the efficiency of extraction of nickel, copper, and cobalt in the process of bacterial-chemical leaching of sulfide ore. A microwave oven with a power of 900 W and a radiation frequency of 2.45 GHz was used as a source of microwave radiation. Irradiation was carried out every day throughout the experiment. The exposure time was 5 and 10 s; the flux density was 0.7 W/cm². It was found that for all the studied microwave irradiation modes, a significant increase in the efficiency of biomass accumulation and the oxidizing ability of the medium was observed in comparison with the control that was not exposed to microwave radiation. Irradiation for 5 s twice a day increased the reduction of nickel by 16 %, cobalt by 15 %, and copper by 6 %. The results of the study allow us to assess the prospects for the application of new biotechnology methods in the industrial practice of ore processing with an improvement in quality indicators.

Marinin M.A., Khokhlov S.V., Isheyskiy V.A. Modeling of the Welding Process of Flat Sheet Parts by an Explosion. Journal of Mining Institute. 2019. Vol. 237, p. 275-280. DOI: 10.31897/PMI.2019.3.275



Abstract. The list of materials subject to explosive welding is very extensive and amounts to several hundred combinations of various alloys and metals, and the variety of explosive welding schemes has more than a thousand options. In almost all technical solutions, the process involves the sequential creation of physical contact of the materials to be welded and their connection due to plastic deformation of the contacting surfaces. The strength of such a connection depends on the mode of the welding process. With the correct selection of the parameters of the mode, it is possible to obtain a high-quality connection of the required strength. However, the experimental selection of such options is a very laborious and costly process. Computer simulation and application of mathematical models for solving dynamic problems of explosion mechanics simplifies the search for optimal parameters and allows to predict the expected result in the shortest possible time. The article discusses the issues of modeling of explosive welding of metals, calculations related to the parameters of the process of formation of the weld using the Ansys Autodyn software package. A model is presented for analyzing the deformation process of explosion welding of a plate and its connection with a matrix. The main parameters of explosion welding (velocity, pressure, time) are determined. The adequacy of the obtained values was evaluated in the systems aluminum – copper and copper – steel. It also provides a comparative analysis of simulation results and field experiments. Based on numerical calculations, a conclusion was substantiated on the suitability of the model obtained for a preliminary analysis of the main welding parameters at the preparatory stage.

Slobodov A.A., Syrkov A.G., Yachmenova L.A., Kushchenko A.N., Prokopchuk N.R., Kavun V.S. Effect of Temperature on Solid-state Hydride Metal Synthesis According to Thermodynamic Modeling. Journal of Mining Institute. 2019. Vol. 239, p. 550-555. DOI: 10.31897/PMI.2019.5.550



Abstract. Thermodynamic modeling of the reduction of copper dichloride in the media of various gaseous hydrides (ammonia, monosilane, methane) in the temperature range 273-1000 K was carried out. Calculations show that in narrower temperature ranges corresponding to the reactions of solid-state hydride synthesis (SHS) of metal substances metal formation is usually supported by theoretical propositions. As a result of thermodynamic modeling, a principal result was obtained on the suppression of competing processes of nitriding, siliconizing and carbonization of metal under SHS conditions, which is important for metallurgical production. This additionally substantiates the correctness of previous experimental studies of SHS metals with modified surface and improved properties. By modeling, it was found that the reduction of solid copper dichloride to metal in ammonia or methane occurs stepwise (sequentially, according to the Baykov rule) through the intermediate stages of the formation of a compound of low-valent copper – copper (I) chloride.

Zhmurova V.V., Nemchinova N.V. Experience of integrated use of gold-bearing raw material in the production of precious metals. Journal of Mining Institute. 2018. Vol. 233, p. 506-511. DOI: 10.31897/PMI.2018.5.506



Abstract. With the depletion of rich gold-bearing ores, the processing started to use polymetallic ores, which, in addition to precious metals, contain other elements that could be valuable after recovery. The problem of using such ores is extremely difficult because of the high cost of recovery of associated valuable components. The paper presents the results of studies on the integrated use of extracted gold-bearing raw materials based on the example of the Berezitovoye deposit (Amurskaya oblast), they have low content of precious metals and many heavy non-ferrous metals (copper, lead). Experimental work was carried out to obtain copper by the method of cementation from solutions formed after the leaching of the impurities of gold-containing cathode deposits with hydrochloric acid. The cementing metal was iron turnings (waste products of the turning shop of the enterprise). Next, it was proposed to use cemented copper as a collector during re-melting of slags – wastes of processing of low-grade polymetallic ores containing precious metals. The authors obtained ingots of alloyed gold with gold weight fraction of 16 %, which meets the requirements of TU 117-2-7-75 on the content of non-ferrous metals. During hydrochloric acid treatment of cathodic deposits silver partially passed into the solution, it was recovered together with cemented copper and, in subsequent melting, passed into alloyed gold. Thus, the method proposed by the authors helps to reduce the content of precious metals in the «incomplete production cycle» of the gold recovery factory. The opportunity of selling the cementation copper at the enterprises specializing on manufacturing of jewels is shown; the expected economic effect at the same time amounted to more than 1.8 million rubles.

Voropanova L.A., Pukhova V.P. Extraction of copper, cobalt, and nickel ions from aqueous solutions by extractant CYANEX 272. Journal of Mining Institute. 2018. Vol. 233. p. 498-505. DOI: 10.31897/PMI.2018.5.498



Abstract. The extractant CYANEX 272, which active component is di(2,4,4-trimethylpentyl)-phosphinic acid ($C_8H_{17}_2POOH$), is effective for extraction of copper (II), cobalt (II), and nickel (II) ions. The extraction of metal ions using di(2,4,4-trimethylpentyl)-phosphinic acid as an extractant is carried out due to the formation of an organophosphorus complex with wide pH range: copper at $pH > 2$, cobalt at $pH > 3$, and nickel at $pH > 5$. They are extracted with an organic phase: copper at $pH = 3-7$, cobalt at $pH = 4-7$, and nickel at $pH = 6-9$, and precipitate in the organophosphorus compound: copper at $pH > 7$, cobalt at $pH \geq 8$, and nickel at $pH \geq 10$. The possibility of separation of copper (II) and cobalt (II) is insignificant, the stripping of copper (II) and nickel (II) happens at $pH = 4-6$, and the stripping of cobalt (II) and any of nickel (II) – at $pH = 5-6$. The obtained results of ion extraction of the investigated metals can be used not only for processing of technological solutions, but also for the wastewater treatment from industrial enterprises from the metal ions in question, mine and mine drainage waters, heap and underground leaching solutions, etc. from the ions of studied metal ions.

Balykov A.A., Levenets O.O., Khainasova T.S. Flow bioreactor for studying bacterial-chemical leaching of sulfide copper-nickel ores and concentrates. Journal of Mining Institute. 2018. Vol. 232. p. 383-387. DOI: 10.31897/PMI.2018.4.383



Abstract. Bacterial and chemical leaching of metals has established itself as an alternative technology for hydrometallurgical processing and enrichment of ore due to a reduction in capital costs and adverse environmental impact. Various bioleaching processes are successfully used for the processing of sulfide concentrates, poor sulfide and oxidized ores. One of the most important tasks for further development of this branch of biotechnology is the improvement of bioreactor installations (in particular – flow type) and installation of systems of additional control of technological parameters. The article briefly highlights the main results obtained at the GSRC of FEB of RAS within the framework of bioleaching studies of sulfide cobalt-copper-nickel ore. A description of a bioreactor for the study of bioleaching in a batch mode and a cascade type reactor for studying bioleaching in a continuous mode is given. A model of an improved bioreactor for bacterial-chemical leaching of sulfide ore is presented. A detailed description of the microcontroller method for controlling technological parameters is given. The field of application of the presented results is laboratory, integrated, and semi-industrial tests of the technology of tank and reactor bacterial-chemical leaching of sulfide ores.

Voropanova L.A., Kisiev N.T. Nickel electrolyte purification from ferrum (III) and copper (II) impurities by extraction using a mixture of oleic acid and triethanolamine. Journal of Mining Institute. 2015. Vol. 214, p. 28-32 (in Russian). <https://pmi.spmi.ru/pmi/article/view/5198>



Abstract. The conditions of the selective and joint extraction of copper and ferrum impurities from a nickel electrolyte by extraction using a mixture of oleic acid and triethanolamine in kerosene were determined: extraction Fe (III) at $3 < \text{pH} \leq 4$, $1 \leq \text{B:O} \leq 4$ and $t = 40 \text{ }^\circ\text{C}$; extraction Cu (II) at $5 \leq \text{pH} \leq 6$, $1 < \text{B:O} \leq 4$ and $t = 40 \text{ }^\circ\text{C}$; joint extraction of copper and ferrum at $\text{pH} = 5-6$, $1 \leq \text{B:O} \leq 4$ and $t = 40 \text{ }^\circ\text{C}$. The process flow sheet of selective extraction of ferrum and copper from a nickel electrolyte by extraction using a mixture of oleic acid and triethanolamine in kerosene is given.

Vasilev F.A., Dolivo-Dobrovolskaya G.I., Saltykova S.N. Roasting of difficult for concentration copper-molybdenum ore. Journal of Mining Institute. 2013. Vol. 206, p. 125-128 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5452>



Abstract. The article analyses the research results of preliminary biological treatment by silicate bacteria influence on roasting process of refractory off-balance copper-molybdenum ore.

Boduen A.Y., Petrov G.V., Spynu A.Y., Andreev Y.V., Mardar I.I. Recovery of rhenium in hydrometallurgic processing osmium-containing process-suitable materials of sulphide-copper ores. Journal of Mining Institute. 2013. Vol. 202, p. 161-163 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5679>



Abstract. Incidental concentrating of valuable elements in processing sulphide-copper ores yields supplementary semi-products enriched with osmium, rhenium, and selenium. Peculiar features of processing properties of rhenium, radiogenic osmium, and selenium are shown in this paper, as well as concentrators for rare microelements and ways of their extraction.



Anode copper. The Severnickel Integrated Plant. Item belongs to the Mining Museum.

Saltykova S.N., Dolivo-Dobrovolskaya G.I., Maksimova A.V. Analysis of data on crystallochemical nature of the phases of the copper-nickel matte and a binary system Co-S. Journal of Mining Institute. 2013. Vol. 202, p. 209-213 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5690>



Abstract. The task of the colour metallurgy is the complex utilization of the ore material and increase in volume of the production with fall of the material expenditures in parallel in unit of the production. During the sulphate ores refining and the nickel and copper ones they extract cobalt, precious and the part of the rare metals, trying realize the very possible cobalts and small part of the ores raws transfer to the nickel product. However nickel can not be separated from copper completely with help of the flotation and that is why they get the sulphate nickel product which has the weight to 4 % of the copper and the copper sulphide concentration with weight 3-6 %. Together with nickel turn the part of the cobalt into the copper concentration. In the school and reference books there are little scientific well-founded and coordinated facts in phases compound of the stanes and finestanes and besides about formes of the presence of the cobalt in the called metallurgy products. It is necessary the deep experience in the study of the christall chemical nature of the finestanes phases for the improvement in extract of cobalt to the nickel product during the flotation process.

Telyakov A.N., Gorlenkov D.V., Rubis S.A., Boguslavskii A.Y. Substantiation of the process of transition of noble metals in solution during the dissolution of copper-nickel anodes on the basis of the diagrams Pourbaix. Journal of Mining Institute. 2013. Vol. 202, p. 217-219 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5692>



Abstract. The increasing need for precious metals causes necessity of development of secondary metallurgy. Now, the important condition of processing of waste of the radio-electronic industry is the fullest extraction of precious metals and reduction of weight of the rests. Assumptions of possible options of behavior of precious metals depending on conditions of conducting process of electrolysis on the basis of charts of Purbe are given.

Ivanov B.S., Boduen A.Y. Application of a combination of hidrometallurgy and mineral dressing for improving the quality of low-grade copper concentrates. Journal of Mining Institute. 2012. Vol. 196, p. 128-131 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6034>



Abstract. The mineral resource base is characterized by the depletion of large fields with relatively good quality of minerals, that's why natural and man-made deposits with a low content of useful components are involved in the processing. Their development was previously uneconomical considered. This article gives a technology of pressure leaching of low-grade sulphide copper concentrate and the results of experiments to improve the quality of the product obtained during the pressure leaching – copper concentrate II.

Orlov A.K., Konovalov G.V., Boduen A.Y. Pyrometallurgical selection of copper-zinc materials. Journal of Mining Institute 2011. Vol. 192. p. 65-68 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6319>



Abstract. The article says about complex processing copper matte and copper-zinc materials are considered. The thermodynamic estimation this process is given. The new way of processing of copper-zinc materials and new metallurgical aggregate is offered.

Danilova N.V. Calculation of material streams of the pirometallurgical cycle of processing of copper sulphidic raw materials. Journal of Mining Institute. 2010. Vol. 186. p. 176-180 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6738>



Abstract. The technology pirometallurgical a cycle of processing of copper sulphidic materials is considered. The technology includes autogenous fusion in furnaces Vanjukova, converting copper steins and copper refinement. The primary goals of drawing up of model and the accepted assumptions are described. The equations of system of model are balance expressions for each of material streams. Expressions for calculation of material streams pirometallurgical a cycle of processing of copper sulphidic raw materials are found.

Modestova S.A. Study of the opening of copper presence electrolytic slimes of the copper production. Journal of Mining Institute. 2010. Vol. 186. p. 191-193 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6742>



Abstract. The methods of processing the electrolytic slimes of copper production are examined. The process of the autoclave oxidizing leaching of copper slime is investigated. It is established that the autoclave opening ensures the selective transfer into the solution of nonferrous metals and concentration in the cakes of the leaching of noble metals.

Ternovoy V.V., Samoilenko A.I., Tsarakov O.I. The basis of minimal industrial maintenance of useful component for deposits of complex mineral raw material. Journal of Mining Institute. 2009. Vol. 184. p. 94-98 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6838>



Abstract. The problems of the calculation of the minimal industrial maintenance for complex ores of nonferrous metals are considered. Then the calculation of the minimal industrial maintenance of nickel according to different formulas for the technical-economic basis of exploratory conditions of concrete ore deposits and the analysis of results were carried out.

Berkutov Y.V. Problems of autogenous processes in copper, nickel metallurgy and ways of their solution. Journal of Mining Institute. 2009. Vol. 182, p. 146-147 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6976>



Abstract. The article contains description of main problems which copper and nickel autogenic smelting faces. Also methods to solve them are considered.

Smirnov Y.M., Melnik K.I. Weighted conversion of copper matte. Journal of Mining Institute. 2007. Vol. 173, p. 147-150 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7580>



Abstract. Calculations have been made of the material and calorific balances of the main chemical processes in gradual formation of copper during copper sulphide oxidation in solid and molten conditions. Calculations have proved the necessity of an optimal quantity of sulphide iron to be present in the charge to secure the thermal balance and copper recovery in conditions of suspended converting.

Chistyakov A.A. Kinetics of zinc leaching from slag of lead-copper production. Journal of Mining Institute. 2007. Vol. 170(1), p. 180-182 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7812>



Abstract. Optimal conditions of the leaching process have been found. Dependences of the process rate on the main technological parameters – temperature, concentration of reagents, L:H phase ratio – have been determined. Kinetic characteristics of the leaching process were obtained: reaction rate constants at different temperatures, apparent activation energy of the process.

Malashta A.V. Experimental prerequisites for the possibility of using nitrogen-containing organic bases in sulfuric acid leaching of gold from copper-containing mining waste. Journal of Mining Institute. 2004. Vol. 159(2), p. 117-118 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8686>



Abstract. The study of the composition of solutions based on urea and thiocarbamide for associated extraction of gold from copper-containing technogenic waste will make it possible to establish conditions for effective leaching of metals in the presence of nitrogen-containing organic bases from technogenic mining waste, reduce the environmental load, obtain additional amount of commercial products and use the leaching tails in the construction industry.

Ivanovskaya E.V. Physical and chemical features of briquetted copper-nickel concentrate processing. Journal of Mining Institute. 2004. Vol. 159(1), p. 148-150 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8744>



Abstract. Due to the upcoming changes in the composition of raw materials processed in the ore-thermal furnaces of Pechenganickel's smelting shop (Kola MMC) and the transition to melting of unburnt briquetted flotation concentrate, the content of non-ferrous metals in slag was assessed. For this purpose, the indicators of electric furnaces of the smelting shop for 2000 were processed using the correlation and regression analysis method. It was found out that SiO₂ concentrations in slag and Fe concentrations in matte are the significant factors of nickel concentration in slag, and SiO₂ and MgO concentrations in slag and Fe concentration in matte are the significant factors of cobalt concentration in slag. Regression equations allowing to calculate losses of non-ferrous metals (nickel and cobalt) with waste slag for new charge compositions were obtained.

Golovanov M.E., Dmitriev S.V. Enhancement of ore dressing processes for copper-nickel ores. Journal of Mining Institute. 2003. Vol. 155(1), p. 166-169 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/9097>



Abstract. The granulometric characteristics of the crushing – classification products were analyzed on the basis of the factory testing of the crushing cycle of the Pechenganickel concentrator. On the basis of this analysis and mathematical models of apparatuses the technological process of grinding with the purpose of its optimization is investigated. A number of recommendations on optimization of grinding and classifying equipment operation were elaborated, proposals on reconstruction of the grinding – classification cycle were developed, operation charts for the grinding process with regard to productivity growth were created.

Technological processes and hardware-technological complexes

Half of all copper produced is used in the electrical industry. The bulk of copper is obtained from primary raw materials, but a very significant proportion of copper is also produced from secondary raw materials. To obtain copper, copper ores are used, as well as waste of copper and its alloys.



The model of Geyer's stamp battery. 1870. Item belongs to the Mining Museum.

Sivenkov A.V. Chemical-thermal treatment of steel in an environment of low-melting solutions. Journal of Mining Institute. 2014. Vol. 209. p. 244-248 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5319>



Abstract. Outlined the main results of chemical-thermal processing of constructional steels in the environment of solutions of refractory metals in low-melting metals with the aim of applying the protective corrosion-resistant coatings. The results of corrosion tests of steel with nickel, nickel-copper and nickel-chromium coating against general corrosion, the corrosion cracking and the propensity for the intergranular corrosion.

Tankov M.S., Shelkoyi I.S. Experience in ore reserves extraction in open-pit borders and bottom in transition from open-pit to underground mining. Journal of Mining Institute. 2012. Vol. 198, p. 37-42 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5911>



Abstract. The article presents the results of industrial-experimental tests of technology for extraction of open-pit border and bottom reserves of copper sulphide ores under different conditions at ore mines of OJSC «Uchalinsk MDK». Description is given to the technology of extraction of border reserves at the Sibay underground ore mine with the use of the open chamber with ore discharge through underground workings, as well as to the order of ore reserves extraction at the Uchalinsk underground ore mine.

Kalandrov P.I., Iskandarov B.I., Abriev B.S. The design decision of technology of polymetallic ores enrichment in copper concentrating factory of MDK «Khandiza». Journal of Mining Institute. 2012. Vol. 198, p. 243-248 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/5952>



Abstract. The article discusses the design decisions and technology of enrichment used in copper-processing plant MDK «Khandiza». It shows the collective-selective enrichment scheme, the performance is supported by a smooth speed control – under bunker feeder on the basis of conveyor scales readings, grinding which is achieved in three stages as well as calculation and selection of equipment and reagents for basic services is considered.

Kovalev V.N. Modern technology concentration platinum metals from industrial waste by processing of sulphide copper-nickel ores. Journal of Mining Institute. 2011. Vol. 189, p. 284-287 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6543>



Abstract. A review of prospective industrial sources of platinum metals and modern technologies to process them has been done. The need for introducing new methods of involvement in the production of man-made platinum-containing materials has been substantiated.

Boduen A.Y., Ivanov B.S., Kononov G.V. Influence of improvement of quality of copper concentrates on efficiency of their processing. Journal of Mining Institute. 2011. Vol. 192, p. 46-48 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6314>



Abstract. At present time high grade and free-milling ore reserves have been exhausted in our country as well as in nearly all other countries in consequence of intensive development of nonferrous metal deposits. Relatively low-grade crude ore, which is deaf and therefore rebellious, is involved into processing. Moreover, after the collapse of the Soviet Union the more free-milling ores turned out to be abroad and so sulphide copper-zinc complex ores which are dressed with lower grade became the major sources of copper and zinc concentrate production in Russia. At the same time the metallurgical production is making higher and higher requirements to concentrate quality every year, and it is possible to meet the requirements only by application of mixed dressing, chemical, hydro- and pyrometallurgical technologies.

Danilov N.V., Kadyrov E.D. Application of fuzzy-logic for modelling of process of fusion of the medno-nickel concentrate in furnace Vanjukova. Journal of Mining Institute 2011. Vol. 192, p. 107-110 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6331>



Abstract. In work mathematical model of process of fusion of copper-nickel sulphidic raw materials with use of methods of indistinct logic is described. Updating of algorithms fuzzy-logic (formation of base of rules of process on the basis of the statistical data of work of the furnace) is described.

Meshcheryakov E.Y. Justification of technological solutions for underground development of copper and cauldron deposits of the Urals. Journal of Mining Institute. 2009. Vol. 180, p. 169-171 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7119>



Abstract. Copper is one of the mostly claimed in home industry nonferrous metals, the main resources of which are represented by copper-pyrites ores of the Ural Region deposits. The production growth of ore mines, developing copper-pyrites deposits, is held by hard geomechanical conditions of mine working. The analysis of the mountain-geological and geomechanical conditions of the copper-pyrites deposits development is carried out. The expedience of forming the system controlling the massif conditions is determined. The results of geomechanical researches in the basis of adaptive technological schemes of mine working development are produced.

Nikolaev A.K., Avksentiev S.Y. Rheological model of the flow of a high-concentration hydro-mixture. Journal of Mining Institute. 2008. Vol. 178, p. 73-76 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7200>



Abstract. The experimental research is made in the laboratory of hydrotransport. It includes determination of rheological properties of copper-zinc ore's high-concentrated hydromixtures. As a result there is a mathematical description of its flow in the pressure head pipeline.

Demyanov S.E. Justification of parameters of the technological equipment at hydraulic transportation of highly concentrated hydraulic mixtures. Journal of Mining Institute. 2007. Vol. 173, p. 75-79 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7559>

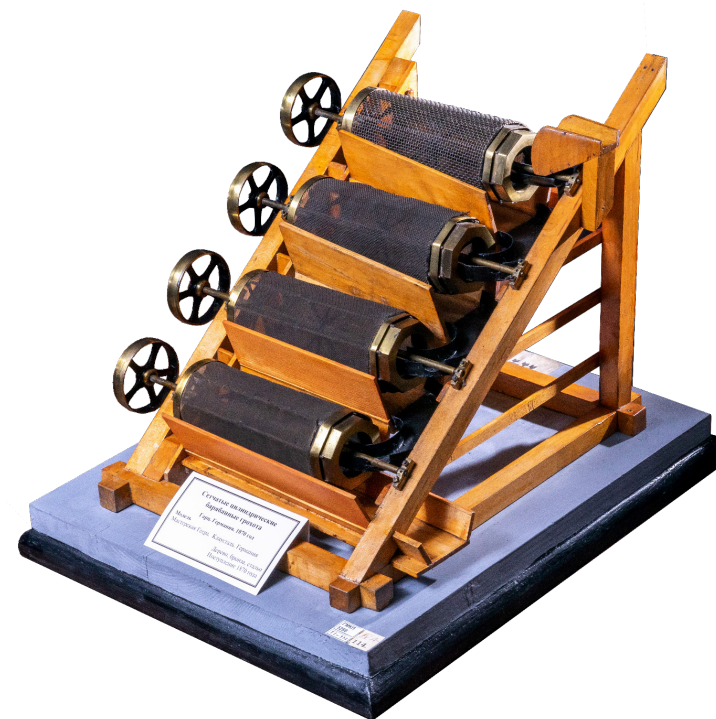


Abstract. An important task in designing hydrotransport mixtures with high concentration of solid particles is the choice of corresponding reological models on the basis of which all parameters of the hydrotransport system are determined. Attempts made by many researchers in applying reological models of pure liquids for high-concentration mixtures have rarely led to obtaining positive results. The core of the problem lies in complexity and sometimes impossibility to determine the main reological features such as upper yield point, effective dynamic and plastic viscosities, etc. Results of such investigations are published in a number of papers. The most often used approaches are the Herschel-Balkley model and two types of the Bingham model. From the practical point of view the Bingham model seems more preferable. The paper presents a design procedure to calculate parameters of high-concentration hydrotransport mixtures, which is based on previously developed mathematical model for transportation of such hydromixtures. This method is based on the assumption that the blow body with variable values of solid particle concentration and viscosity is formed in the volume of high-concentration hydromixture. Experimental investigations carried out in both laboratory and industrial conditions using copper ore mill tailings have shown high convergence of theoretical and experienced data, which allows application of this model to calculate pipeline transportation of high-concentration hydromixtures.

Lyapishchev Yu.B. Modern state of processing of electrolyte sludge of copper production. Journal of Mining Institute. 2006. Vol. 167(2), p. 245-247 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8014>



Abstract. The article considers the main technological schemes of processing of electrolyte sludge from copper production. The main advantages and disadvantages of sintering, selenide, sulfatizing and combined methods are described. The possibilities of the technological scheme of nitrate leaching are studied.



*Filter rotary screens. Germany, 1870. Working model.
Item belongs to the Mining Museum.*

Zaitsev Y.A., Ivanov V.A. *Investigation of copper behavior during tellurium precipitation from sulfide-alkaline solutions. Journal of Mining Institute. 2006. Vol. 169, p. 120-123 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7864>*



Abstract. The research is devoted to the possibility of copper transition into sulfide-alkaline tellurium solutions using radioactive isotopes of copper and tellurium. The authors studied the possibilities of purification of such solutions from copper, proposed a method of copper splitting as a product of processing. Application of this method to industrial solutions makes it possible to obtain tellurium containing millionths of copper, which ensures compliance with T-1 grade.

Demyanov S.E. *Influence of fine fractions on hydrostructure of solid particles of copper ore dressing tailings. Journal of Mining Institute. 2006. Vol. 167(1), p. 168-170 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8097>*



Abstract. Pipeline hydraulic transportation is widely used in underground and open-pit mines, coal preparation plants and external plant utilities to move various rocks. Mixing with water, coal and rocks due to different granulometric and petrographic parameters turn into different types of hydraulic mixtures and are characterized by certain movement patterns inside the pipeline. One of the types of hydraulic mixtures is the tailings of copper ore mining plants. This paper presents the results of research on the particle size distribution and hydraulic dimensions of these hydraulic mixtures, as well as a formula for calculating the particle drag coefficient calculated for the studied hydraulic mixtures.

Shneerson G.A., Krivosheev S.I., Nenashev A.P. *Installation of automatic sorting-mixing of metal-containing wastes. Journal of Mining Institute. 2005. Vol. 166, p. 223-225 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8213>*



Abstract. A prototype of a magnetic pulse separator was developed. The technology of automatic extraction of non-ferrous metal from smelting contaminated scrap metal with simultaneous separation by density (sorting aluminum and its alloys from copper and copper-zinc alloys) has been developed. The proposed separation method for processing of industrial and household waste contaminated with non-ferrous metal (e.g., old refrigerators, washing machines, automobile and truck transport, household waste with the contents of beer cans, etc.) can be used.

Seregin P.S., Rumyantsev D.V., Maksimov D.B. *Improvement of copper concentrate roasting furnace design using physical modeling method. Journal of Mining Institute. 2005. Vol. 165, p. 160-162 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8280>*



Abstract. The data on physical modeling of fluidized bed furnaces for roasting of copper concentrate from matte separation are presented. On the basis of observance of similarity criteria, a physical model of fluidized bed furnace is constructed to study the properties of fluidized bed and the influence of various factors on its properties. The influence of introducing a fluidizing agent into the blowing box on the non-uniformity of fluidization of the material in the furnace has been studied.

Fedorov M.S., Tsymbulov L.B., Tsemekhman L.S. Some regularities of processing of sulfide copper-nickel concentrates with increased content of magnesium oxide by oxidative smelting. Journal of Mining Institute. 2005. Vol. 165, p. 198-200 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8291>



Abstract. The results of research of oxidative smelting technology of ore concentrate from Pechenganickel Combine with increased content of magnesium oxide are presented. The experiment was carried out in laboratory conditions and at the enlarged plant with top oxygen blowing for matte of different composition. The process of depletion of the obtained slags was investigated. The results of slag research by X-ray microanalysis are presented.

Polikarpov V.K., Ronin A.L., Eliseev A.A., Zakharov S.N., Shtokalenko M.B., Kozlov S.A. Technology of forecasting and prospecting for sulfide copper-nickel ores with platinum group metals. Journal of Mining Institute. 2005. Vol. 162, p. 42-44 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8421>



Abstract. A concept for forecasting and searching for sulfide copper-nickel deposits has been developed. Based on this concept, a technology for forecasting and searching was created using a complex of geochemical and geophysical data (gravity, magnetic and electrical prospecting). The novelty lies in the fact that the methodology from “general to specific” is implemented, i.e. from constructing a geological and geophysical model of the study area and a model of the ore-magmatic system to a separate ore body. The effectiveness of the technology has been proven in the Monchegorsk ore district, where an increase in the predicted resources of copper, nickel and platinum group metals was obtained. The specific costs for identifying a unit of predicted resources are 0.22 USD/t, or 0.003% of the cost of the identified resources.

Fokeeva I.G., Tsymbulov L.B., Ertseva L.N. Investigation of crystallization patterns of high copper/nickel ratio matte with increased copper/nickel ratio. Journal of Mining Institute. 2005. Vol. 165, p. 201-202 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8292>



Abstract. The results of research of oxidative smelting technology of ore concentrate from Pechenganickel Combine with increased content of magnesium oxide are presented. The experiment was carried out in laboratory conditions and at the enlarged plant with top oxygen blowing for matte of different composition. The process of depletion of the obtained slags was investigated. The results of slag research by X-ray microanalysis are presented.

Bashlykova T.V., Pakhomova G.A., Lagov B.S., Zhivaeva A.B. Technological solutions to improve the efficiency of subsoil use. Journal of Mining Institute. 2005. Vol. 161, p. 120-122 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8476>



Abstract. A rational series of technological solutions aimed at improving the efficiency of study and development of deposits and including seven stages is proposed: predictive assessment of ore contrast in the subsurface, assessment of the contrast of extracted ore of initial size, operational technological assessment of the obtained grades, ore preparation with the use of centrifugal-impact type apparatuses, maximum use of gravitational processes with full or partial abandonment of flotation schemes, enrichment of technological grades obtained by large lump processing. The complex of innovative technologies for gold-sulfide, gold-quartz, copper-silver ores and copper ores with gold mineralization is given. The developed rational range of technological solutions is used in the creation of the concept of antimony industry development in the Republic of Sakha (Yakutia).

Krivosheev S.I., Nenashev A.P., Shneerson G.A. Electromagnetic pulse separator of non-ferrous metals for scrap automotive and household appliances. Journal of Mining Institute. 2004. Vol. 158, p. 233-235 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/8845>



Abstract. The technology of automatic extraction of non-ferrous metal from contaminated metal scrap with simultaneous separation by density (separation of aluminum and its alloys from copper, copper and zinc alloys) has been developed. The suggested method of separation can be used for processing industrial and domestic waste contaminated with non-ferrous metal (e.g. old refrigerators, washing machines, cars and trucks, household waste in the form of beer cans, etc.). A prototype of a magnetic-pulse separator was developed.

Physical chemistry, copper enrichment

Copper ore is one of the richest metallic mineral resources in the world. However, most ores in their natural state are not suitable for direct processing, and enrichment helps to increase the concentration of the useful element. Essentially, enrichment is a mechanical process of separating ore particles that represent either a useful mineral or waste rock. Occasionally, during the ore enrichment some of the harmful impurities are removed with waste rock.



*Pentlandite and talnakhite. The Talnakh field, Norilsk.
Item belongs to the Mining Museum.*

Kurchukov A.M. The control algorithm reagent conditions of flotation copper-nickel ores on the basis of optimizing the ionic parameters. Journal of Mining Institute. 2011. Vol. 189, p. 292-294 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6545>



Abstract. In the article considered the control of reagent conditions of flotation copper-nickel ores, it is proposed to take into account in the control algorithm residual ion concentration of sodium dimethyldithiocarbamate (DMDK) in the pulp. Flow control DMDK based on the residual concentration of its ions in flotation pulp provides optimized reagent conditions and improves the qualitative rate of enrichment copper-nickel ores with the simultaneous reduction of material costs for the implementation of the operation.

Kurchukov A.M., Kordakov V.N. Automated control system for the flotation process of copper-nickel ores. Journal of Mining Institute 2011. Vol. 189, p. 295-298 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6546>



Abstract. This article introduces the functional diagram and calculation methodology of the automated control system the flotation of copper-nickel ores, based on the optimization of reagent conditions and parameters of froth. Their use at the stage of designing the control system guarantees the efficiency of flotation process and increase quality rate of enrichment.

Purevdash M. Prospects of hydrometallurgical processing of oxidized copper ores and sulfide copper concentrate, as part of new technology of complex processing deposit «Erdenetiin Ovoo». Journal of Mining Institute. 2011. Vol. 189, p. 313-316 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6551>



Abstract. The issue of the Erdenetiin ovoo deposit development depth increase is considered based on application of heap leaching for oxidized, mixed, cutoff grade ores and pressure leaching for copper sulfide concentrate. The information about reserves difficultly processed ores of the deposit «Erdenetiin Ovoo». Given the parameters of predictive recovery of copper from copper sulfide ore heaps № 6 and № 2 of the deposit «Erdenetiin Ovoo».

Purevdash M., Saltykova S.N., Telyakov N.M. Biohydrometallurgical processing of copper sulfide ore of «Erdenetiin Ovoo» deposit. Journal of Mining Institute. 2011. Vol. 189, p. 317-319 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/6552>



Abstract. It is studied bioleaching of copper sulfide ore of Erdenetiin ovoo deposit. It is studied effect of ore size and pH of bacterial solution, the bacteria count of the bacterial solution on the extraction of copper of bacterial leaching.

Beloglazov I.N., Dolivo-Dobrovolskaya G.I., Saltykova S.N. Study of the material composition of copper-nickel sulphide raw materials. Journal of Mining Institute. 2006. Vol. 169, p. 63-65 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7848>



Abstract. To establish the physicochemical nature of phases in matte and matte, it is necessary to consider binary systems Cu-S, Ni-S, Fe-S, because the structural components in these systems can serve as phases in matte and matte, as well as be the beginning of the formation of new phases in them.

Gorlenkov D.V., Pecherskii P.A., Rubis S.A., Telyakov N.M. Method of dissolution of copper-nickel anodes containing noble metals. Journal of Mining Institute. 2006. Vol. 169, p. 108-110 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7860>

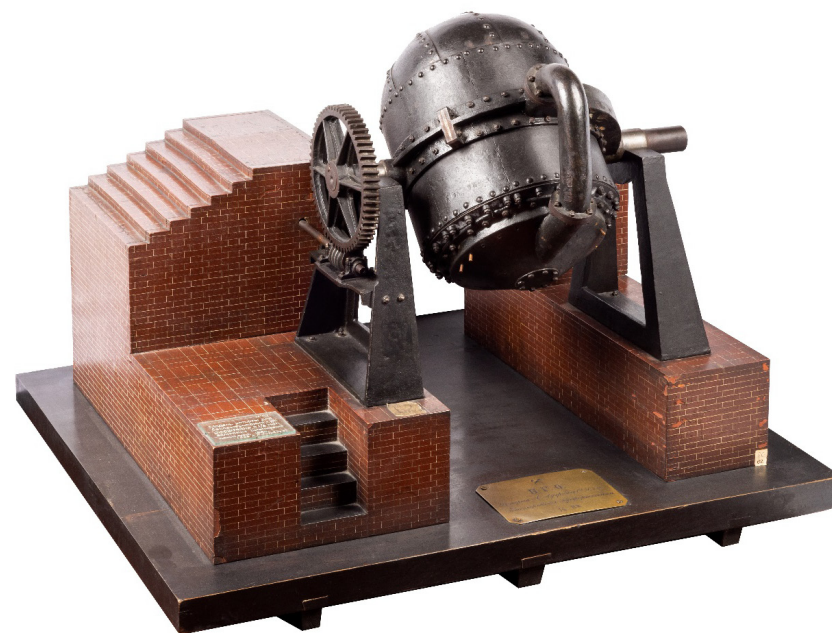


Abstract. The article reflects the main aspects of determining the dissolution potentials of copper- and nickel-based alloys containing precious metals in laboratory conditions and the choice of electrolyte for their dissolution. The composition of the investigated anode, graphs of dependence of the obtained potentials on time and voltage are given. The influence of some impurities on the process is explained. The conclusion about the rationality of using hydrochloric acid electrolyte is made.

Ziyazitdinova O.V., Beloglazov I.N., Golubev V.O., Pantyushin I.V. Application of press filters at the stage of copper-nickel concentrates dehydration. Journal of Mining Institute. 2006. Vol. 169, p. 124-126 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7865>



Abstract. The paper describes the operation and control system of modern press filters on the example of Larox PF filters installed in the roasting shop of Pechenganickel Combine. The main problems of improving and optimizing the operation of press filters are identified and a method of their solution is proposed by drawing up regression dependencies for the main characteristics of filter operation based on experimental data.



Copper smelting converter. The model designed by Auerbach. The item belongs to the Mining Museum.

Pavlyuk D.A. Improvement of melting technology of nickel and copper sludge cakes in metallurgical shop of copper plant of MMC Norilsk Nickel. Journal of Mining Institute. 2006. Vol. 169, p. 167-169 (in Russian). <https://pmi.spmi.ru/index.php/pmi/article/view/7879>



Abstract. MMC Norilsk Nickel uses the process of drying coke cuprum-pyrite sludge and nickel sludge on secondary anodes to produce platinum metal concentrates. The process is characterized by high temperature, low stability of lining (furnace working cycle-7 days) and significant emission of dust and gas mixture. In laboratory conditions a structural loading has been developed, which allows reducing the process confusion temperature by 200-250 °C. To achieve this result, it is proposed to carry out technological mixing with the formation of slags, which are between silicate and bisilicate in terms of acidity. The slags are characterized by low mixing temperature and viscosity, which provides reduction of losses with them of platinum metals.

Scientific edition

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Digest

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