Scientists develop new technology for extracting non-ferrous and noble metals

May 23 2019

Credit: Ural Federal University

Scientists at Russia's Ural Federal University (UrFU) are working on solving the problem of extracting non-ferrous and noble metals which are found in hard-to-process ores. Currently, there are many deposits where it is technically difficult to extract valuable components. This may be due to the presence of nanoscale gold and platinum group metals, their dissemination into the minerals' sulfide matrix, or the presence of

such highly toxic compounds as arsenic or antimony in the ore.

According to the project manager, senior researcher at the UrFU Academic Department of Nonferrous Metallurgy Denis Rogozhnikov, the relevance of the study is determined by the need to find new ways to process such refractory materials, as due to the depletion of ores rich in minerals and the deterioration of processed raw materials, currently, the existing technologies are not efficient or cost-effective from both economic and environmental points of view.

"Even modern high-intensity methods, such as ultrafine ore grinding, bacterial leaching, high-temperature autoclave oxidation, do not always allow [us] to achieve acceptable rates for the extraction of non-ferrous and noble metals," Denis Rogozhnikov says. "In this regard, it is of particular importance to search for ways to open such resistant ores and to further isolate gold, silver or platinum metals in order to reduce their losses at various stages of the technological process."

The goal of the research is to study the physicochemical patterns and mechanisms of nitric acid dissection of resistant sulfide minerals containing non-ferrous and noble metals. This will make it possible to complete the fundamental principles of the high-intensity hydrochemical process of developing such resistant materials contained in the processed raw materials of both Russian and global mining and metallurgical complexes.

"We want to create an integrated technology for hydrometallurgical processing of such complex materials, carry out a project feasibility study, test it on a pilot scale and in the future build industrial enterprises to process these types of valuable raw materials based on nitric acid leaching," Denis Rogozhnikov emphasizes. "In the course of the project, the fundamental task of developing a process for using the nitrous gases formed during leaching without their removal from the system in a

closed cycle will be solved."

From a scientific point of view, the results of studying surface phenomena at the solid-liquid interfaces are of great interest: the formation of intermediate product films, the thickness and continuity of films, proposals for eliminating their influence on the speed of the studied processes, and other determined kinetic characteristics. On the basis of the studies performed, development of mathematical models of the nitric acid leaching of the natural monosulfides in question is planned. These models will allow us to calculate the rates of the processes and the degree of dissection of the materials under consideration for given mineralogical compositions.

In order to create new technologies, plans are underway to conduct research both on model monosulfides and on real production facilities. This will allow us to apply the research results in the real sector of the economy: metallurgical enterprises.

"An extremely important advantage of the complex technology being developed is a prerequisite for obtaining environmentally friendly industrial waste, since in this case it is a question of processing raw materials containing highly toxic compounds, primarily arsenic," Denis Rogozhnikov notes. "[We take into account] the disposal and further long-term storage of waste in the form of the compounds which are insoluble, compact and not subject to the effects of natural atmospheric conditions. This provides another important advantage of the technology: the environmental factor."

The scientists are confident that the involvement of refractory gold-bearing raw materials in processing will provide additional benefits from the sale of recoverable valuable products of precious metals. In turn, the processing of toxic components will help avoid fines imposed by environmental agencies, which have been constantly reinforcing the

requirements for environmental control in recent years.

The project, led by Denis Rogozhnikov, received a two-year presidential grant for the development of scientific research. The grant amounts to 600 thousand rubles a year. In addition, the project's research team will become part of the Research and Educational Center "Advanced Industrial Technologies," created in the Urals region in the framework of the national project "Science."

Provided by Ural Federal University

Citation: Scientists develop new technology for extracting non-ferrous and noble metals (2019, May 23) retrieved 27 April 2024 from https://phys.org/news/2019-05-scientists-technology-non-ferrous-noble-metals.html