INTERNATIONAL SYMPOSIUM
"ENVIRONMENTAL AND ENGINEERING ASPECTS FOR SUSTAINABLE LIVING"
Programm Abstracts

Europäische Akademie für Naturwissenschaften, e.V. Hannover
Europäische Wissenschaftliche Gesellschaft e.V Hannover

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ISBN 978-3-00-032886-2

Publisher:
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One of the richest color metals deposits of Azerbaijan Republic is Filizchay pyrites-polymetallic ore, located in the area of Belokan-Shiki metallocenic zone. Its mineralogical composition is: 77.93% pyrite, 4.85% galena, 7.45% faulit and 1.61% chalcopyrite. There are the main components (Pb, Cu, Zn, Fe, S) and the accompanying microcomponents (Ag, Au, Bi, Sb, Cd, Se, Co, Ga, In, As, Te, Tl and others) in composition of Filizchay ore, which are possessed of the industrial value.

Presented work is dedicated to the pyrohydrothermalization of Filizchay pyrites-polymetallic ores in inert atmosphere and autoclave oxidizing leaching of pyrothotized products in the presence of gas-oxygen-\( \text{SO}_2 \).

Autoclave hydrothermalleaming allow to intensify technology processes, increase direct extraction of metals, improve the selectivity of their separation, draw into the processing the raw materials of complex composition. In this connection rather actual is processing of hardenrichable pyrites-polymetallic ores by autoclave method.

Pyrohydrothermalizing of ore is performed for obtaining more reactivity pyrothotite \((\text{Fe}_x \text{Sn}_y)\) at break of crystalline lattice of pyrite entering the composition of investigated ores in the process of their thermic dissociation. As a result of pyrohydrothermalizing ore, pyrite, chalcopyrite, arsenopyrite and other high sulphides decompose into low sulphides with the formation of elementary sulphur and arsenic. The received elementary sulphur and arsenic are sublimated. Sulphides of non-ferrous metals remain immutable.

An autoclave leaching of pyrothotized ore is carried out with use of lignosulphonate as surfactant, under high pressure at temperature not higher than the melting point of elementary sulphur (383K) for the prevention of occlusion of decomposed sulphides. In the process of autoclave oxidizing leaching of pyrothotized product, elementary sulphur is received simultaneously from two sources: sulphide sulphur of pyrothotized ore and from gas-oxygenante \((\text{SO}_2)\). High temperature and pressure of gas-oxygenante \((\text{SO}_2)\) promote increasing oxidation-reduction potential of solution due to what practically complete oxidation of pyrothotite to ferrous sulphate \((\text{FeSO}_4)\) must take place. Ferrous sulphate obtained in the process of autoclave leaching transforms into solution. Rare metals \((\text{Ga}, \text{In})\) entering into the composition of ore are not sublimated at the process of ore pyrohydrothermalizing and also transfer into solution at autoclave leaching of obtained product. The non-ferrous \((\text{Pb}, \text{Cu}, \text{Zn}, \text{Ag}, \text{Au})\) metals are concentrated in sulphur-sulphide solid residuum. Thus, selective separation of the non-ferrous metals from ferrum is provided.

The results of carried out investigations may be used for the basing and elaboration of processing of the other high pyritous polimetallic ore deposits of analogous to Filizchay ore deposit such as Ozernoye, Kholodinskoye (Russian Federation) Jayrem (Kazakhstan), Rammelsberg, Meggen(Germany), Maunt-Isa, Broken-Hill(Australia).

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**High Ash Coal Burning in the Combustion Chamber of TPP in Kazakhstan**


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The application of thermal engineering cause great interest and has a great value for practice. The importance and growing attention to the given problem is related to the importance of creation and modernization of existing combustion chambers that decrease quantity of the polluting substances released into the atmosphere and increase the energy efficiency.

The impact of the power enterprises in environmental contamination by products of fuel combustion and solid wastes is significant. First of all, due to power stations which work on solid fuel and are the basic contaminants of air, water and soil. The atmosphere in Kazakhstan contains hazardous substances such as carbon and nitrogen oxides, dust, lead, sulfur dioxide etc...

This problem can be solved only on the basis of physical, mathematical and chemical modeling using advanced technology. Thereby numerical experiment becomes one of the economic and convenient ways to make detailed analysis of the difficult physical and chemical phenomena occurring in the combustion chamber of a specific power plant (TPS) and for any power fuel.

In this article we discuss application of 3-D modeling methods to study the processes of heat and mass transfer of burning power fuel in combustion chambers operating TPS. Using these methods we can on the basis of the solution of unsteady 3-dimensional Navier-Stokes equations taking into account a heat transfer, thermal radiation, chemical reactions and multistage of environment.

The coal-dust flame in modern combustion chambers in gas-dynamic relation represents three-dimensional (curvilinear) turbulent flows of compressed gas, moving in the conditions of burning and intensive heat exchange with surrounding surfaces. At construction of settlement schemes with reacting currents in furnace chambers, it is necessary to deal with difficult system of the nonlinear equations in the private derivatives, consisting of the conservation of momentum, mass and energy, motion of the viscous environment, distribution of heat and diffusion for a component of a reacting mix and reaction products. Besides, the given system contains the equation of state and the equations of chemical reaction kinetics, which determine intensity of nonlinear sources of energy and substance. This problem is further complicated due to the weak level of knowledge of the kinetics of chemical reactions and the difficulty in describing the turbulence.

Thermal engineering in Kazakhstan is aimed at using high-ash coals (to 55%). Use of such coal leads to unstable burning, causes problems of slagging and protection of the atmosphere from the emission of ash, carbon oxide \((\text{CO})\), nitrogen oxides \((\text{NO} and \text{NO})\) and other polluting substances.
The problem of energy saving and water-saving technologies is crucial in modern industry. This is because many processes in industry consume large amounts of energy and water, which can lead to significant costs and environmental impacts. The development of energy-saving and water-saving technologies is therefore essential for improving efficiency and reducing environmental footprint.

To solve this problem, there is an increasing interest in the study of physical-chemical processes. The numerical simulation of heat and mass transfer in the presence of physical-chemical processes is an important area of research. This involves the use of computational models to simulate the behavior of multiphase, reactive, and transport processes. These models can provide valuable insights into the underlying mechanisms of complex physical-chemical systems.

One of the key challenges in this area is the development of accurate and efficient numerical methods for solving the governing equations. This requires a deep understanding of the underlying physics and chemistry, as well as the development of robust algorithms that can handle the complexity of the problem.

Recent advances in computational methods and high-performance computing have made it possible to tackle increasingly complex problems. However, there is still much work to be done to develop more effective and efficient numerical methods for physical-chemical processes. This is an active area of research, and there are many exciting opportunities for future work in this field.