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"ENVIRONMENTAL AND ENGINEERING ASPECTS FOR SUSTAINABLE LIVING"

Programm Abstracts

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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-Sheki metallogenic zone. Its mineralogical composition is: 77.93% pyrite, 4,85% galena, 7.45% sfalerit 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 pyrrhotization of hardenrichable Filizchay pyrites-polymetallic ore in inert atmosphere and autoclave oxidizing leaching of pyrrhotitized product in the presence of gas-oxidizer- SO_2.

Autoclave hydrometallurgy allow to intensify texnology 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 ore by autoclave method.

Pyrrhotization of ore is performed for obtaining more reactionary pyrrhotite (Fe_nSn_{n+1}) at break of crystalline lattice of pyrite entering the composition of investigated ore in the process of its termic dissociation. As a result of pyrrhotitizing 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 pyrrthotitized ore is carried out with use of lignosulfonate 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 pyrrhotitized product, elementary sulphur is received simultaneously from two sources: sulphide sulphure of pyrrhotitized ore and from gas-oxidant (SO_2). High temperature and pressure of gas-oxidant (SO_2) promote increasing oxidation-reduction potential of solution due to what practically complete oxidation of pyrrhotite to ferrous sulphate ($FeSO_4$) must take place. Ferrous sulphate obtained in the process of autoclave leaching transforms into solution. Rare metals (Ga, In) entering into the composition of ore are not sublimated at the process of ore pyrrhotitizing and also transfer into solution at autoclave leaching of obtained product. The non-ferrous (Pb, Cu, Zn, Ag, 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 detail 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 (CO), nitrogen oxides (NO and

and gas emissions.

According to the results of computational experiments, the authors obtained new results of theoretical research, mathematical and computer modeling of turbulent heat and mass transfer from the combustion of pulverized coal in the combustion chamber of the boiler industry of Kazakhstan.

The results of computational experiments can be used in the design of new and improvement of existing combustors industrial boilers using solid fuels, as used models are the most complete, modern and optimal for a given level of development of science. This, in turn, would solve the problem at the same time intensifying the process of burning, energy consumption, increase efficiency of low-grade coal combustion and reduce harmful dust and gas emissions into the environment.

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NUMERICAL SIMULATION OF HEAT AND MASS TRANSFER IN THE PRESENCE OF PHYSICAL-CHEMICAL PROCESSES

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At present time, there is an increased interest to the study of heat-and-mass transfer in high temperature environments in the process of burning. These processes occur in strong turbulent and non-isothermal flows, multiphase fluids, in the conditions of significant impact of nonlinear effects of thermal radiation, interfacial interactions and multistage chemical reactions. Such phenomena are widespread, they play an important role in thermal processes, and their study is an actual task of macrokinetics, physics of combustion and explosion, and modern thermal physics.

To solve the problems of modern power engineering and ecology it is especially important to study the processes of heat and mass transfer in the high-temperature reacting media and to simulate physical and chemical processes that occur during the combustion of pulverized coal. These problems are related, on the one hand, to the concept of "energy safety" of the country and, on the other hand, to the development of processes of "clean" fuel combustion under strict standards of emission of harmful substances into the environment.

In the conditions of depletion of natural power resources and environmental pollution, the development of the theory of heat and mass transfer and implementation of technological processes with the rational use of fossil fuels, solution of the problems of economic use of power equipment, increase in the efficiency of energy generation and solution of environmental problems are actual and important tasks in numerous thermophysical studies in this direction.

to achieve the geometrical and physical resemblance of the objects and to observe basic parameters and operation conditions corresponding to the technological combustion scheme used at the real power facility.

Theoretical investigations of heat-and-mass transfer in the presence of physical and chemical transformations in moving high-temperature responsive environment also cannot answer all the questions. This is due to the fact that such flows are described by a complex system of non-autonomous nonlinear multidimensional partial differential equations corresponding to the transfer of momentum, distribution of heat, components of the reaction mixture and the reaction products, which must take into account a considerable turbulence, multi-phase medium and source terms related to chemical kinetics of the processes.

Analytical solutions of this complex system of equations have not yet been found, and they can be solved only numerically. Recently, the main methods used to study such processes, particularly in the areas of real geometry, are the methods of numerical modeling and on their basis numerical experiments that adequately reflect the actual physical processes occurring in the combustion chambers. Progress in the development of computational models, in the creation of efficient computational algorithms and problem-oriented software packages allows us to solve many problems that are of great practical application in various industries.

Therefore, it is important to carry out a comprehensive study of physical and chemical processes of heat transfer in the high-temperature environment. This study will be based on the achievements of modern thermal physics, the use of new numerical methods of 3-D modeling, construction of efficient computational algorithms and new computational models that enable scientists to describe with high degree of accuracy real physical processes that occur during combustion of power-plant fuels in the combustion chambers of operating power stations.

Olga Atamanova

ENERGY-SAVING AND WATER-SAVING TECHNOLOGIES IN WATER ALLOCATION OF IRRIGATION CHANNELS

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The problem of energy saving and resource saving is increasing in most regions of the world at present time. Tasks of energy resources supply, clean water, clean food are coming to the fore in many countries of the world.

Water saving is of particular importance in indigenous irrigation regions where irrigation indigenous plant and animal breeding depends entirely on irrigation. This is