AP14972877 "Development of methods for forecasting sudden coal and gas emissions based on the study of coal nano-coating" – p.m. Mausymbaeva A.D.

Relevance:

The results of the research can be applied at the enterprises of "ArcelorMittal Temirtau" JSC, "Industrial Energy Alliance" LLP, "TaldyKuduk-Gas" LLP, "KazTransGas" JSC, coal mines of "Shubarkol Komir" JSC, "Zhalyn" mine, "Saryarka-ENERGY" LLP in the forecast of sudden coal and methane emissions on the basis of determining the nanostructure of explored seams, thus preserving the safety of miners' labor. The research results can be applied in the assessment of stress-strain state of coal seams not only in practice, but also in the educational process. The research results can be applied in the intensification of methane recovery of coal seams by knowing their nanostructure. The results of the research can be applied in the use of new methods of impact on the coal seam to increase gas recovery.

The authors have developed an experimental setup to be used for the proposed devices. It is intended for debugging hardware and software solutions at the stage of device design and consists of an inductance coil wound on a quartz tube, a breadboard with an amplifier, filter, phase shifter and synchronous rectifier mounted on it. The experimental setup also includes a controller board designed to generate all the necessary signals, a laboratory power supply and an oscilloscope designed to monitor the shape and levels of signals at the stage of debugging the hardware part of the device.

The project purpose:

To develop an innovative method of forecasting sudden coal and gas emissions by studying nano-coating of coal substance with their subsequent implementation in coal mines.

Expected and achieved results:

- for 2024:

The analytical solution of the problem for the density of coal solution flow at the most general initial and boundary conditions; the problem of seepage of coal solution with methane in a porous medium under homogeneous boundary conditions; to make an assessment of the model of the critical velocity of solution flow through the characteristics of the capillary and solution; to consider the model of the method of thermal influence on the coal seam; the model of thermobarogradient method of influence on the system "coal-gas" to intensify the gas recovery of coal seams, where it is possible to form a coal seam. This contributes to the development of more accurate models for predicting the critical solution flow rate, which is necessary to prevent sudden releases of methane and coal, thus ensuring the safety of mining operations. Consideration of the model of thermal influence and thermobarogradient method of influence on the system "coal-gas" for intensification of gas recovery of coal seams opens new ways to improve the efficiency of methane production, reducing the risk of emission hazardous zones and increasing the overall productivity of coal mines.

The analysis of the method of degassing coal seams, including directional drilling of wells from the surface along the coal seam, treatment of the seam with working fluid in the hydrodissection mode; to propose a method of measures to combat sudden coal and gas emissions by reducing the natural gas content of the seam; to substantiate, using a nanostructural model, the relationship between gas emission and resistivity, gamma method, acoustic wave propagation of the coal seam, where the formation of emission-hazardous zones is possible.

The proposed emission control measures include the use of a nanostructural model to substantiate the relationship between gas emission and resistivity of the coal seam, which allows for more accurate prediction of high hazard zones. The use of gamma ray method and acoustic wave propagation to assess the condition of the coal seam facilitates early identification of potentially hazardous areas, which in turn allows preventive measures to be taken to decontaminate them. As a result, this approach provides safer and more efficient methods of coal mining, reducing the risk of accidents and increasing the overall productivity of coal mines.

List of publications:

Published monograph:

New methods of impact on the coal seam to increase gas recovery under stress-strain conditions: Monograph / Mausymbaeva A.D., Mullagalieva L.F., Portnov V.S., Mullagaliev F.A.; Abylkas Saginov Karaganda Technical University. - Karaganda: KazPrint-2018 LLP, 2024 - 151 p.

Published 1 article in Scopus database publications

Maussymbayeva A.D., Yurov V.M., Portnov V.S., Rabatuly M., Rakhimova G.M. "Assessment of the influence of the surface layer of coals on gas-dynamic phenomena in the coal seam", Journal "Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu", 2024, No.2, P.5-11.

1 patent RK:

No. 36237 for invention. Subject "Radioisotope method of determining the age of minerals", authors: Pak Yu.N., Pak D.Yu., Mizernaia M.A., Inkin D.A., Mausymbaeva A.D., Ibyrkhanova A.I., Tleubergenova A.K.

1 filing of an application for a Eurasian patent:

No. application number - 202292438 dated 23/09/2022, theme "Method of applying anti-corrosion coating to parts of mining equipment"
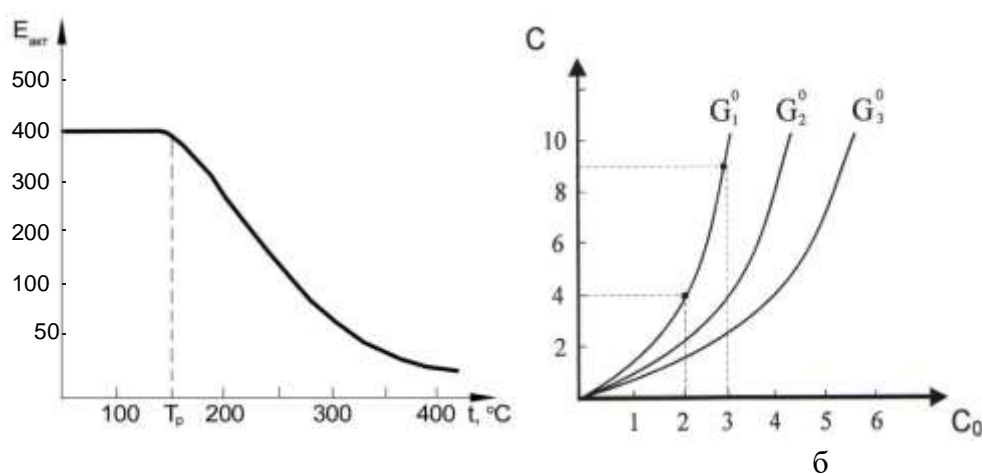
Figure 1 - Change in activation energy of methane during decomposition of "carbon methane"
a - schematic representation of temperature dependence of activation energy of coal methane decomposition; b - dependence of gas emission on methane content of coal bed

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Information for potential users:

Target consumers of the obtained results, including subject composition: economic and industrial interest in the technology was shown by the enterprises of "ArcelorMittal Temirtau" JSC, "Industrial

Energy Alliance" LLP, "TaldyKuduk-Gas" LLP, "KazTransGas" JSC, coal mines "Shubarkol Komir" JSC, "Zhalyn" open-pit mine, "Saryarka-ENERGY" LLP.

Scope:

The scientific effect consists in the creation of new devices for measuring the quality of mechanical engineering parts by electrochemical analysis and determining the wear of coatings.

The social effect of the Project realization includes training of qualified personnel from among young people and, ultimately, increase of intellectual potential of the country.

The economic effect from the Project implementation consists of various indicators: significant reduction of unplanned costs due to failure and technological downtime of apparatus and equipment of nuclear and thermal power plants, mining, engineering and metallurgical production, growth of labor productivity and reduction of labor intensity due to introduction of modern technologies, reduction of material intensity and production cost, growth of profit and profitability.

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