

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

Relevance

The results of the obtained research can be used at enterprises of the ArcelorMittal Temirtau JSC, the Industrial Energy Alliance LLP, the TaldyKuduk-Gas LLP, the KazTransGas JSC, coal mines of the Shubarkol Komir JSC, the Zhalyn open-pit mine, the Saryarka-ENERGY LLP in forecasting sudden coal and methane outbursts based on determining the nanostructure of explored seams, thereby maintaining the safety of miners. The research results can be used to assess the stress-strain state of coal seams not only in practice, but also in the educational process. The research results can be used to intensify methane recovery from coal seams by knowing their nanostructure. The research results can be used as new methods of impacting a coal seam to increase gas recovery.

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

Project objective

To develop an innovative method of predicting sudden coal and gas outbursts by studying nanocoatings of the coal matter with subsequent implementation in coal mines.

Expected and achieved results

- for the second half of 2024:

Analysis of the coal solution flow density under general initial and boundary conditions was performed, which made it possible to assess the effect of the porous medium on solution migration. A model of the critical coal solution flow rate was estimated, taking into account the capillary characteristics and properties of the solution, which makes it possible to predict the stability of gas recovery. A model of thermobarogradient action on a coal seam was also developed to intensify gas recovery, taking into account the redistribution of stresses in the near-wellbore zone.

The article "Rock shear process impact on the methane content of longwall faces" was published in the journal "Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu", 2024, No. 4, pp. 11-17 (<https://doi.org/10.33271/nvngu/2024-4/011>) Scopus 41%.

The implementation act was received. The scientific and methodological foundations for the implementation of the technology for predicting sudden coal and methane emissions based on the study of the nanostructure of coal seams were considered, complexes of methods of nanostructural analysis and hydraulic impact are proposed, providing an assessment of the outburst hazard at various stages of deposit development, taking into account the distribution of gas-bearing zones and the physicochemical parameters of coal seams that affect the intensity of methane recovery and the processes of safe mine operation.

List of publications for 2024

A monograph was published: New methods of influencing a coal seam to increase gas recovery under stress-strain conditions: Monograph / Maussymbayeva A.D., Mullagaliyeva L.F., Portnov V.S., Mullagaliyev F.A.; Abylka Saginov Karaganda Technical University NJSC. Karaganda: KazPrint-2018 LLP, 2024. 151 p.

An article was published in Scopus database edition: Maussymbayeva A.D., Yurov V.M., Portnov V.S., Rabatuly M., Rakhimova G.M. Assessment of the surface layer of coals impact on gas-dynamic phenomena in the coal seam», Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2024, No.2, P.5-11

An RK patent was received: No. 36237. "Radioisotope method of determining the age of minerals", authors: Pak Yu.N., Pak D.Yu., Mizernaya M.A., Inkin D.A., Maussymbayeva A.D., Ibyrkhanova A.I., Tleubergenova A.K.

There was filed an application for a Eurasian patent: No. 202292438 dated 09/23/2022. Method of applying an anti-corrosion coating to parts of mining equipment.

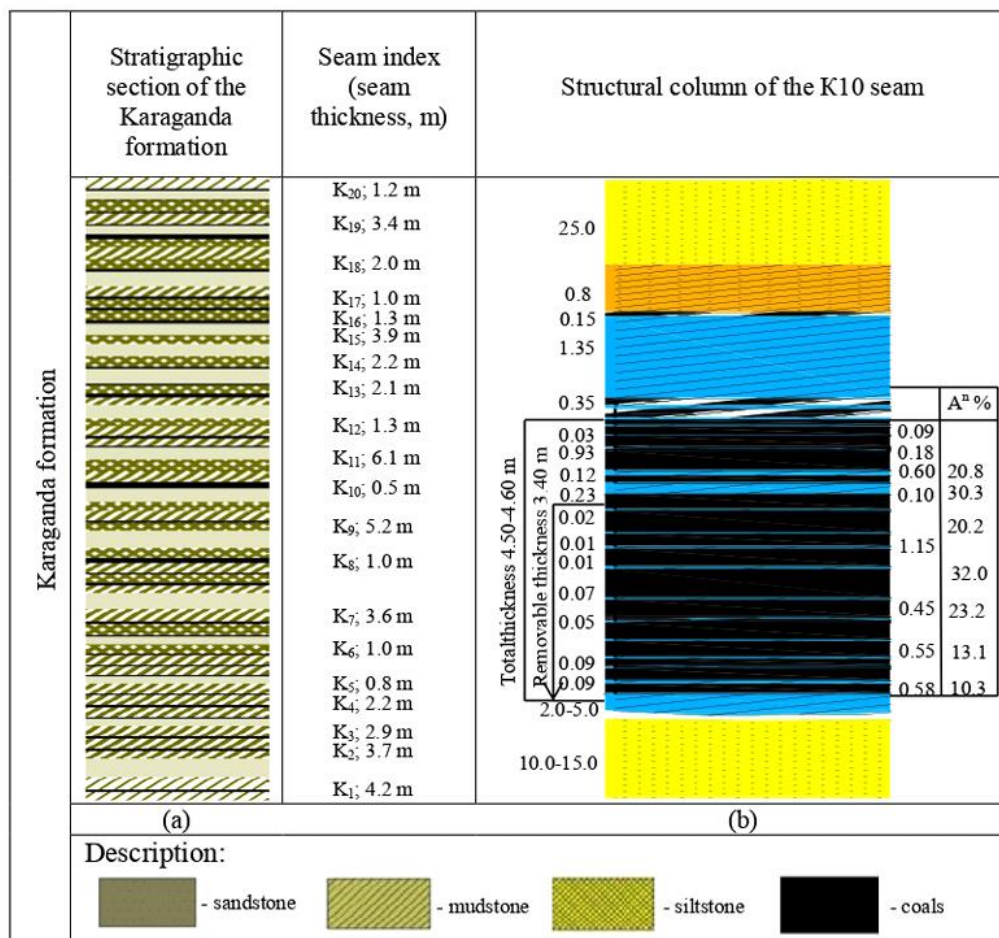


Figure 1 – Geology: stratigraphic section of the Karaganda series (a), structural column of the K10 formation (b)

Research team

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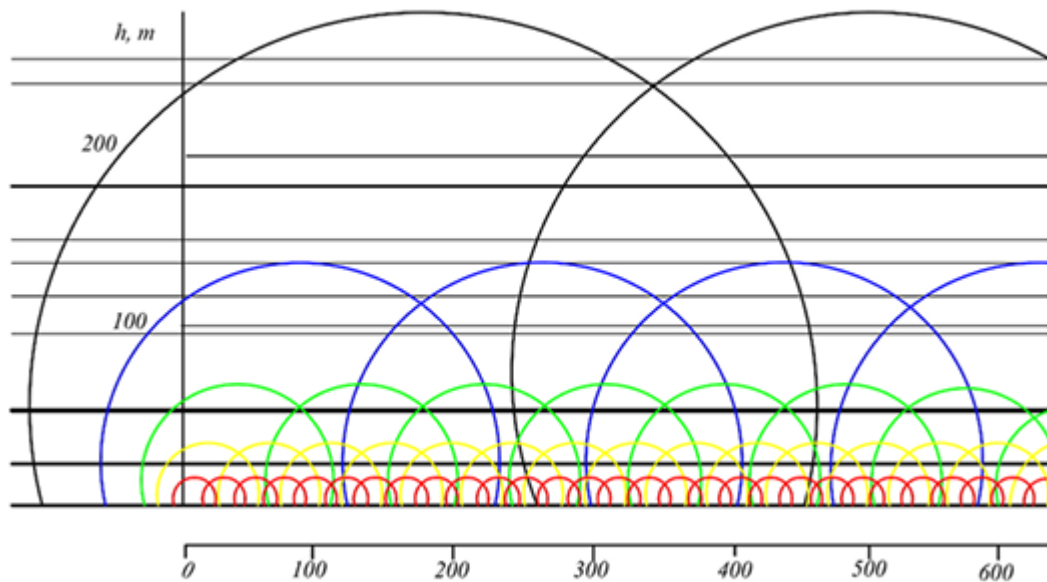


Figure 2 – Formation of unloading arches in geomechanical layers for conditions of face 72k10-z of the Saranskaya mine along the length of the extraction pillar: fragments of the vertical scheme of geomechanical structuring of rock massifs

Information for potential consumers

The target consumers of the obtained results, including by subject composition: economic and industrial interest in the technology was shown by enterprises of the ArcelorMittal Temirtau JSC, the Industrial Energy Alliance LLP, the TaldyKuduk-Gas LLP, the KazTransGas JSC, coal mines of the Shubarkol Komir JSC, the Zhalyln open pit, the Saryarka-ENERGY LLP

Scope

The scientific effect consists in the development 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 implementation includes the training of qualified personnel from among young people and, ultimately, the increase in the intellectual potential of the country.

The economic effect of the project implementation consists of various indicators: significant reducing the unplanned costs due to the failure and technological downtime of equipment and machinery of nuclear and thermal power plants, mining, mechanical engineering and metallurgical production, increasing labor productivity and reduced labor intensity due to the introduction of modern technologies, reducing material consumption and production costs, increasing profits and profitability.

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