AP13268841 "Development of technology for maintaining preparatory mine workings for conditions of coal mines" – p.m. Zhumabekova A.E.

Relevance of the project consists in providing sound technological solutions for determining the parameters of the support for its efficient operation and can be achieved through the development and implementation of technology and means with the justification of the support parameters, taking into account the stress-strain state of the host rocks, which will reduce labor and material costs during the operation of mine workings, as well as achieve a high technical and economic effect and increase the safety of underground mining operations.

Project goal - development of a technology for maintaining development workings based on managing the stress-strain state of the marginal rock mass in front of the working face.

Results achieved:

Within the framework of the project, successful industrial tests of the polyurethane resin «BlokpurS» were conducted at the mine of the Karaganda coal basin. The tests showed high strength of the bonded rock with lower resin consumption compared to analogues, penetration of the resin into small cracks (0.15-0.2 mm in size) with subsequent foaming and strengthening of the rock was ensured. Passports for fastening mine workings were developed and approved, confirming the effectiveness of the technology.

Based on the results of the completed work, a certificate of state registration of intellectual property rights was obtained (Zhumabekova A.E., Demin V.F. «Mine workings supporting technologies on stress and strain state control basis», application No. 36838 dated 06/08/2023) and a patent (Zhumabekova A.E., Demin V.F. et al. No. 8679 dated 12/01/2023 «Method of combined fastening of ventilation workings of an extraction column»).

The scientific results have been published in leading journals: an article accepted for publication in a journal from the first quartile of Web of Science (Environmental Geotechnics, 76% percentile), an article submitted for review to Scopus (Creation of technological schemes of treatment excavation for complex mining and geological conditions, 51% percentile), and an article published in the journal CQAES (Evaluating the Efficiency of the Mine Workings Supporting Technology Application to Increase Contour Stability). A textbook in English has also been published (Mining Of Outburst Hazard Coal Seams In The Karaganda Basin, ISBN 978-601-320-949-4).

An act of implementation of technological developments has been received. An agreement has been concluded with TOO «Maker» KFMBP for adaptation and implementation of the developed solutions in industrial production. The developed concept of commercialization of technologies for fastening mine workings allows using the obtained results for production of anchor fastenings at mining enterprises.

Additionally, a method for increasing the stability of mine workings has been developed in order to manage stresses in the vicinity of the workings. The principles of supporting mine workings at all stages of their existence have been established. A project web page has been created, where information on the results of the research and the project participants is posted. The equipment necessary for the implementation of the project has also been purchased and put into operation.

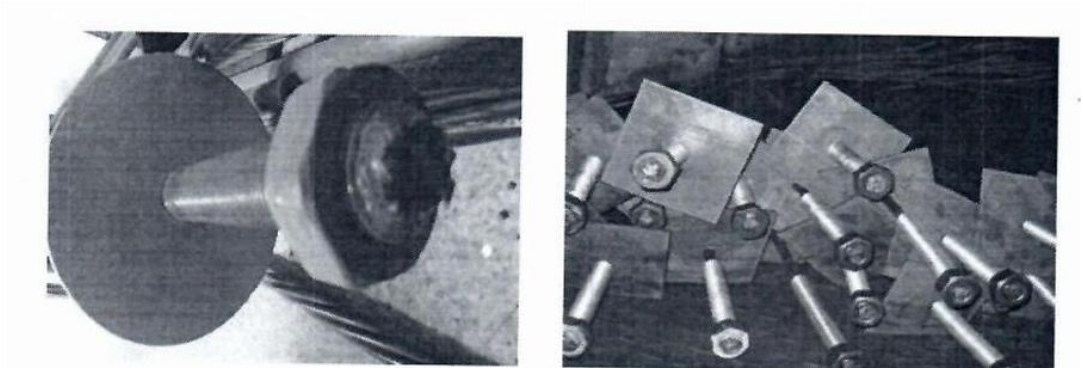

Figure 1– Construction of a rope anchor

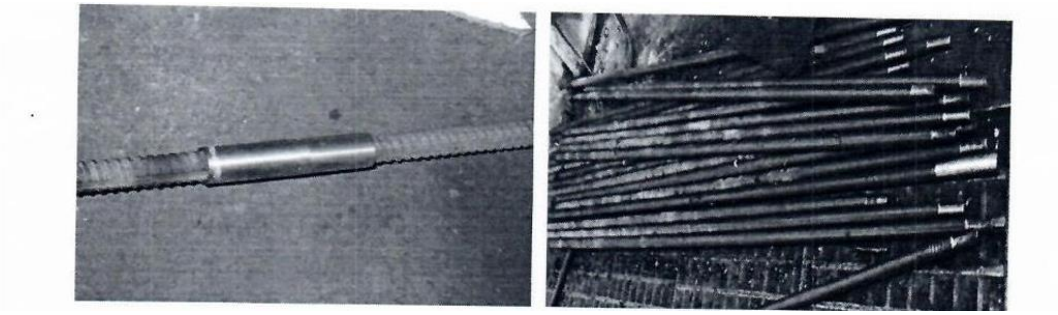

Figure 2– Construction of a composite anchor

Research group

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List of publications

Publications of the scientific director and members of the research group:

1. Ussenbekov M.S., Issabek T.K., Polchin A.I., *Zhumabekova A.E., Dynamics of methane emission during mining operations in zones of geological disturbances, “Mining information and analytical bulletin”, MIAB. Mining Informational and Analytical Bulletin, 2022;(12):141-151. Engineering industrial and manufacturing engineering, 27th percentile. UDC 622.8:614.8 DOI: 10.25018/0236_1493_2022_12_0_141

2. Zhumabekova A., Demin V., Abeuov E., Tanekeyeva G. «Mine workings supporting technologies on stress and strain state control basis»,» Scientific, technical and production» Mining Journal of Kazakhstan No. 1, 2023, pp. 40-47https://doi.org/10.48498/minmag.2023.213.1.004

3. Zhumabekova A.E., Demin V.F. «Mine workings supporting technologies on stress and strain state control basis», RIS dated 08.06.2023.

4. Issabek T., Ussenbekov M., *Zhumabekova A. Gas control in mines of the Karaganda basin (republic of Kazakhstan), collective scientific monograph on the topic: «The main directions of complex innovative scientific and technological development of mining regions», published in English by a European publishing house, http://dx.doi.org/10.31713/m1208

5.A. Zhumabekova, V. Demin, E. Abeuov, G. Tanekeyeva. Mine workings supporting technologies on stress and strain state control basis // Mining Journal of Kazakhstan, No. 1, 2023, pp. 40-47.https://doi.org/10.48498/minmag.2023.213.1.004

6. Ussenbekov M.S. Issabek T.K., Polchin A.I., Zhumabekova A.E. Dynamics of methane emission during mining operations in zones of geological disturbances. Mining information and analytical bulletin (scientific and technical journal), 2022, (12), pp. 141–151. (Scopus36%).Citation3. https://doi.org/10.25018/0236_1493_2022_12_0_141,https://www.scopus.com/record/display.uri?eid=2-s2.0-85143989145&origin=resultslist;

7. Zhumabekova A.E., Demin V.F. «Mine workings supporting technologies on stress and strain state control basis», RIS dated 08.06.2023.

8. Issabek T., Ussenbekov M., Gas control in mines of the Karaganda basin (Republic of Kazakhstan). Key trends of integrated innovation-driven scientific and technological development of mining regions: monograph. - Petroșani, Romania: UNIVERSITAS Publishing, 2023. - R. 150-176.https://doi.org/10.31713/m1208

9. Zhumabekova A., Demin V., Issakov B., Demina T., Tanekeyeva G. Evaluating the Efficiency of the mine workings supporting technology application to increase contour stability. Proceedings of the University. 2024. No. 1. 185-195. DOIhttps://doi.org/10.52209/1609-1825_2024_1_185

10. Patent No. 8679 dated 12/01/2023 «Қазба бағанының желдетуші қазбасын біріктіріп бекіту тәсілі. Способ комбинированного крепления вентиляционной выработки выемочного столба. Method of combined supporting excavation pillar ventilation working». Zhumabekova A.E., Demin V.F. etc.

11. References to articles in high-ranking scientific journals indexed by the international SCOPUS database percentile 50+, on journal review. Mining of Outburst Hazard Coal Seams In Karaganda Basin: Textbook / M. Ussenbekov, T. Issabek, B. Khussan, M.Rabatuly, Zhumabekova, A.; Non-profit Joint Stock Company «Abylkas Saginov Karaganda Technical University». - Karaganda: Non-profit Joint Stock Company «Abylkas Saginov Karaganda Technical University» Publishing House, 2024. – 193p. ISBN 978-601-320-949-4

Information for potential users

Underground mine workings in the mines of the Karaganda coal basin are in an unstable state (in terms of displacements of roof, soil and side rocks), are maintained with significant material costs and labor intensity of work, which follows from the lack of justification for the compliance of their support parameters with operating conditions in specified mining and geological, technical and production conditions. Making substantiated technological decisions on determining the support parameters and effective operation requires a geomechanical predictive assessment of the deformed state of the rocks of the host rock mass around the perimeter of mine workings. Development and implementation of technology and means with

justification of their support parameters taking into account the stress-strain state of the host rocks will reduce labor costs and materials during the operation of underground mine workings.

Today, one of the current areas of development of the coal industry is the development and testing of technological resource-saving methods and active means of supporting workings with stabilization of the rock mass to achieve a high technical and economic effect and improve the safety of mining operations.

Scope of application

Mining production in the coal industry with the dissemination of the obtained scientific and technical potential to underground mining enterprises.

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