

ABSTRACT

of the dissertation for the degree of Doctor of Philosophy (PhD) in
specialty 6D070700 – Mining

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Justifying the parameters of mine working in the zone of impact based on the geomechanical model

Relevance. Mining and preparatory work is one of the labor-intensive and capital-intensive processes of mining production in the extraction of minerals by the underground method. When coal is mined underground, the selection of optimal supporting parameters is of particular importance. At present, anchor and combined roof supports are widely used in the Karaganda coal basin. The popularity of anchor supporting is explained by the low price, lower labor intensity of the installation. However, anchor supporting has a number of limitations that determine the scope of these supportings. Incorrectly selected lining parameters can lead to additional costs for maintaining and even re-supporting mine workings. In this regard, there is a need to develop a method for calculating the parameters of the supporting. Currently, the results of studies of the 70s are used in the regulatory documents on supporting. Since then, the depth of mining has increased the influence of rock pressure on underground mine workings in conditions of large worked-out spaces. Until now, the influence of the worked-out space has been taken into account through correction factors, setting the vertical stress on $2\gamma H$.

The development of computer technology, modern methods of mathematical modeling make it possible to improve the methods for predicting the expected loads on the supporting and increase the reliability of determining the optimal parameters of the supporting. In this connection, the work aimed at increasing the reliability of determining the parameters of the support is relevant.

The purpose of the dissertation

The purpose of the dissertation work is to substantiate the means of supporting and the parameters of preparatory mine workings, taking into account the influence of the goaf.

The idea of the work is to take into account the influence of the mined-out area when choosing the means of support and setting the parameters for the support of preparatory mine workings based on three-dimensional modeling of the stress-strain state of rocks.

Main research objectives:

- to investigate deformation and disintegration processes in the near-contour part of preparatory mine workings, taking into account mining and geological, mining engineering factors;

- to develop a three-dimensional geomechanical model of the mining area, including the mined-out space, preparatory workings, taking into account the volumetric stress-strain space;

- to develop recommendations on the choice of support means for mine workings and the calculation of optimal supporting parameters, taking into account the support pressure from previously worked out longwalls.

Scientific provisions submitted to be defended:

- the formation of loads on the support and displacement of rocks near the mine workings is due to the stress-strain state of the near-contour massif, is associated with the location of the workings relative to the worked-out space;

– the developed geomechanical model for studying geomechanical processes near mine workings allows justifying the choice of means for maintaining mine workings and supporting parameters, taking into account the influence of the support pressure of previously worked out longwalls.

Scientific novelty of the results of the work is as follows:

- in establishing the patterns of formation of displacements and loads on the lining of development mine workings in the zone of influence of mining operations, depending on the size of the goaf, and the location of the development workings relative to the goaf;

- substantiation of the load on the support of development workings, located along the normal to the previously worked out longwall at different distances from the conditional middle of the column, differing by a factor of two;

- a methodology for developing a calculation of the load on the lining, taking into account the spatial arrangement of workings and worked-out space.

Validity and reliability of scientific provisions.

The validity of scientific provisions and research results is confirmed by the use of modern achievements in the field of mechanics and physics of rocks, analysis and processing of a sufficient amount of experimental data.

The reliability of the research results is confirmed by the calculations performed according to the proposed method, and the convergence with the results of field observations.

Implementation of the work results.

The method developed by the author for determining the parameters of the lining, taking into account the influence of the mined-out space, was implemented when performing R&D on the topic: "Development of an algorithm and software for three-dimensional modeling of the Kazakhstanskaya mine."

The practical value of the work lies in the substantiation of the means and parameters of the lining of development workings according to the developed methodology for coal mines.

The author's personal contribution is as follows:

- setting research objectives;

– processing of experimental data, research and establishment of regularities of the influence of goaf on the SSS of the massif near development workings;

– study of geomechanical processes taking place in the marginal part of the working;

– development of a methodology for calculating the loads on the lining and the parameters of the supporting of development workings.

Testing of the work. The main provisions of the dissertation work were reported and discussed at international scientific and practical conferences: "Sagynov readings - 2020", Karaganda, 2020; "Sagynov readings - 2021", Karaganda, 2021.

Publications of the work. The main content of the work is reflected in 7 publications, including 4 articles and 2 abstracts, 1 IIS.

Structure and scope of work. The dissertation consists of an introduction, four sections and conclusions, appendixes, contains 116 pages of printed text and list of sources used from 90 items.