

Summary

of the dissertation work by PhD doctoral candidate in specialty 6D071200 “Mechanical Engineering” Pleshakova Yelena Aleksandrovna “Studying and Developing Technological Process of Applying Pseudo-Floatable Coverings on Mining Equipment Parts”

The work relevance. The requirements to producing powered supports both the new technological level and for repairing the used old output of mining equipment used in heavy-duty conditions works are constantly growing. Its cause is the decreasing of the time and funds expenditure for repairing and producing the units of equipment unsuitable for work, increasing reliability and durability of a powered support and decreasing the prime cost of coal and improving working conditions of employees in mining industry.

The important elements of the powered support sections are hydraulic racks and jacks which represent sliding step systems. Efficiency, reliability and durability of these units considerably depends on the ability of their parts to resist to harmful effects of wear, corrosion, the working surface, as well as different types of loadings and deformation.

The development of technology of obtaining and applying pseudo-floatable coverings on the surface of the powered support rods providing durability and efficiency of anti-corrosion protection of parts with pseudo-floatable coverings is a topical problem of improving the manufacturing techniques of mining equipment which solution will permit to increase substantially the durability and reliability of mining equipment and to reduce the time and funds expenditure for repairing equipment.

On the basis of the above-mentioned there was formulated the work purpose.

The purpose of the work is establishing dependences defining the physical essence and technology of the process of applying pseudo-floatable coverings on mining equipment parts.

The idea of the work consists in increasing wear resistance and corrosion resistance of powered support parts owing to the use of a pseudo-floatable covering.

In connection with the defined purpose there were formulated the following tasks of the study:

- to develop a model of kinematics of the mechanism of applying a pseudo-floatable covering;
- to establish operating conditions of the proposed mechanism of applying protective coverings;
- to develop and investigate a mathematical model of the electric arc process of the coverings sputtering;
- to carry out pilot studies of the technology of obtaining pseudo-floatable coverings on the basis of the electric arc process of sputtering;

- to develop recommendations and an economic justification of the process of sputtering pseudo-floatable coverings.

The work scientific novelty consists in:

- the development of a mathematical model of sputtering a pseudo-floatable covering;

- there were for the first time obtained analytical dependences of determining the thickness of the sputtered layer on the distance of sputtering, linear speed, speed of movement of the torch, the corner of dispersion of the melted particles;

- justification of characteristics of a pseudo-floatable covering depending on parameters of the electric arc process of sputtering.

Practical value of the work:

- there was developed software for the Coating Mode Solver (CMS) which was intended for the automated calculation of technological parameters of applying a covering on the surface of objects of mechanical engineering;

- there was developed and accepted for practical use in production the "Method of Calculating Technological Parameters and Modes of Electric Arc Process of Sputtering Pseudo-Floatable Coverings on Diametrical Parts";

- there were developed and accepted for practical use in the laboratory works at the University "Recommendation on the technology of the electric arc process of sputtering pseudo-floatable coverings".

Scientific provisions to be defended:

- the process of applying pseudo-floatable coverings is possible when fulfilling the conditions of equality of the coverings applying expenditures;

- linear speed is directly proportional to the speed of the torch movement depending on the set parameters of the torch nozzle diameter and the covering width;

- increasing corrosion resistance, wear resistance, hardness of the covering is provided due to the modeling of technological parameters of the electric arc process of sputtering.

The validity and reliability of scientific provisions, conclusions and recommendations are confirmed by:

- the statistical analysis of a large volume of production data on the fault detection of clearing powered support rods obtained according to Kurylysmet LLP and Karaganda Machine-Building Consortium LLP and under acts of audits and adjustments from 2008 to 2013 of powered supports at the mines of the CD "ArcelorMittal Temirtau";

- the use of basic provisions of the technology of mechanical engineering, theoretical mechanics and solving tasks on PC;

- carrying out mathematical modeling and laboratory pilot studies of parameters of the pseudo-floatable covering quality using methods of mathematical statistics and solving tasks on PC;

- establishing the qualitative and quantitative convergence of the results of theoretical and pilot studies. Maximum deviations of the calculated values do not exceed the errors of the experiments processing and are adequate to each other at the level of significance of 2%.

The work implementation. The work was performed by the State Program of the Ministry of Education and Science of the Republic of Kazakhstan on subjects: "Development of nanotechnology of modifying the working surface of tribocoupling on the basis of carbon and nitrogen providing corrosion wear resistance" (2012-2014); "Design-and-technological and instrumental quality assurance of mining and mining-and-processing equipment for the purpose of increasing its operational strength" (2011-2014).

The basic provisions and results of the study are accepted by the Karaganda Machine-Building Consortium LLP, Kargormash-M LLP for using when developing manufacturing techniques and capital repairs of the powered support rods.

The work publications. On the dissertation materials there were published 17 printing works including: articles in the journals recommended by the Committee - 7; in the Scopus Company (including in the Thomson Reuters database) with a nonzero impact-factor – 1; in the materials of international and foreign conferences – 9.