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INFORMATION SUPPORT OF THE PROCESS OF MONITORING THE STATE OF EXPLOSION PROTECTION SYSTEMS

The modern world of industrial technology and production brings not only new opportunities but also increased risks, including explosion hazards. Monitoring the condition of explosion protection systems is becoming an important link in ensuring the safety of enterprises and the environment. Information technology plays a key role in improving the effectiveness of this control by providing accurate data, operational feedback and intelligent analysis algorithms. In the mining industry, monitoring the explosion hazard status of enterprises plays a crucial role. Effective information technology is becoming a key factor in ensuring the safety of mines and their personnel by providing accurate data, operational responses and intelligent analysis algorithms.

The introduction of modern information technologies in the processes of controlling the technological safety of coal mines significantly increases the level of safety and efficiency of emergency protection systems. In this article, we will consider the issue of information support for the process of controlling the explosive hazard of coal mines, where information support is becoming an integral part of modern enterprise security systems.

With the increasing complexity of technological processes, explosive systems require more accurate and efficient control. The task is to develop and implement information technologies capable of providing reliable monitoring and prompt response to potential threats. The aim of this study is to improve the level of safety at mining enterprises through the effective use of information technologies in monitoring the condition of explosive systems.

Various information support is used to monitor the status of explosion protection systems and readings of explosion hazard sensors:

The information software can provide real-time monitoring of explosive gas concentrations. Operators can track changes in the concentration of explosive gases and receive immediate warnings if the permissible thresholds are exceeded. The systems can store and analyze historical data on the concentration of substances, which allows them to identify trends and anticipate possible problems.

If a threat is detected, the systems can automatically shut down equipment that could serve as a source of ignition of explosive gas mixtures or stop processes to prevent accidents. Alert systems can be used to send instant notifications to operators or automatically activate fire extinguishing systems in the event of a hazardous situation.

Information support can ensure the integration of explosion control systems with management systems, providing feedback and the ability to automatically control safety parameters depending on the detected threats. Information management software can use analytical tools to model data and predict possible scenarios, which helps prevent problems before they occur.

Modern systems for monitoring the explosive hazard of coal mines use thermocatalytic methane sensors. They are characterized by high reliability, stability of readings and are operable in difficult underground conditions. However, unforeseen changes in operating conditions, exposure of the sensors to machine and mechanism elements, water jets during the washing of workings, dust during blasting operations, accidental falls and other events can lead to their failure or malfunction of equipment safety shutdown systems in the event of explosive

mixtures. Therefore, to increase the reliability of explosion protection systems, it is necessary to constantly monitor their condition by computer to detect the displacement of zero readings of methane analyzers, control the sensitivity of sensors, detect cases of contamination of gas diffusion filters of sensors and cases of unauthorized interference with the operation of control systems.

Studies [1] have made it possible to substantiate the method of diagnosing the condition of stationary thermocatalytic methane analyzers in terms of detecting cases of significant contamination of the gas diffusion filter of thermocatalytic methane sensors and to develop the information support necessary to identify critical cases and correct readings in case of non-critical contamination of gas diffusion filters. This is achieved by analyzing the transient processes that occur in the analyzer after a short-term decrease in current through the sensor thermocouples to a value at which the catalytically active element does not undergo methane oxidation. It was found that in a thermocatalytic sensor with a double diffusion filter, in the case of significant contamination of its filter element, the ratio of the amplitude of the output voltage surge of the bridge after a short-term decrease in current through the thermocouples to the value at which the methane oxidation process stops increases significantly. This makes it possible to detect contamination by analyzing changes in this ratio.

The process of detecting significant contamination of the gas diffusion filter can be integrated with the process of automatic remote control of zero readings of analyzers [2]. This control is carried out by reducing the supply voltage of the thermo-group to a value at which no methane oxidation reaction occurs on the working thermocouple, followed by analyzing the change in the voltammetric characteristics of the thermocouples and calculating the shift in the characteristics of the working thermocouple at the rated supply voltage.

Conclusions:

The use of information software for analyzing transient processes, detecting cases of significant contamination of the gas diffusion filter of thermocatalytic methane sensors, and automatically correcting zero readings of analyzers makes it possible to conduct centralized monitoring of explosion protection systems. Continuous monitoring and automatic response systems significantly reduce the risk of explosive situations. By preventing emergencies and optimizing the operation of equipment, effective resource management is achieved. In addition, information support for explosion protection systems makes it possible to respond promptly to any changes in the environment and take quick action to prevent hazards. The development of technologies in this area contributes to the creation of a safer and more efficient production environment, where digital solutions play a key role in preventing accidents and minimizing risks to employees and the environment.

References

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