ISSN 2409-9066. Science and Innovation. 2014. V. 10. No. 6. P. 47—49 doi: http://dx.doi.org/10.15407/scine10.06.047

Trifonov, A. Tumanov, V., and Gluhov, A.

Ukrainian State Research and Design Institute of Mining Geology, Rock Mechanics, and Mine Surveying of NASU, Donetsk

TECHNIQUE FOR SEISMIC DIAGNOSTICS OF ROCK MASS CONDITIONS ABOVE THE WORKING IN THE COURSE OF MINING THE COAL SEAMS PRONE TO GEODYNAMIC PHENOMENA

Methodical guidelines to receive seismic evidence of console block cracking and hardware for continuous recording of seismic processes have been developed. Energy and spectral characteristics of seismic emission for the development of tectonic destruction zones in various rock structures of the upper roof have been established. The ability to display the spatial migration of hypocenters of seismic events and their energy magnitude has been determined. The algorithm for computation of diagnostically informative features of geodynamic hazard has been elaborated.

Key words: seismic process, upper roof, console formation, energy parameters, spectral characteristics, and geodynamic process.

INTRODUCTION. BACKGROUND

The formation of geodynamic dangerous conditions in the bottomhole of coal seam is mainly determined by geomechanical processes in the rocks of the upper roof, whose console formations can create stresses in the seam, with these stresses materially exceeding those caused by weight of the rock strata above the seam. The cracking of the heaviest consoles can be accompanied with significant dynamic impact on the seam in local areas near its bottomhole between the maxima of diagrams of bearing pressure caused by console formations of the upper and the direct roofs. The local character of these dynamic effects having significant energy parameters can cause destruction of coal with release of free methane adsorbed on the pore walls. This local part of the seam can be pressure-isolated for some time due to a poor permeability partially impaired by console of the direct roof of the seam edge. As the geomechanical situation changes, it can lead to either pressure fracture of the seam boundary layer with a significant release of methane or to a rapid destruction thereof with large gas emission.

Largely and randomly varying seismic emission that arises while the console formations are cracking can be predominantly determined by insignificant (in terms of geomechanical danger) factors.

The cracking of powerful and strong structures of the upper roof can be accompanied with manifestations of natural bending vibrations of console structures. Given the significance of these consoles from the standpoint of their extension and power, their bending vibrations seem to be very low frequent. Due to the experimental research done using the developed methodology for receiving seismic manifestations above the working and the designed hardware for continuous recording of seismic processes the seismic information was received on 5th southern longwall block of *Pokrovske* mine, which allowed the researchers to establish the effect of grouping seismic emission signals by frequency and energy parameters

into several groups having noticeably different values of energy parameters. This fact means the simultaneous development of cracking in several console formations that significantly differ in strength of rock structures. Activation of cracking in one of them may precede these processes in console parts of above rock layers. The separation of the below console from the solid mass reduces support of the above console, with such a dynamic impact on the solid mass provoking the bending vibrations of above consoles and activating cracking therein.

THE RESEARCH RESULTS

In 2013, the Presidium of the National Academy of Sciences approved a list of research innovation projects. Among them, numbered 8th, there is *Technique for Seismic Diagnostics of Rock Mass Conditions above the Working in the Course of Mining the Coal Seams Prone to Geodynamic Phenomena* project (the developer is the Ukrainian State Research and Design Institute of Mining Geology, Rock Mechanics, and Surveying of NASU, Donetsk).

The research project was aimed at elaborating methods and designing hardware for recording the seismic manifestations of geomechanical processes in the rock mass above the working, as well as for developing an algorithm for the calculation of seismic emission parameters that would provide sufficient information for controlling the early stages of geodynamic hazards formation.

The obtained results of the project allowed the researchers to identify diagnostically informative signs of geomechanical changes occurring above the workings and to develop an algorithm for calculating the parameters of seismic manifestations to reflect properly the initial stages of formation of geodynamic hazard and to estimate its possible magnitude.

Pursuant to the proposed concept of decisive role of the upper roof console structures in the formation of geodynamic situation above the working, the methodical recommendations for receiving the seismic manifestations of console separation have been prepared; the hardware for continuous recording of seismic processes has been designed. The energy and spectral parameters of seismic emission related to the development of cracks in different rock structures of the upper roof have been established; the ability to display the spatial hypocenter migration of seismic events and their energy magnitude has been proven. The authors has developed an algorithm for calculating diagnostically informative signs (current ratio of energy parameters of several specific frequency bands of the seismic emission of two separated surface reception points) which provide the objective determination of the beginning of geodynamic hazard formation.

О.С. Трифонов, В.В. Туманов, О.О. Глухов

Український державний науково-дослідний
та проектно-конструкторський
інститут гірничої геології,
геомеханіки та маркшейдерської справи
НАН України, Донецьк

РОЗРОБЛЕННЯ ТЕХНОЛОГІЇ СЕЙСМІЧНОЇ ДІАГНОСТИКИ СТАНУ ГІРСЬКОГО МАСИВУ НАД ВИДОБУВНОЮ ВИРОБКОЮ ПРИ ВІДПРАЦЮВАННІ ВУГІЛЬНИХ ПЛАСТІВ З ПОТЕНЦІЙНОЮ НЕБЕЗПЕКОЮ ГЕОДИНАМІЧНИХ ЯВИЩ

Розроблено методичні положення щодо прийому сейсмічних проявів відриву консольних блоків і апаратура безперервної реєстрації сейсмічних процесів. Встановлено енергетичні та спектральні особливості сейсмічної емісії розвитку тріщиноутворення в різних породних структурах основної покрівлі і можливість відображення просторових міграцій гіпоцентрів сейсмічних подій та їхньої енергетичної масштабності. Розроблено алгоритм розрахунку діагностично інформаційних ознак.

Ключові слова: сейсмічний процес, основна покрівля, консольне утворення, енергетичні показники, спектральні характеристики, геодинамічний процес.

А.С. Трифонов, В.В. Туманов, А.А. Глухов

Украинский государственный научно-исследовательский и проектно-конструкторский институт горной геологии, геомеханики и маркшейдерского дела НАН Украины, Донецк

РАЗРАБОТКА ТЕХНОЛОГИИ СЕЙСМИЧЕСКОЙ ДИАГНОСТИКИ СОСТОЯНИЯ ГОРНОГО МАССИВА НАД ДОБЫЧНОЙ ВЫРАБОТКОЙ ПРИ ОТРАБОТКЕ УГОЛЬНЫХ ПЛАСТОВ С ПОТЕНЦИАЛЬНОЙ ОПАСНОСТЬЮ ГЕОДИНАМИЧЕСКИХ ЯВЛЕНИЙ

Разработаны методические положения по приему сейсмических проявлений отрыва консольных блоков и аппаратура непрерывной регистрации сейсмических процессов. Установлены энергетические и спектральные особенности сейсмической эмиссии развития трещинообразования в различных породных структурах основной кровли и возможность отображения пространственных миграций гипоцентров сейсмических событий и их энергетической масштабности. Разработан алгоритм расчета диагностически информативных признаков.

Ключевые слова: сейсмический процесс, основная кровля, консольное образование, энергетические показатели, спектральные характеристики, геодинамический процесс.

Received 27.06.14