Experimental studies of crossing the disjunctive geological faults with underground gasifier

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Coal is the main fossil fuels used in power generation. According to the World Energy Resources 2013 on an average 60% of global substandard coal reserves located in difficult mine and geological conditions, including the geological fracturing zones. Development of such coal would allow to increase the time of its consumption due to additional production and integrated use of the following 40–60 years. International and local experience shows that traditional coal mining in areas of geological fracturing is unviable because of the high cost of coal produced, low labor safety of miners and gas-dynamic phenomena that occur near the affected zones. The concentration of coal seams in difficult mining and geological conditions at a considerable depth requires a comprehensive review of development opportunities. There is a need to develop the alternative technology of extraction based on scientific investigation, consistent with the modern development of science and technology is cost-effective and environmentally safety and most importantly – belong to Clean Coal Technology. Such technology is underground coal gasification (UCG).

In the article the possibility of crossing the disjunctive geological faults without full coal seam fracturing by underground gasifier, based on the established time dependences of underground gasifier output to an effective gasification regime at application the technology of UCG are substantiated. On laboratory unit found the changing dependency of time when the underground gasifier reaches the regime of stabilization during underground coal gasification. The time in which the underground gasifier reaches the regime of stabilization determined by the rate of non-fracturing of coal seam and regulated by the reaction channel advance and balanced supply of reagents blast.

The dependences of fault plane amplitude in geological fault on the distance at which the gasifier reach the regime of stabilization on the total output of combustible gases and their heating value are received. Change the dependence of the coefficient of gasification enhancement, depending on the thermochemical rate processes in reaction channel of the underground gasifier is submitted. The approach to transfer the results of the experimental investigation in natural conditions based on geometric and

time simplifications is offered. The results of the research will allow making adjustments to the calculation of material and heat balance of the gasification process to determine the optimal qualitative and quantitative composition of injected air.

The results of experimental investigations stand out enough for practical applications of precision, can be used to identify output parameters for determining the process reach the regime of stabilization during underground coal gasification. It give the possibility to expand the use of underground coal gasification technology in the geological fracturing zone and potentially involve for mine development the substandard coal reserves for energy and chemical generator gas production, chemicals and heat manufacture.

The possibility of coal seams gasification with a large number of small-amplitude geological faults without coal seam fracturing, determine the minimum distance between faults, unconsumed coal left by the faults of various types; impact the stability of wells near geological faults, etc. currently is poorly understood. Thus, the existing technologies of underground coal gasification process in the area of small-amplitude geological faults not sufficiently reflect the latest achievements of science and technology. Based on the problems associated with cross the disjunctive geological faults, it is clear that the study of new methods for the coal seams extraction in difficult geological conditions is now an urgent task not only for Ukraine but other countries around the world.

Objectives of the article are to set the time when the gasification process reach the regime of stability with variable fault plane amplitude of geological dislocations on the basis of laboratory investigation.

The main conclusions of the article are:

The distance (l) at which reduces the percentage concentration of combustible gases during crossing geological fault with underground gasifier changed with power-low dependence $l = 15h_{d.a}^{2,75}$ at the amplitude of the displacement right up to 0.9 of coal seam thickness.

Time t at which underground gasifier reach the regime of stabilization, that are determined by the total output of generator gases and the heating value of generator gases crossing disjunctive geologic fault with the amplitude up to 0.9 of coal seam thickness at an exponential dependence depends on the displacement amplitude $h_{d.a}$ and the speed of combustion face advance V_g.

The fine precision of received results allows to determinate the distance from fault plane at which gasification process reach the regime of stabilization.

$$l = 1{,}9\mathrm{e}^{1{,}1h_{d.a}}$$

Reduce the percentage concentration of combustible gases appears ahead of disjunctive fault plane of the geological fault, because the break down an altogether chemical zone in coal seam perpendicular to the reaction channel.

The enhancement of the geological fault crossing zones depend on balanced supply of injected reagents, respectively, take into account heterogenic geometry of coal seam, it is necessary to conduct additional calculation of material and heat balance and make manual mode of gasification process