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DEGREE OF SUSCEPTIBILITY OF CHANGES IN THE COAL MASS UNDER VIBRATION AND DIRECTIONS FOR ORGANIZING MANAGEMENT ACTIONS TO INCRESE METHANE RECOVERY

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Abstract: *The article is devoted to the problem of organizing management actions to increase methane recovery by means of formation of fractures in a low-permeable gas-saturated coal massif using vibration. In order to increase the gas recovery from the coal seam, the task is to propose the management actions characterized by a set of parameters. As a research task, the author carried out the attempt to assess the degree of susceptibility of changes in the coal mass caused by external influencing factors and investigated the destabilization of the coal mass (Premysler et al., 1962).*

Keywords: Susceptibility, Vibration, Formation, Factors, Methane release.

1. Introduction

The degree of susceptibility of changes in the coal produced by external influencing factors during realization of the destabilization process by means of the vibration exposure is determined by a set of parameters of the functioning areas and by the management actions as the decisive factors of realization of the technological process (Nikolaev, 1989 and Dawe et al., 1987).

A great interest in tools for increasing fracturing of the coal mass and new forms of technologies arrived at joint research in this field.

The degree of susceptibility of changes in the coal mass depends on the frequency and amplitude of the vibration and their relationship with the methane release from various volumes of coal. The penetration and growth of the cracks in the coal and the ability to control the methane removal were evaluated, both in the laboratory and in situ conditions. The investigations can be used for the design solutions in different geological conditions. The research was conducted in the low frequency range (Pavlenko, 2001 and 2002).

The vibration effect on the coal massif is a method for destabilization of the "coal + methane" system and depends on a number of external conditions and factors.

The applied vibration in specific coal environments has its own dynamics, which depends on the coupling forces of the methane molecules in microcracks, and this gives different possibilities for controlling the methane release.

Utilizing the specific coal environment features makes it possible to choose suitable oscillation frequency and amplitude of the vibration to enable formation and growth of the cracks in low-permeable coal, to set conditions for the methane release from the initial massiff state, and to create technological possibilities for further stable growth of methane recovery.

Despite a large amount of experimental information, the degree of susceptibility of changes in the coal mass under vibration excitation remains insufficiantly explored. The processes taking place in the pores and micropores and the effect of the vibration on a low-permeable coal mass are significant but they have not almost been explored by the experimental approach yet. Special attention must be paid to the coal field areas, which are not enough investigated due to the specific natural conditions.

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2. Practical solution

For the first time, the relationship between the destabilization in the "coal + methane" system and the vibration effects in the low frequency range of 1 ÷ 100 Hz was studied and the mechanism of their interaction was revealed in (Pavlenko, 2002).

It was concluded that organization of the management decisions depends on the geological conditions of the underlying reservoir, on properties of the low-permeable coal mass during the period of vibration, and on application of the appropriate methods for various conditions.

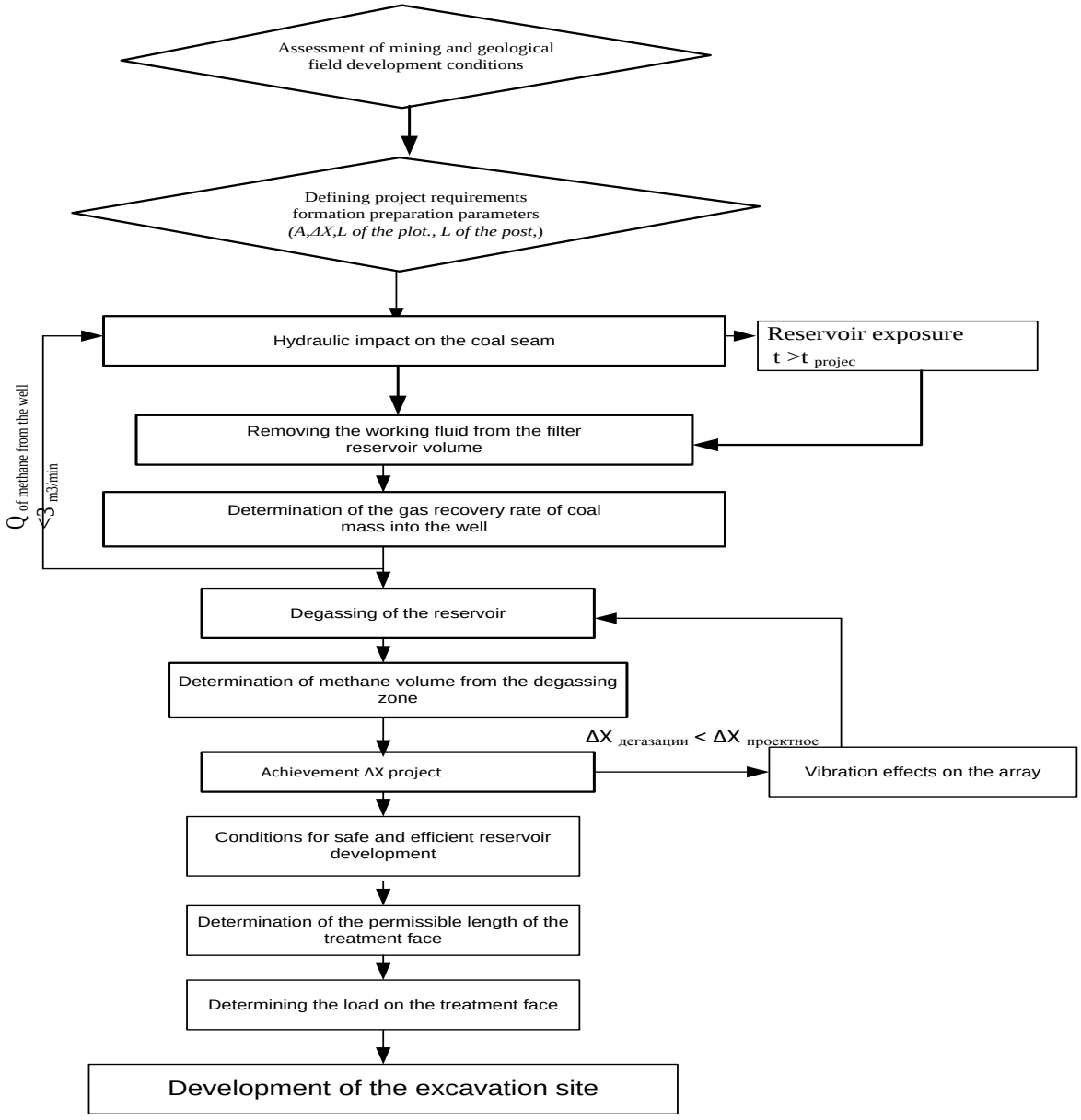

Fig. 1: Flowchart of technological solutions for safe and effective preparation of gas - saturated coal mass.

The decision-making technological procedure for active action on the massif formation, the sequence of operations, and preparation of the gas-saturated coal mass is shown in Fig. 1 (Pavlenko, 2002).

The changes in the general "coal + methane" system in the process of vibration, which is considered as a structural part of this system, are highlighted.

Fig. 2 shows the technological solutions for the preparation of a mine field.

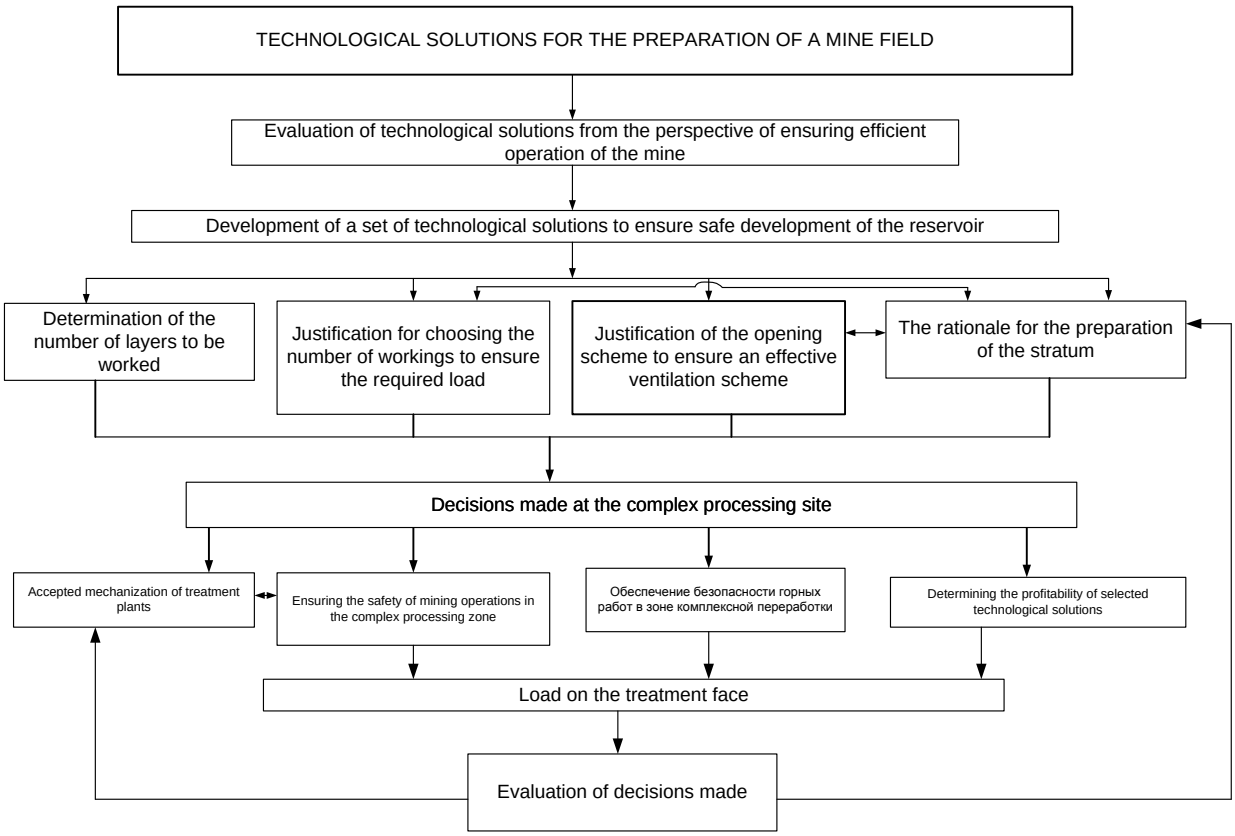

Fig. 2: Technological solutions for the preparation of a mine field.

3. Results and discussion

The proposed system of vibration actions on a low-permeable coal mass is based on utilization of pieces of geological information. It allows to evaluate the properties of a low-permeable coal mass, to predict methane recovery from the coal seam, and to determine the optimal density of the grid of engineering wells. At the present stage of the study of the engineering and geological conditions of deposits the problem of choosing the appropriate exploration method and adequate management decisions leading to efficiency of the methane recovery arises.

Among the solutions in the field of management decisions there are such that optimize the processes of the methane recovery by means of assessment of the spatial variability of the rock mass properties, which is essential for preparing the coal deposits for effective and safe mining.

The conducted research has shown that further theoretical investigations in the area of the methane recovery from the coal massif are very needed. In particular, the following aspects are of the scientific and practical interest:

- deepening the knowledge of the essence of destabilization of the coal-methane system aiming at intensification of the methane recovery,
- study of the characteristic features of the dynamics of the methane recovery in specific mining and geological deposits,
- the development of the quantitative estimates of methane release during the vibration action aiming at improvement of the present-day procedures.

The management decision is the choice of the optimal solution from a number of possible predictive alternatives. It determines the means for achieving the goal, organizes the process of vibration, and is especially needed in the case of a low-permeable methane-saturated coal massif.

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