Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 26 (2011) 524 – 530

Procedia Engineering

www.elsevier.com/locate/procedia

First International Symposium on Mine Safety Science and Engineering

Study on Scientific Exploitation Technology for Coal-and-gas Double-energy in High Gassy Coal Seam Group

XIE Sheng-rong[a], ZHAO Yao-jiang[b], YANG Hong-zeng[a],

ZHANG Shou-bao[a],XIAO Dian-cai[a] *

[a]*College of Resources & Safety Engineering, China University of Mining & Technology(Beijing), Beijing 100083, China*
[b]*College of Mining Engineering, Taiyuan University of Technology, Taiyuan 030024, China*

Abstract

By using the method of theoretical analysis, numerical simulation and practical experiment, the distribution character of mining fissure and law of gas moving in gob are studied. The combined suction way by long and large diameter roof fissure borehole group and high-position borehole group is brought forward and the scientific exploitation technology system for coal-and-gas double-energy established. The practical experiment proves the high concentration gas can be drained out effectively by reasonably laying out the boreholes position. The effect of gas controlling is good, and finally the scientific exploitation for coal-and-gas double-energy can be achieved in Shaqu colliery.

Keywords: high gassy coal seam group; scientific exploitation; long and large diameter boreholes group; CFD simulation

In recent years, with the expansion of mining and rapid development of intensive production, the geological conditions of some mines get more and more complex. Gas in coal seam has become a key factor which affects the safe and high-efficiency production in these mines. Shaqu colliery is high gassy mine and coal-and-gas outburst mine. The occurrence of coal seam for Shaqu colliery shows the characteristics of high gas, close distance, multi coal seams, instability and so on. At the first stage of

* Corresponding author: Tel.: +8613810521426.
E-mail address: xsrxcq@163.com

1877-7058 © 2011 Published by Elsevier Ltd.
doi:10.1016/j.proeng.2011.11.2201

mining, the mainly extracting seam is No.4 coal seam. The average thickness of this seam is 2.45m. Its above and below adjacent coal seams are the No.2 seam, No.3 seam and No.5 seam from top to bottom. The space between each adjacent coal seam is less than 10m and gas-bearing capacity is high. Original gas-bearing capacity is 30.73-41.25m^3 / t for No.4 coal seam and 20m^3 / t or more for its adjacent seam (No. 3 and No. 5). The practical datum shows the gas quantity of ventilation and suction can be up to 100m^3/min on fully mechanized coal face. In this mine, the comprehensive suction way of extracted coal seam pre-drainage, next seam suction, tailing way suction and high-position suction is adopted. The gas concentration in the upper corner and outtake air on fully mechanized face always exceeds the limitation and the power supply cuts off frequently. This heavily influences the normal production and safety of this mine. Since the mine was established and put into production in the year of 2004, design production capacity never can be achieved. Gas has become to the bottle-neck of the mine development. How to suction the gas safely and utilize it successfully, and consequently achieve a scientific exploitation [1], has turned into the first and key problem of Shaqu colliery.

Both the domestic and oversea scholars have done deep researches on the theory and technology of gas drainage in complex geology [2-5]. But the study of 1000m long directional roof boreholes drainage technology is not done very much. Based on the theoretical analysis of numerical model and practical experiments, the researches of gas suction on high gassy coal seam group by the 1000m long and large diameter roof boreholes is done in this article. Thus the difficulty of gas control which limits the mine's development in past many years is solved and scientific exploitation for coal-and-gas double-energy achieved.

1. Basic principle of scientific exploitation for coal-and-gas double-energy

For Shaqu colliery, scientific exploitation for coal-and-gas double-energy mainly depends on the high efficient suction and utilization of gas. Based on the distribute character of mining fissure field and gas concentration field, technology of long and large diameter roof boreholes to drain the press-released gas is put forward, and the technology system of scientific exploitation for coal-and-gas dual-energy is established to direct the field production practice.

1.1. Press-released gas storage and migration in gob

Practice indicates for those low-penetrability seams, the permeability can be increased by dozens and hundreds of times due to the impaction of mining. It creates the condition for gas migration. Study shows that for Shaqu colliery, after mining No.4 coal seam, most of gas in gob is the press-released gas from its adjacent coal seam. No.3 coal seam included in caving zone directly released gas into gob. For No.2 coal seam, press-released gas migrates into gob through mining fracture. At the same time, floor rock stratum occur the expansive and distortion under the impact of ground pressure, so its permeability increases greatly. No.5 coal seam with high gas-bearing capacity migrates a big amount of press-released gas stably into gob. Gas of each emission sources migrates into the gob according to each moving law and they are mixed together. Some flows into coal face under differential concentration and ventilation negative pressure. Other rises up along the fissure channels of mining fracture zone due to the flotage. They mix with the surrounding air during rising. The differential concentration of gas between from the sources and surrounding air decreases gradually until it is zero. Thus, the mixture gathers into bed separated fissure of the upper crack zone. Gas moved into the gob occurs normal diffusion under the action of concentration gradient. Because of the gravity of air, the gas produces pressure gradient downwards. Contrarily to the pressure direction, gas diffusion direction is upwards. Say gas has a upward diffusion tend [6]. The gas in the surrounding area of "O-shape" migrates into "O-shape" in the way of diffusion or seeping under the gradient of concentration and pressure. Therefore, "O-shape" becomes the main channel for gas to gather and move under the gas flotage, concentration gradient and ventilation negative pressure. "∩-shape"