Control of High Permeability Zone by Ground Stress Field in Daning-Jixian Area

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Abstract: Ground stress field is one of the important factors that control enrichment and high production of coalbed methane. Study of the relationship between the crustal stress field and permeability of coal seams may give better guidance to exploration of coalbed methane. Based on diplog data and analysis of sidewall collapse by monitoring the earth potential, the orientation of the horizontal maximum principal stress is obtained in Daning-Jixian area. Based on sonic differential time log and resistivity curve the maximum principal stress value is calculated. The results of the research indicate that the Guyi-Yaoju anticlinal axis part is a low value zone of the maximum principal stress which controls the high permeability zone of coalbed methane, and also the most favorable exploration zone in this area.

Key words: Daning-Ji Xian, CBM, ground stress field, high permeability zone

Discussion on Scheme of Surface Technology for Drainage and Extraction of Gas

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Abstract: Combined underground coal extraction by entries with surface gas drainage, especially pressurization of gas for transmission for sales purposes, is a new project in this country. Investigations are under way in aspects of surface gas drainage with suction, surface flow sheet for pressurization of gas, monitoring, control, etc. The purpose of this paper is to discuss this project with the readers.

Key words: surface gas drainage by suction, pressurization of gas for transmission, surface flow sheet and automatic control

Physical and Numerical Simulation of Gas Content of Brown Coal in Wanquan Coal Field in Hebei Province
Abstract: Based on isothermal absorption test of balanced water of brown coal (raw coal), the adsorption gas content of brown coal is calculated. Based on laboratory simulation of water soluble methane, the water soluble gas in coal seam is computed. The free gas content of brown coal is estimated by using pycnometer (bottle) method and mercury intrusion method and 马略特 Law.

Key words: brown coal, gas content, simulation, Wanquan coal field

Comparison of Methods for Measuring Gas Content of CBM

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Abstract: The paper mainly describes several existing methods for computation of coalbed methane quantity, based on which two methods are applied for calculation of the gas content of coal seam by using existing data obtained from Guqiao mine in Huainan mine area. The first method is based on analytical data obtained from the laboratory. The results are corrected by using the influence of temperature and intensity of pressure on adsorption quantity, and the corrected value is then obtained. The other method is based on logging and seismic data. The Langmuir equation is applied to compute the adsorption gas content of coal seam on the basis of seismic inversion data, and the results are compared with other method. The overall analysis considers that when compared with other method which is applied for calculation of gas distribution in the entire coal seam based on limited single well computation data, the Langmuir equation method for calculation of seam adsorption gas quantity based on seismic inversion data, can better reflect the details of seam deposition, structure and coalbed methane reservoir.

Key Words: coal seam, gas, coalbed methane, seismic data, Langmuir equation

CBM Occurrence Characteristics in Liangbei No.2 Mine

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Abstract: Liangbei No.2 mine has fairly rich coalbed methane resources, and exploration and development of the resources is of significance in aspects of energy, environmental protection, mine safety, etc. The paper makes a systematic description of CBM occurrence characteristics in Liangbei No.2 mine based on measured data obtained from coalfield exploration and CBM
prospection and the measured data. Coal in the mine area has strong adsorption capacity, and the
gas content varies from 0 - 20 m³/t. The general spreading rule of the landform is high in the south
and low in the north and high in the west and low in the east, which is mainly influenced by the
burial depth and dynamic conditions of the ground water. In the southwest part of the mine
field the burial depth is deep, and the ground water retention zone has become a favorable place
for enrichment of CBM. The isothermal adsorption curve and gas bearing capacity of the No.2-1
seam determine that the theoretical recovery rate of CBM in the southwest part is high. The
mudstone or sandy mudstone provides favorable conditions for preservation of coal bed methane.
The geological conditions of Liangbei No.2 mine determine enrichment of CBM in the south part.
However, the intensive tectonic movement has damaged the coal mass into mylonitic structure
coal with poor permeability. Thus, the development of CBM in this area is an issue worthy of
discussion.

Key words: Liangbei No.2 Mine, CBM, occurrence characteristics

Progress of Research on CBM desorption Characteristics

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Abstract: The desorption characteristics of CBM is key to development of CBM and to
simulation of the coal reservoir as well. The authors have studied the progress of research on
CBM desorption features on the basis of literatures and materials in the domain of CBM published
in recent years. The paper describes the basic theory of CBM desorption, rules of change, the trend
of variations of CBM desorption parameters, the physical properties of coal reservoir and the
influence of geological factors on desorption of CBM. The paper points out that currently research
of desorption properties of CBM is insufficient. The paper has summarized the progress of the
research on CBM desorption characteristics and a preliminary analysis of the progress is made.
Key words: CBM, desorption characteristics, coal reservoir, geological factor

The Status of CBM work in Coal Resources Prospecting Stage and
the Countermeasures

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Abstract: Based on investigation of current status of CBM work in the prospecting stage of coal
resources, some problems have been found. They are insufficient knowledge on CBM resources,
inadequate division of the CMB prospecting stages due to technical specifications for prospecting
CBM resources having not yet promulgated, and sampling and testing not meeting the need, etc.
Some countermeasures are proposed for the healthy development of CBM work in Hebei Province
Key words: CBM, current status, countermeasures, Hebei province

Trials on Hydrofracturing Technology for Enhancement of
Permeability of Outburst Prone Coal Seam
Abstract: The goals of the test are acquisition the technical parameters, such as pressure and flow rate, etc. necessary for hydro-fracturing of coal seams with low permeability, further probing the effective radius of hydro-fracturing, reduction of the drilling volume to a great extent, lightening of labor intensity, reduction of drainage duration to the maximum for giving more time for coal mining.

Key words: hydro-fracturing, enhancement of permeability, test

Discussion on Proposal for Classification & Utilization of CBM Resources

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Abstract: The paper has made a proposal for classification and utilization of CBM resources in China on the basis of current status of surface development of CBM and underground gas drainage China, by giving overall consideration of effective development and utilization of CBM resources and mitigating as much as possible contradictions between departments for underground gas drainage and surface development. The classification is made on the basis of enrichment features of CBM resources, specific characteristics of CBM development. The main criterion for classification is gas content, but factors like complexity of structures, seam permeability rate etc. are also considered. This proposal can give guidance to CBM research, gas drainage and surface development.

Key words: CBM, classification of resources, utilization scheme, mode of development

China CBM Geology and Resources Evaluation

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Abstract: The authors have laid a theoretical foundation for evaluation of resources by summarizing systematically the geological settings and rules for formation and enrichment of coalbed methane in China. Unified evaluation method system and parameter system are introduced to obtain CBM resources and their spatial distribution. Based on overall zonal
evaluation, the favorable zones are selected which indicate the direction of future exploration and development. The crustal movement was characterized by superposition in a multiple stages in China. The tectonic activities were diversified, and the geological conditions for coal formation and coalification were complicated. The coal seam enrichment and formation condition were quite different. CBM occurrence refers to accumulation of certain quantity of methane in coal seams under the effect of ground pressure. The authors have established a system of methods and a corresponding parameter system for evaluation of resources, mainly including the volumetric method and zonal composite evaluation method. The results of evaluation are that the CBM geological resources are 36.81×10¹²m³ in coal seams to a depth of 2000m, the workable CBM resources are 10.87×10¹²m³ in seams to a depth of 1500m in 42 major gas-bearing CBM basins in China. They are distributed mostly in 9 basins, like Ordos and Qinshui basins with geological resources greater than 10000×10⁸m³. Two most favorable zones are selected in Qinshui basin and eastern fringe of Ordos basin, four favorable zones including southern fringe of Ordos basin, Ningwu, Anyang-Hebi, and Songzao, and eleven fairly favorable zones in Huainan, Yili, etc.

**Key words:** CBM, resource evaluation, basin, zone

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**Economic Evaluation and Sensitivity Analysis of Improvement of CBM Recovery Rate by Injection of Carbon Dioxide and Nitrogen**

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**Abstract:** The influence of injection of different gases, gas price and mechanical parameters of coal matrix on methane output and the mining scheme is simulated and compared by using a coupled CBM numerical model. With the decrease of mole percentage of nitrogen in the injected gas, the cumulative output of methane reduces successively. Under the conditions when the purchase price of nitrogen being one, or two, or three, or four times of that of carbon dioxide respectively, the best proposals for improvement of recovery rate are as the following: gas mixture with pure nitrogen, gas mixture with 75%N₂+25%CO₂, mixture with 50%N₂+50%CO₂, and 25%N₂+75%CO₂. When the price of nitrogen is four times higher than carbon dioxide, the best proposal is to inject pure carbon dioxide. The simulated cumulative output of methane and NPV are in direct proportion with Young modulus. When Young modulus is 1.4GPa and 2.8GPa, the maximum NPV is in reverse proportion with Poisson’s ratio. The results indicate that the compositions and price of gas and the mechanical parameters of coal matrix have a great influence on feasibility of development scheme, the magnitude of profit and working life.

**Key words:** injection of gas mixture, extraction of methane, economic evaluation and sensitivity analysis