QUANTITATIVE EVALUATION OF COALBED METHANE GAS CONTENT BASED ON ULTRA-LONG ELECTROMAGNETIC WAVE REMOTE SENSING TECHNOLOGY

Yanbing Bai, Qiming, Qin,Li Chen, Nan Wang
Institute of Remote Sensing and GIS, Peking University, Beijing, 100871, China
Corresponding author: Qiming Qin. Tel: +86-10-62765715. Fax: +86-10-62751962.
E-mail address: qmqinpku@163.com

Abstract：Coalbed gas content of coal reservoir is one of the most important parameters and must be fully evaluated to improve process design and performance of CBM recovery and/or CO2 sequestration. There are two traditional methods for determination of coalbed gas content. The first method is based on analytical data obtained from the coal cores.. The other method is based on logging and seismic data. Although the traditional methods can provide accurate data of coalbed methane gas, the cost is huge. Therefore it is of great significance to develop a practical evaluation approach for coalbed gas content.

Coal containing gas electromagnetic coupling theory insists that coal containing gas is a rheological medium. The electrokinetic effect, piezoelectric effect and SiJiePan's effect caused by the rheological medium are likely to make coal containing gas produce large amounts of electromagnetic radiation to its surrounding space, The frequency band of electromagnetic radiation produced by gas flowing is usually in low frequency. The coalbed gas content of coal reservoir can be evaluated by combing such a measurement with electromagnetic data obtained by using Ultra-long Electromagnetic Wave Remote Sensing technology.

Ultra-long Electromagnetic Wave Remote Sensing technology is carried out on the ground using electromagnetic methods to measure physical properties of formations and fluids underground. These results are a series of curves plotted on a graph showing changes in the properties with depth. Abundant field experiments have showed that the signal curves collected by the ultra-long electromagnetic detector showed high amplitude anomalies in areas which are rich for coalbed methane, The higher the content of coalbed methane was, the more obvious amplitude anomalies of the curve showed. Besides, the depth of the high amplitude anomaly showed on the corresponding detection curve and the buried depth of coal seam were almost the same. Thus it is possible that the coalbed gas content in these areas can be evaluated from ultra-long electromagnetic responses.

In this paper, The Ultra-long Electromagnetic Wave data are used to evaluate the coalbed gas content for the No. 3 coal seam in the southern Qinshui Basin (Hudi coal zones).The relationships between coalbed gas content of coal reservoir and characteristics of ultra-long electromagnetic wave have been analyzed. Coalbed gas content of drilling core samples from coal seams was determined experimentally. The results, together with the ultra-long electromagnetic data obtained from Ultra-long Electromagnetic Wave Remote Sensing technology, have been analyzed by using BP neural network modeling, permitting correlation of the coalbed gas content to the electromagnetic responses. The correlation developed in this study provides better understanding of the coal reservoir for coalbed methane exploration in given coalfields by an new prediction method of the coalbed gas content.

Keyword： Evaluation Coalbed methane Remote Sensing