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Editorial

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The recent report on "*Strategy Study on Sustainable Development and Utilization of Clean Coal in China*" by Chinese Academy of Engineering has clearly stated that coal, as the dominant energy source in China, will continue to be the case in a quite long period of time in the future, and the coal industry will continue to be a "pillar industry" and an important driving force for China's economic development. But the gas-related hazards in Chinese coal mines are very severe due to the extreme complexity of coal geology, high seam gas content, high seam gas pressure, seam softness, and low seam permeability. The prevention and control of coal mine gas is a long-term and key research focus of the coal industry in China.

In recent years, extensive studies have been carried out in the prevention and control of coal mine gas by researchers in China and made a number of technological breakthroughs. One of such breakthroughs is the integrated coal production and gas extraction technologies for pillarless mining of multiple seams of low permeability with the "Y" type ventilation system through retaining goaf-side roadways. These technologies have been successfully applied in almost all highly gassy mining areas in China where 2.1 billion tonnes of coal is produced annually, putting an end to the gas explosion accidents, and achieving safe coal production.

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Over the last decade, coal production increased significantly in China, with an average annual increase of about 200 million tonnes; the number of the coal mine gas-related accidents decreased from 414 in 2005 to 47 in 2014, down 88.6 %; and the number of the fatalities dropped from 2171 in 2005 to 266 in 2014, decreasing 87.7 %.

Integrated coal production and gas extraction is a scientific model for resource developments by integrating coal mining with gas extraction and utilization. Instead of the traditional "top to bottom" coal mining sequence in multiple seams, the first mining seam (it is also often referred to as a protective seam) is so selected in the integrated technology that its mining can result in the deformation, de-stressing, enhanced permeability, and easy gas drainage of its overlying and underlying coal seams. In the case that there is only one seam or no protective seam is available, a roadway needs to be special excavation in the roof of the seam and a large number of cross-measure boreholes need to be drilled from the roadway into the seam for gas drainage to ensure that the seam is extracted in the condition of low seam gas content.

The integrated technology has enabled safe and highly efficient mining of coal seams of high gas content, high stress and low permeability. With the technology, mining cost has been reduced, coal mine gas controlled, and coal recovery ratio improved, resulting in huge economic, social and environmental benefits. It has played an important role in continues improvement of coal mine safety in China, in particularly in the gas-related accidents of coal mines.

The theoretical and innovative achievements in the integrated coal production and gas extraction technology have been widely noted and highly recognized by the Chinese government and the international mining industry. Since 2006, five international workshops on coal mine gas prevention and control technologies have been successfully

held in Huainan, China and attended by over 1200 delegates from various international and domestic organizations, including the United Nation Development Program, Germany, Australia, USA, Poland, India, and Ukraine. The achievements in the integrated technology have been well recognized. The Chinese government organized two nation-wide on-site meetings on coal mine gas prevention and control (in 2005 and 2011) in Huainan to promote the integrated coal production and gas extraction technologies. In 2011, the integrated coal production and gas extraction technologies won the "Outstanding Contribution Award" in the 22th World Mining Congress. In 2013, the World Intellectual Property Organization and the State Intellectual Property Office of China jointly awarded China Patent Medal to the goaf gas drainage method through roof destressing and goaf-side roadways retaining with the "Y" type ventilation system, a key component of the integrated coal production and gas extraction technologies, the only gold medal awarded in the Chinese coal mine safe production category. In 2014, the project on the comprehensive mine gas control and utilization in Huainan mining area, in which the integrated coal production and gas extraction technologies made up the key achievements, won the China Industry Grand Award.

The integrated coal production and gas extraction technologies have become the dominant technologies and a key research area in coal mine gas prevention and control. To summarize and exchange the latest developments and promote the application and further research of the technologies, we publish this special issue on *Integrated Coal Production and Gas Extraction* by the Internaitonal Journal of Coal Science & Tchnology. The special issue is coordinated the Journal and State Key Laboratory of Deep Coal Mining & Environment Protection of China. After careful review, a total of 11 papers have been accepted and included in this special issue. The selection of the papers was based on the key components, applications and fundamentals of the integrated coal production and gas extraction technologies.

Each of the selected papers has its originality and reports the latest study results. In the article on theory and practice of integrated coal production and gas extraction, Liang Yuan reviewed the research status of coal and gas co-extraction, put forward the basic framework of the co-extraction in deep and multiple seams of high gas content and low permeability, systematically described the principle, theoretical fundamentals and key components of the co-extraction technologies, and summarized the main technological achievements and application status. Using advanced real-time monitoring tools for rock stress, displacement, and pore pressure, and numerical software such as COSFLOW and CFD, Hua Guo has studied the dynamic characteristics of mining-induced rock stress, fractures and gas flow in the surrounding rocks. Sheng Xue has undertaken numerical simulation of outbursts of coal and gas and developed a coupled numerical model with DEM & LBM to simulate the entire process of outbursts.

In addition to those mentioned above, some researchers have conducted simulation tests of gas adsorption and desorption characteristics of coal in large scale and obtained gas desorption characteristics in both natural and mining-induced conditions. The movement and fracture evolution of overburden rocks in pillarless mining have been revealed by studying the de-stressing effect of overlying rocks with large-scale physical simulation systems under different coal mining conditions. The characteristics of pore structures of low rank coal and the controlling mechanism of gas desorption from the coal have also been studied to find ways to efficiently drain gas in the coal. Other researchers have reported their research outcomes in targeted gas drainage techniques and methods and their optimization in pillarless mining with the "Y" type ventilation.

Some of the theories and technologies mentioned above have been successfully verified in coal mines of China, Germany, Poland, and Australia. These research findings are very important in enriching our understanding of integrated coal production and gas extraction.

I am hopeful that the publication of this special issue on *Integrated Coal Production and Gas Extraction* will have positive impacts on mine gas prevention and control in coal mines. I'd like to sincerely thank the authors and reviewers for your contributions.