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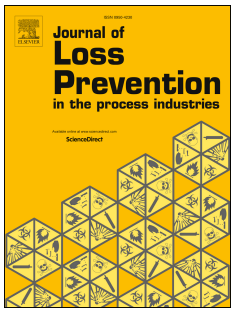

Adsorption heat features of coalbed methane based on microcalorimeter

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PII: S0950-4230(18)30080-9

DOI: 10.1016/j.jlp.2018.05.006

Reference: JLPP 3698

To appear in: *Journal of Loss Prevention in the Process Industries*

Received Date: 26 January 2018

Revised Date: 28 April 2018

Accepted Date: 12 May 2018

Please cite this article as: Li, H., Kang, J., Zhou, F., Qiang, Z., Li, G., Adsorption heat features of coalbed methane based on microcalorimeter, *Journal of Loss Prevention in the Process Industries* (2018), doi: 10.1016/j.jlp.2018.05.006.

Adsorption heat features of coalbed methane based on microcalorimeter

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Abstract: Basic knowledge of the adsorption thermodynamic process of coalbed methane is conducive to a deep understanding of its adsorption mechanism. In this study, we directly measure the adsorption heats of methane on coals using the microcalorimetry with volumetric method. The adsorption content and adsorption heat of four types of coals and their oxidized and extracted coals were measured at 308.15K in the 0~3.5 MPa pressure range. The results show that extracted coal has lower adsorption content and adsorption heat than raw coal because of the decrease in micropore volumes, which indicates that the micropores of coal significantly affect the adsorption properties of coal. The release heat from the adsorption process increases the coal temperature, and the change in temperature can be more than 20K. In the experimental pressure range, the isosteric heat decreases with the increase in adsorption content, and because of the enhanced adsorption potential of micropores, methane is preferentially adsorbed in smaller micropores. In addition, a new method to estimate the pseudo-saturation vapor pressure of supercritical adsorption has been introduced according to the experimental results of isosteric heats of adsorption.

Keywords: adsorption heat; isosteric heat; coalbed methane; microcalorimetry

1. Introduction

Coalbed methane (CBM), which mainly consists of methane, has been recognized as a clean nonconventional natural gas resource, most of which is stored in the absorbed state in coal seams. In recent years, the adsorption mechanism of coalbed methane has been an important research field for engineering applications of coalbed methane [1]. The adsorption capacity of coal can be simply reflected by the adsorption content of methane, and there are many theoretical and experimental studies on the adsorption content of methane on coal and the relationship between the adsorption content of coal and the coal characteristics (e.g., coal rank, maceral and mineral composition, pore structure, proximate analysis indices, and functional group content) [2-5]. However, only the research of the adsorption content is not sufficient

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