

论文

煤系地层注入CO₂开采煤层气质交换的机理

张美红, 吴世跃, 李川田

太原理工大学 矿业工程学院, 山西 太原 030024

摘要:

论述了注CO₂开采煤层气质交换机理和煤系地层封存CO₂意义,建立了注CO₂开采煤层气的物理数学模型。采用饱和食盐水集气方法测定了表征解吸阻力大小的综合参数——综合传质系数 α 随浓度、煤变质程度、放散时间的变化规律。试验结果表明: α 随煤粒吸附基质浓度的增大而增大;变质程度相同时,CH₄的 α 随时间的衰减较CO₂的 α 随时间的衰减慢;基质浓度相同时,煤变质程度越高, α 越小,且对不同变质程度的煤岩,CH₄的 α 大于CO₂的 α ,即不同变质程度的煤岩对CO₂的吸附能力都大于CH₄。说明注气增加储层压力促进气体解吸置换,各种煤岩对CH₄的解吸量大于对CO₂的解吸量这一现象与煤的变质程度无关。因此,在不同变质程度煤层,甚至煤系地层中,注气开采煤层气与储存CO₂技术在理论上都是可行的。

关键词: 煤系地层; 注气; 煤层气; 质交换机理; 综合传质系数

Mass exchange mechanism of coalbed methane exploitation by CO₂ injection in coal measure strata

Abstract:

This study investigated the mass exchange mechanism of exploiting coal bed methane by CO₂ injection and the significance of carbon storage in coal strata. Also, a physical and mathematical model of exploiting methane by CO₂ injection was developed. Gas collecting method by saturated salt solution was used for an experimental study on the relationship of mass transfer coefficients, which vary with the degree of coal metamorphism, the concentration and gas emission time. According to the analysis on experimental data, a positive correlation was found between α and concentration. With the same degree of coal metamorphism, the speed of α deduces over time, and the α speed reduction of CH₄ is slower than that of CO₂. With the same concentration level, a negative correlation was found between α and coal metamorphism. The α of CH₄ is higher than that of CO₂ with different metamorphisms, which means the adsorption capacity of CO₂ is higher than that of CH₄ with different metamorphisms. The CO₂ injection not only increases the reservoir pressure, but also enhances the gas desorption displacement. The desorption amount of CH₄ was more than that of CO₂ has nothing to do with the coal metamorphic level. Therefore, the exploitation of coal bed methane by gas injection and carbon dioxide storage is feasible in different metamorphic degrees of coal seam, even in the coal measure stratum.

Keywords: coal measure strata; gas injection; coalbed methane; mass exchange mechanism; combination mass transfer coefficient

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通讯作者: 张美红

作者简介: 张美红(1982—), 女, 山西太原人, 博士研究生

作者Email: zmh-625@163.com

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