

煤层中气水两相运移的NMRI 试验研究

潘一山¹, 唐巨鹏^{1,2}, 李成全¹

1 辽宁工程技术大学力学与工程学院, 辽宁阜新 123000

2 北京大学地球与空间科学学院, 北京 100871

收稿日期 2007-4-29 修回日期 2008-5-23 网络版发布日期 2008-9-17 接受日期

摘要 首次将先进的无损检测NMRI成像技术引入煤层中气水两相运移的研究领域, 将自主设计研制的、可同时改变围压、轴压和孔隙压的、非磁性聚碳酸酯材料制成的三轴渗透仪置于NMRI成像仪磁体腔中, 通过气驱水和水驱气NMRI试验实时观测了气水流动规律. 主要以水驱气NMRI试验为例, 详细介绍了核磁共振三轴渗透仪和型煤试件的研制, 并重点阐述了水驱气试验过程和相关参数, 利用NMRI技术实时观测得到了不同时间沿驱替方向型煤试件水平剖面的NMRI成像图, 最后对试验结果进行了比较分析, 揭示了一些新的规律认识: (1)水驱替前缘具有不一致性, 从NMRI试验角度验证了前人甲烷类气体赋存形式主要以吸附在孔隙内表面为主的重要结论; (2)煤试件存在优势驱替路径, 且这种优势路径在驱替过程中基本保持不变, 水驱气的优势驱替路径易产生在煤试件边缘, 即煤孔隙裂隙发育区; (3)水驱流量变化决定了水驱前缘的运移速度, 且对水驱气效果具有滞后效应; (4)水驱气初次驱替效果好于二次驱替效果; (5)水驱替气的顺序为: 主要大裂隙—周边裂隙—周边孔隙.

关键词 [采矿工程](#), [NMRI](#), [煤层](#), [气水两相](#), [水驱](#)

分类号 [P631](#)

DOI:

NMRI test on two-phase transport of gas-water in coal seam

PAN Yi-Shan¹, TANG Ju-Peng^{1,2}, LI Cheng-Quan¹

1 School of Mechanics and Engineering, Liaoning Technical University, Liaoning Fuxin 123000, China

2 School of Earth and Space Sciences, Peking University, Beijing 100871, China

Received 2007-4-29 Revised 2008-5-23 Online 2008-9-17 Accepted

Abstract An advanced non-destructive measurement technique (NMRI technique) was applied for the first time in the research of two-phase transport of gas-water in coal seam. The home-made triaxial osmoscope which is made up of non-magnetic polycarbonate material and can change confining pressure, axial pressure and pore pressure, was placed into the magnetic cavity of NMRI instrument. Through the tests on gas driving water and water driving gas, the flow law of gas and water was real-time observed. Mainly based on the test of water driving gas as an example, the development of molding coal sample and NMR triaxial osmoscope was demonstrated. The experiment process of water driving gas and parameters were demonstrated. NMRI images of molding sample in horizontal cross-section along the driving direction were obtained by NMRI instrument. The results from images were analyzed and compared. Some novel laws were obtained as the following: (1) the leading edge of water driving has inconsistency. This certified the important previous conclusion that the storage of methane mainly was absorbed in inner surface of pore from NMRI technique; (2) the existence of dominant driving pathway was tested and the way kept almost fixed. The pathway is apt to exist in the edge of coal samples where pore and fracture fully develop; (3) the variation of water flow determines the transport velocity of leading edge of water driving and it has lag effect; (4) the effectiveness of the first driving is better than the second driving; and (5) the subsequence of water driving gas are from trunk fractures to branch fractures, then to branch pores.

Key words [Mining engineering](#); [NMRI](#); [Coal seam](#); [Gas-water two-phase](#); [Water driving gas](#)

通讯作者:

潘一山 panyish_cn@sina.com

作者个人主页: 潘一山¹; 唐巨鹏^{1,2}; 李成全¹

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