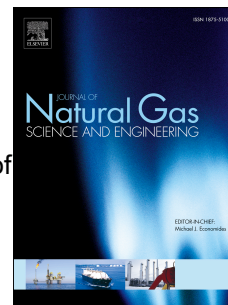


Accepted Manuscript

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PII: S1875-5100(17)30443-2

DOI: [10.1016/j.jngse.2017.11.020](https://doi.org/10.1016/j.jngse.2017.11.020)

Reference: JNGSE 2354

To appear in: *Journal of Natural Gas Science and Engineering*

Received Date: 3 April 2017

Revised Date: 8 November 2017

Accepted Date: 9 November 2017

Please cite this article as: Liu, D., Wang, Z., Zhang, X., Wang, Y., Zhang, X., Li, D., Experimental investigation on the mechanical and acoustic emission characteristics of shale softened by water absorption, *Journal of Natural Gas Science & Engineering* (2018), doi: 10.1016/j.jngse.2017.11.020.

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Experimental Investigation on the Mechanical and Acoustic Emission Characteristics of Shale Softened by Water Absorption

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Abstract: Shale is a fine-grained, clastic sedimentary rock composed of clay minerals and other minerals. The water-shale interaction plays an important role in the borehole drilling and hydraulic fracturing during the process of shale gas exploitation. In this study, laboratory experiments, including water absorption experiments and uniaxial compression tests, were used to investigate the mechanical behaviours of the water-absorbing shale specimens. From the laboratory experiments, the following statements can be drawn: a) the water-absorbing shale specimens experience longer compaction and crack closure stages than the natural shale specimen; b) the mechanical properties of the water-absorbing shale specimens, such as uniaxial compressive strength, Young's modulus and peak strain, are less than those of the natural shale specimens; c) the apertures of the failure cracks in the water-absorbing shale specimens are greater than those in the natural shale specimens under uniaxial compression loading. The acoustic emission technique was also used to capture the acoustic emission events of the shale specimens during the uniaxial compression tests. By the acoustic emission analysis, it is concluded that the water absorption stimulates the AE events in the shale specimens.

Keywords: shale; water absorption; uniaxial compression; acoustic emission

1. Introduction

Shale gas exploration has attracted much recent attention worldwide because shale gas is considered as an alternative for the conventional natural gas. According to a report by the U.S. Department of Energy (EIA USA, 2015), the annual production of shale gas in America has continued to increase since 2014.

Up to 2015, the shale gas production has occupied 56% of the total annual production of the natural gas in America. The proven reserves of shale gas in China was five hundred billion cubic metres with the annual production capacity of 6.5 billion cubic metres (Li et al., 2016). The interaction between shale and water plays an important role in the shale

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