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下扬子地台二叠系页岩储集物性特征及控制因素

曹涛涛, 宋之光, 王思波, 夏嘉 ▾

Physical Property Characteristics and Controlling Factors of Permian Shale Reservoir in the Lower Yangtze Platform

CAO Tao-tao, SONG Zhi-guang, WANG Si-bo, XIA Jia ▾



PDF (PC)

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摘要/Abstract

摘要 :

对选自下扬子芜湖地区昌参1井二叠系的页岩样品进行氮气吸附实验和压汞实验来研究其储集物性特征,并结合地球化学数据分析影响页岩储集物性的因素。研究结果表明页岩比表面积介于4.70~21.86m<sup>2</sup>/g之间,平均为12.60m<sup>2</sup>/g,其中81.80%的比表面积是来自微孔的贡献|页岩孔隙度介于1.18%~4.95%之间,多数页岩样品孔隙度低于4%,其中中大孔(或裂隙孔)贡献了66.38%的孔隙度|渗透率介于(0.001~15.56)×10<sup>-3</sup>μm<sup>2</sup>之间。通过对页岩储集物性影响因素分析,可以得出:①TOC含量是页岩比表面积主要的控制因素,随着TOC含量的增加,比表面积明显增加|②孔隙度随TOC含量增加有明显降低的趋势,可能与孤立分散的有机质粒内孔与裂缝连通性较差以及有机质充填矿物孔隙有关,这说明了有机质主要是贡献比表面积而非孔隙度;微孔和过渡孔体积与黏土矿物有一定的正相关性,中大孔(或裂隙孔)体积与脆性矿物含量有一定的正相关性,说明脆性矿物和黏土矿物可能共同影响页岩的孔隙度;③渗透率与排驱压力呈极好的指数负相关性,排驱压力越小,渗透率越高,就越有利于页岩气的开采。

关键词: 下扬子地台, 二叠系页岩, 比表面积, 孔隙度, 渗透率

Abstract:

Nitrogen adsorption and mercury intrusion experiments were carried out to study the shale reservoir physical property characteristics and to analyze the controlling factors of Permian shales from well Changcan 1 in Wuhu area in the Lower Yangtze Platform.The results show that the specific surface area is ranging from 4.70m<sup>2</sup>/g to 21.86m<sup>2</sup>/g,of which 81.80% is contributed by micropores.The porosities range between 1.18% and 4.95% with most below 4%,and 66.38% of the porosities are from the contribution of mesopores and macropores(crack pores).The permeability is between 0.001×10<sup>-3</sup>μm<sup>2</sup> and 15.56×10<sup>-3</sup>μm<sup>2</sup>.Through analyzing the controlling factors,the following conclusions can be drawn:(1)TOC content is the major controlling factor of the specific area for Permian shales|(2)The porosity has an obvious decrease trend with the increase of TOC content,which may be caused by the isolation and poor connectivity of organic pores with cracks even related to the filling of mineral pore space by organic matter.Micropore and transition-pore volumes have good positive correlation with mineral matter content,while,mesopore and macropore(crack pore)volume has a positive correlation with brittle mineral content|(3)Permeability exhibits an exponential negative correlation with threshold pressure,reflecting the lower the threshold pressure,the higher the permeability and the more beneficial for shale gas production.

Key words:

The Lower Yangtze Platform, Permian shales, Specific surface area, Porosity, Permeability

中图分类号:

TE122.2+3

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地址：甘肃省兰州市天水中路8号 (730000)

电话：(0931)8277790 Email: [geogas@lzb.ac.cn](mailto:geogas@lzb.ac.cn)

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