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页岩气稳定碳同位素特征研究

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Characteristics of Stable Carbon Isotopic Composition of Shale Gas

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摘要/Abstract

摘要 :

选用低成熟富II型有机质页岩,在真空MSSV体系中分别以2°C/h、20°C/h的升温速率进行生烃模拟实验,测定气态烃的稳定碳同位素组成并讨论了页岩干酪根热解气态烃演化的稳定碳同位素特征及页岩气碳同位素倒转的原因。热解气态烃中甲烷碳同位素组成随热模拟实验中温度升高先变轻后变重,乙烷和丙烷的碳同位素组成都是随着温度的升高逐渐变重。影响页岩气碳同位素组成的主要因素包括:有机质类型、热演化程度以及气体在页岩系统中的微运移。页岩气烷烃序列稳定碳同位素值出现倒转的原因目前尚不十分清楚,但根据热模拟实验结果可以得出单纯热成因的页岩气的碳同位素组成不会发生倒转,因此发生同位素倒转的页岩气必定有其他地球化学过程的介入。对Barnett、Fayetteville页岩气同位素数据分析表明,该页岩气形成过程很有可能发生了水煤气反应和费—托合成作用。

关键词: 页岩气, 碳同位素, 热解, 干酪根, 同位素倒转

Abstract:

Pyrolysis experiments were conducted with low maturity kerogen isolated from type II organic-rich shale in a vacuum MSSV(Micro scale sealed vessel) system, to simulate gas hydrocarbon generation at two heating rates of 2°C/h, 20°C/h. The stable carbon isotopic compositions of generated gas hydrocarbon were measured to investigate their characteristics and influencing factors. At the beginning, $\delta^{13}\text{C}$ value of methane becomes more negative with increasing temperature until reaching the lightest point, then it changes more positive and the $\delta^{13}\text{C}$ value of ethane and propane shows a positive trend with elevated temperatures. The main factors impact on carbon isotope of shale gas may include: type of organic matter, maturity of the shale and micro-migration of gas in shale gas systems. Although it is still unclear the reason leading to carbon isotope reversal, we can conclude that isotopic reversal phenomenon wouldn't happen in a single thermogenic gas reservoir according to our pyrolytic experiment results, thus it must be involved with some other geochemical processes. Carbon isotope compositions of gas from the Fayetteville and Barnett shales show that it may include water-gas reaction and Fischer-Tropsch synthesis during its formation.

Key words: Shale gas, Carbon isotope, Pyrolysis, Kerogen, Isotope reversal

中图分类号:

TE122.1+13

参考文献

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Metrics

本文评价

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