实验方法评价松辽盆地烃源岩的生排烃效率

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An Experimental Method to Evaluate the Hydrocarbon Generation and Expulsion Efficiency in the Songliao Basin

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摘要/Abstract

摘要：

针对烃源岩生排烃效率评价现有方法的不足和第四次油气资源评价研究的需要，基于模拟地质条件的最新生排烃实验平台，以白垩系烃源岩为例，开展了松辽盆地烃源岩生排烃条件和过程的模拟实验。结合包括轻烃在内的产物计量方法探索，对实验产烃量进行计量；通过实验产物的H/C原子比数据，对干酪根热成熟度进行标定，获得实验点所对应的地质R_O值；从而实现了对松辽盆地白垩系烃源岩在各热演化阶段的生排烃效率厘定。结果表明，轻烃在总烃中的含量为5%~29%，并有随实验热演化程度升高的特征，在生油高峰期的轻烃含量约为25%，从而弥补了传统实验和利用岩心残留烃分析排烃效率方法中缺少轻烃组分的缺憾|通过生排烃效率曲线显示，松辽盆地白垩系烃源岩的最大生油效率为680mg/gTOC，生油高峰期对应的绝对排烃效率为57%。对压力的影响分析认为，压力确实影响热成熟演化，在生油阶段对R_O的抑制约为0.2%；压力的释放促进排烃，是导致岩心滞留烃量降低和轻烃散失的主要原因，仅轻烃散失造成的生油高峰期绝对排烃效率偏差值就达18%。常规方法低估了地质实际的滞留烃量，深层找气的前景乐观。

关键词: 松辽盆地, 生排烃, 排烃效率, 模拟实验, 轻烃, 压力

Abstract:

The process and condition of hydrocarbon generation and expulsion has been simulated on the Cretaceous source rocks from the Songliao Basin, based on the latest experiment platform of hydrocarbon generation and expulsion.New hydrocarbon measurement method is used to acquire accurate data about experimental products including light hydrocarbon.The geological R_O are correlated with atomic H/C ratios of pyrolyzed kerogens from experimental solid products.Thus hydrocarbon generation and expulsion efficiency in the thermal evolution process is determined.Results show that, the content of light hydrocarbon is about 5%-29% and about 25% during the peak period of oil generation, and it increases with the increase of thermal maturation.The maximum amount of hydrocarbon generation is 680mg/g TOC, and the absolute hydrocarbon expulsion efficiency at the peak of oil generation is 57%.Analysis of pressure factor indicates that, fluid pressure does affect thermal maturation and hydrocarbon expulsion.Pressure can reduce the maturity in oil generation phase.The decreased value of R_O is about 0.2%.Pressure release promotes hydrocarbon expulsion, which results in the decrease of residual hydrocarbon content and light hydrocarbon loss from cores.Light hydrocarbon loss can cause 18% deviation of expulsion efficiency at oil generation peak.The conventional method underestimated the residual hydrocarbon amount in geological conditions, and gas exploration prospect is optimistic.

Key words: Songliao Basin, Hydrocarbon generation and expulsion, Hydrocarbon expulsion efficiency, Simulation experiment, Light hydrocarbon, Pressure

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