

Artificial pyrolysis of monomer alkane (C₁₋₅) with TSR and without TSR

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The hydrocarbon gas in highly-matured gas reservoirs strongly altered by TSR is dominated by CH₄. It lacks study whether CH₄ can be further involved in TSR reactions, and the mechanism and process of carbon isotope fractionation associated with the consumption of heavy hydrocarbon gases (C₂-C₅) by TSR is still unclear. Pyrolysis experiments of a few high purity monomer alkanes (CH₄, C₂H₆, C₃H₈, C₄H₁₀, and C₅H₁₂) sourced from natural gases were conducted. Two experiment conditions (with MgSO₄ and without MgSO₄) were designed, representing TSR and non-TSR reaction systems respectively. The result shows that CH₄ can participate in TSR reactions, but TSR has no effect on its carbon isotope value. For the cracking of C₂H₆, C₃H₈, C₄H₁₀ and C₅H₁₂, their carbon isotope value from the TSR system is obviously heavier (1‰ -2‰) than that from the non-TSR system, but the carbon isotope values in both systems for a specific alkane (e.g. C₂H₆) are all controlled by their conversion rates (a linear correlation) and the tow suite data hold one line, which implicates that the carbon isotope fractionation trajectory in both systems is the same. Therefore, TSR reactions occurring in gas reservoirs do not change the carbon isotopic fractionation mechanism, and its influence on carbon isotope value of a heavy hydrocarbon gas is due to its promotion to cracking of the hydrocarbon.

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