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CHARACTERIZATION OF PYROLYSATES FROM MACERAL COMPONENTS OF TARIM COALS IN CLOSED SYSTEM EXPERIMENTS AND IMPLICATIONS TO NATURAL GAS GENERATION

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In Northwest China, large deposits of Jurassic coal represent important oil and gas sources. Although they are formed in similar sedimentary environments with major contributions of terrestrial plants deposited under aerobic conditions, difference in their hydrocarbon potential are observed, ranging from oil-prone in the Turpan-Hami Basin (Cheng et al., 1994; Cheng and Zhang, 1998; Li et al., 2001), to gas-prone in the Tarim Basin (Dai et al., 2003; Liang et al., 2003). In addition, CH_4 in the Tarim Basin is generally isotopically heavier than in the Turpan-Hami Basin (Cheng et al., 1994; Dai et al., 2001; Dai et al., 2003; Liang et al., 2003). The $\delta^{13}C_{CH4}$ values in the Turpan-Hami Basin range from -37.9 to -44.8‰ and average -41.2‰(Cheng et al., 1994), while in the Tarim Basin they vary from -44.3~-14.6‰ and average -31.3‰ (Dai et al., 2003). With exception of thermal maturity, are there other reasons leading to $\delta^{13}C_{CH4}$ difference between two basins? How did the maceral components control or influence oil generation from coals? The objectives of this paper are to study the chemical-physical properties of pyrolysis products and extractable organic matter (EOM) derived from vitrinite, exinite, and inertinite (fusinite and semi-fusinite), and to provide experimental evidence and give an appropriate explanation for hydrocarbon generation in Jurassic coals and coaly shales and other coal-bearing basins in China.

The macerals vitrinite, exinite, fusinite and semi-fusinite from low-mature coal (VR_r=0.40%) of Manjiaer depression, Tarim Basin were isolated and subjected to isothermal pyrolysis in a sealed stainless steel reactor at temperatures ranging from 250 to 550 °C in 50 °C intervals (pyrolysis time:72 hours). Total gas yields (predominantly CH_4 and CO_2) from exinite and vitrinite were much higher than those from fusinite and semi-fusinite. The carbon isotopic composition of CO_2 and CH_4 was determined for the gas phase collected from each experiment. Carbon dioxide generated from exinite was slightly enriched in ^{13}C ($\delta^{13}C_{CO2}$ range: -19.7 to -12.2 ‰) as compared to CO_2 produced from vitrinite ($\delta^{13}C_{CO2}$ range: -22.4 to -19.1‰). Methane produced from exinite ($\delta^{13}C_{CH4}$ range: -35.0 to -30.3‰) tended to be isotopically lighter than methane generated from inertinite (fusinite and semi-fusinite; $\delta^{13}C_{CH4}$ range: -33.7 to -25.2‰).

The $\delta^{13}C_{CH4}$ values of all macerals showed a similar evolution pattern with temperature: the initial gas was isotopically heavy, then became lighter at intermediate temperatures and finally became heavier again. Among the original macerals, the yield of extractable organic matter (EOM) was highest for the vitrinite and decreased in the order exinite and inertinite (fusinite and semi-fusinite). With increasing thermal stress, however, exinite showed the highest hydrocarbon generation potential followed by vitrinite, while the inertinite had only a poor hydrocarbon potential.

With increasing pyrolysis temperature, *n*-alkane parameters such as OEP and CPI decreased while the $\sum C_{21}$-/$\sum C_{22}$+ ratio increases and the bimodal pattern of the *n*-alkane distribution changed to a unimodal pattern. The Pr/Ph ratio was found to vary irregularly from the immature to the overmature stage.

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