AAPG HEDBERG CONFERENCE
"NATURAL GAS GEOCHEMISTRY: RECENT DEVELOPMENTS, APPLICATIONS, AND TECHNOLOGIES"
MAY 9-12, 2011 – BEIJING, CHINA

Experimental Study about High Fluid Pressure Action on Gas Generation of Coal

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It still is a controversy whether high fluid pressure has an inhibition for the hydrocarbon generation of source rock or not. To understand the action of high fluid pressure on gas generation from coal, 4 groups gas generation experiments were conducted under different fluid pressure (25Mpa, 50Mpa, 75Mpa and 100Mpa) and same heating rate (20°C/h) in golden tube closed system. According to the analysis results, including the amount of different gas components, the $\delta^{13}C_1$ and the element analysis of coal pyrolysis residue et al, we suggest that high fluid pressure action for gas generation of coal is not acceleration or inhibition simply, but an inhibition with fluid pressure increasing in some scope, then an acceleration under higher fluid pressure. There maybe are different roles of high fluid pressure between on methane generation and on heavy hydrocarbon gases generation.

The maximum amount of total hydrocarbon gases generated by 1mg coal sample are 102.32ml, 95.63 ml, 122.26 ml and 124.56 ml under 25Mpa, 50 Mpa, 75Mpa, 100 Mpa pressures, respectively. The different fluid pressures have little effect on alkane gas generation at low temperature (<430°C), and the amount of total alkane gas decreasing first, then increasing with fluid pressure increasing at high temperature (>470°C, Fig.1). The amount of total gas generated by coal has a same tendency of total alkane gas with fluid pressure increasing. This suggests that the high fluid pressure action for gas generation of coal is inhibition first, and higher fluid pressure load acceleration on gas generation of coal.

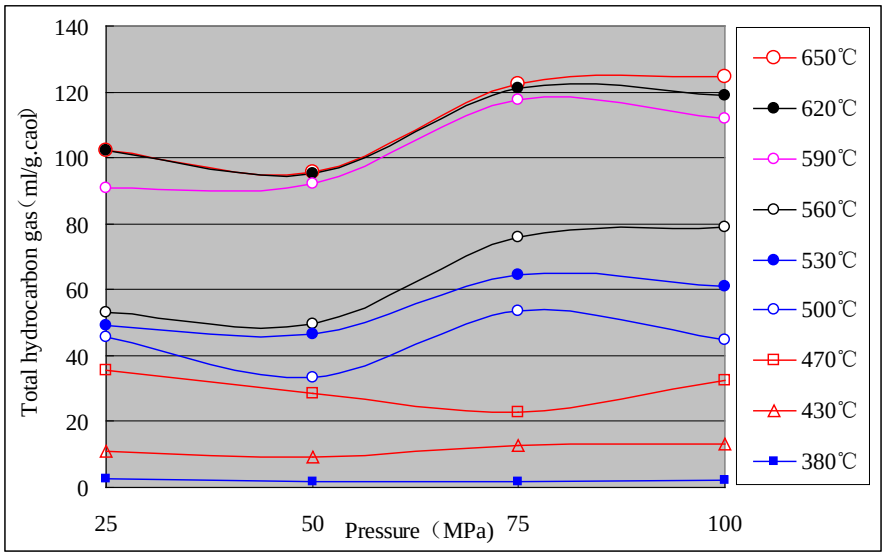

Fig 1 the amount of total hydrocarbon gas generated by coal under different fluid pressure and temperature

The amount drift tendencies of different gas components with fluid pressure increasing are different. The amount of heavy gas (C_2-C_5) generated by coal is biggest under 25Mpa fluid pressure, and the ones are equal approximately under 50Mpa, 75Mpa and 100Mpa fluid pressure. However, the temperature at which the maximum amounts of heavy gas born deviate to low temperature with the fluid pressure increasing. The amounts of H_2 generated by 1g coal decrease with the fluid pressure increasing which are 6.95ml, 2.01ml, 1.965ml and 0.67ml correspond to 25pa, 50Mpa, 75Mpa and 100Mpa of fluid pressure, respectively. The amount of H_2S increases with temperature rising, but there is no obvious correlation between the H_2S volume and fluid pressure. The different tendencies of all kinds of gas components with the fluid pressure and temperature increasing indicate that the formation mechanisms of these gas components are different, and the low fluid pressure is better to heavy hydrocarbon gas generation than that of high fluid pressure. This hints that high fluid pressure maybe have different roles on gas generation and liquid hydrocarbon generation of source rock. Further work need to be conduct.

The shift of $\delta^{13}C$ of methane is not more intense with the fluid pressure than that of methane volume, but the tendencies are similar between them. There is no explicit correlation between the value of $\delta^{13}C_1$ and the fluid pressure before the 430°C, the value of $\delta^{13}C_1$ becomes from light to heavy first, then from heavy to light with the fluid pressure increasing above 470°C (Fig.2). The tendency of $\delta^{13}C_1$ accomplishing fluid pressure increasing is consistent with that of the methane volume which shows a tendency of “high-low-high-high” with the fluid pressure increasing.

The H/C ratio of coal residue in different temperature become from low to high slightly first, then from high to low at the same temperature with fluid pressure increasing. This tendency of H/C ratio of coal residue is consistent with the total amount of hydrocarbon gas generated by coal. So, the element analysis of coal pyrolysis residue does also suggest relatively low high fluid pressure inhibit the gas generation from coal, and relatively higher fluid pressure accelerate gas generation.

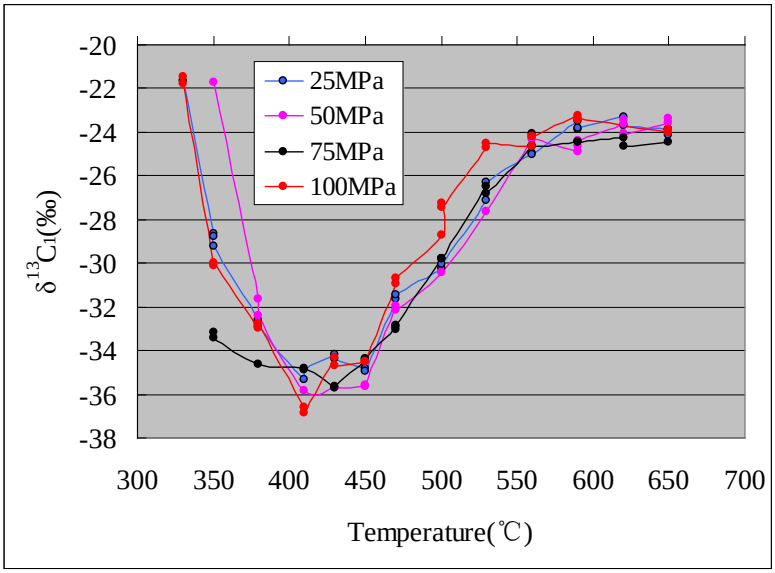

Fig 2 $\delta^{13}C$ of methane generated by coal under different fluid pressure and temperature