

## Application Note Energy

Author:  
K. Sam

The Pyroprobe 5200 HP Steam Unit is designed to collect pyrolysis products onto a sorbent trap before transferring them to the GC, to facilitate analysis in steam and at elevated pressures. Fixed gases like carbon monoxide and methane pass through the trap, and may be analyzed using the Model 5500 Fixed Gas Analyzer, which includes a sample loop, packed column and TCD. A combination of the Pyroprobe 5200 with a GC/MS and the 5500 FGA system produces information on both the major organic pyrolysis products and the fixed gases produced.

Samples of coal were pyrolyzed at 1200°C at 250psi using CDS Model 5200HP Steam system, both with steam, and without steam. Figure 1 has GC/MS results. Aromatics normally associated with coal, like benzene, toluene, and xylene are present in both pyrograms. Phenols are also generated, but the amount is substantially reduced when steam is added.

Figure 2 shows the analysis of the fixed gas compounds that passed through the trap and into the sample loop of the 5500. More carbon monoxide, carbon dioxide and methane are produced with steam. Table 1 presents the amount of each gas generated per gram of coal pyrolyzed.

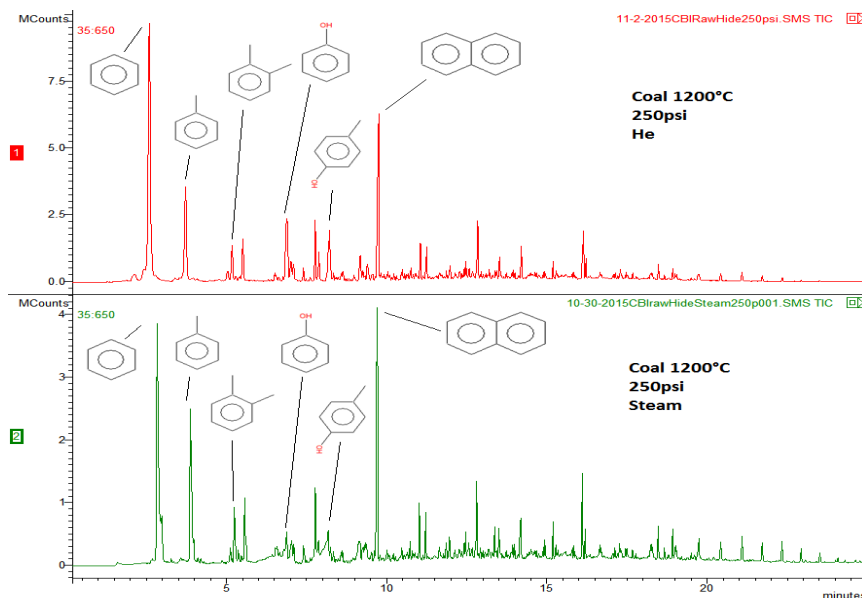


Figure 1: GC/MS of Coal at 250psi with and without steam.

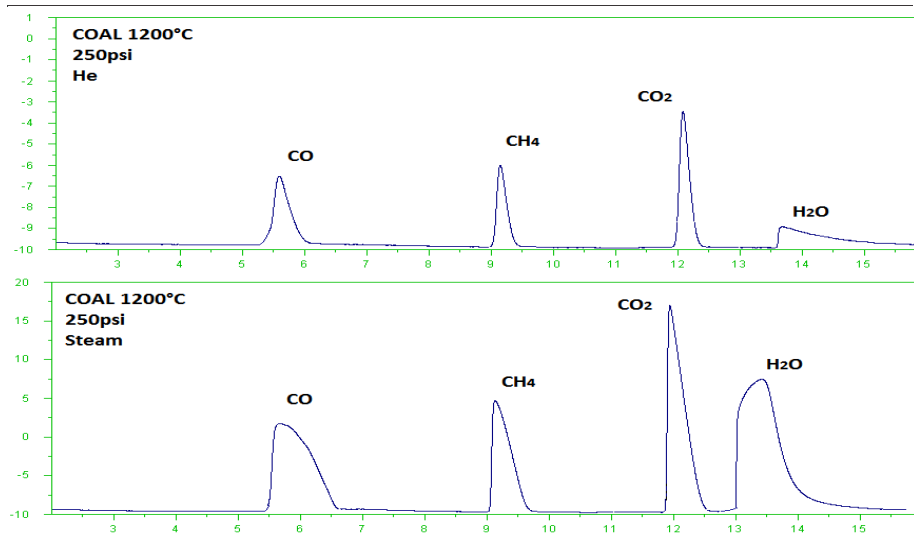


Figure 2: Fixed Gas analysis of Coal.

|                 | mL/g coal |       |
|-----------------|-----------|-------|
| Gas             | No Steam  | Steam |
| CO              | 0.50      | 3.71  |
| CH <sub>4</sub> | 0.59      | 3.92  |
| CO <sub>2</sub> | 0.71      | 4.68  |

Table 1: mL of Fixed gas per g of coal.

### Instrument Conditions

#### Pyroprobe

Pyrolysis: 1200°C for 60 seconds  
 Interface: 300°C for 7 minutes  
 He Purge Flow: 50 ml/min  
 Reactant Gas: (Steam) 0.002mL/min  
 Trap desorption: 300°C for 4 minutes  
 Valve Oven: 300°C  
 Transfer Line: 300°C

#### GC/MS

Column: 5% phenyl (30m x 0.25mm x 0.25µm)  
 Carrier: Helium, 75:1 split  
 Inlet: 300°C  
 Oven: 40°C for 2 minutes  
 12°C/min to 300°C  
 Mass Range: 35-600 amu

#### Fixed Gas Analysis

Column: Carboxen 1000 1/8" X 9"  
 Detector: TCD  
 Oven: 40°C for 1 minutes, then  
 20°C/min to 275°C