

## Supplementary material

The spectrograms of ZD and YM coal under 1000°C pyrolysis condition are showed in Fig.1 and Fig.2 below, repectively.

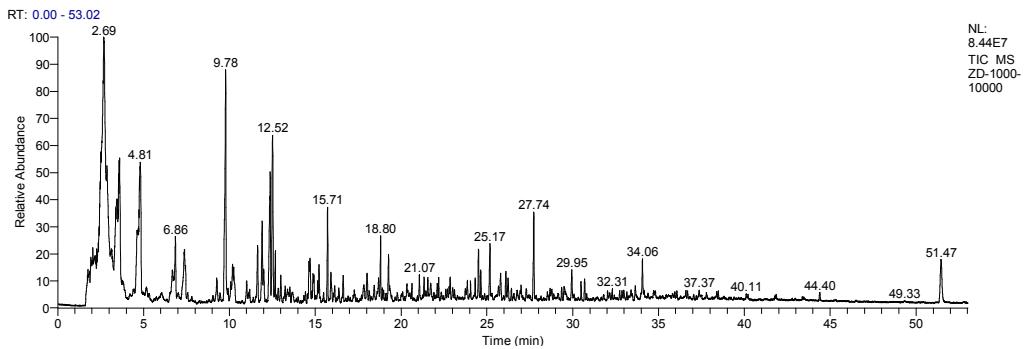


Fig.1 The spectrogram of ZD raw coal under 1000°C pyrolysis condition

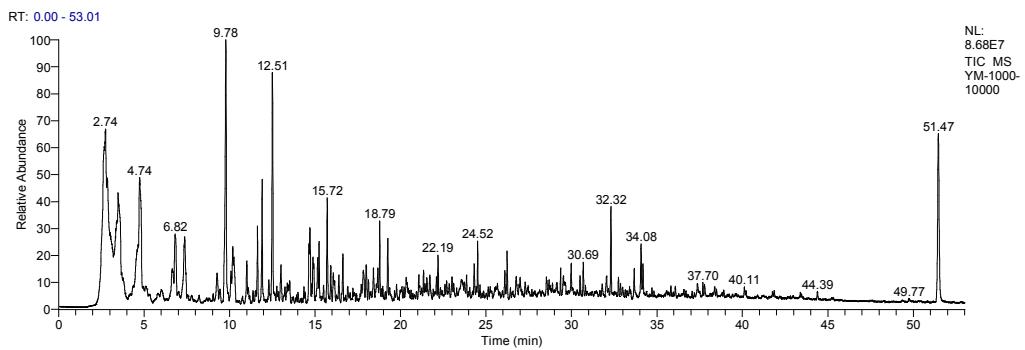


Fig.2 The spectrogram of YM raw coal under 1000°C pyrolysis condition