01 SOLID FUELS

Sources, winning, properties

03/00459 A new method for measuring the graphite content of anthracite coals and soots

Jiang, Y. J. *et al. Energy & Fuels*, 2002, 16, (5), 1296–1300.

A new method for estimating the average fraction of graphitic structure (the graphite-like factor) found in carbonized materials such as anthracitic coals and soots has been developed. This method employs a Q meter, a device that can be used to measure the resistance of a coil at high frequency. The resistance, and therefore the Q response, depends on the conductive behaviour of the delocalized electrons in the sample placed inside a RF coil. On the basis of the Q measurement, one can estimate the percentage of the sample that contains graphite-like regions in which delocalized conduction electrons exist. A series of measurements was made on a set of graphite and silica gel mixtures in order to calibrate the measured Q values. This method was then applied to a series of anthracitic coal samples and a number of soot samples. The Q values obtained were related to the graphitic content of the soot or coal. These results are compared with carbon-13 NMR data and ESR unpaired electron spin concentration measurements.

03/00460 An investigation into the thermal behavior of coals

Versan Kok, M. *Energy Sources*, 2002, 24, (10), 899–905.

The thermal behaviour of four coal samples was investigated using simultaneous thermogravimetry (TG/DTG) and differential thermal analysis (DTA) methods. Upon heating the coals in an inert atmosphere up to 800°C, 31.44–43.82% weight loss occurs. The 2 temperature regions of increased chemical reactivity are evident in the coal samples studied. Two different models determined kinetic analysis of the samples, and the results are discussed.

03/00461 Application of XPS in research on occurrence of organic sulfur in vitrain

Dai, S.-F. *et al. Zhongguo Kuangye Daxue Xuebao*, 2002, 31, (3), 225–228. (In Chinese)

Occurrence of organic sulfur in the hand-picked vitrain samples from coal seams 9, 12 and 15 in Wuda coalfield, located on the western edge of Ordos Basin, was studied using the XPS technology. The research shows that the versatile occurrence of organic sulfur are detected by pre-coal material, sedimentary environment, and catagenesis. The lower organisms, such as bacteria and algae in the swamp in large quantities during the peat accumulation might be the main reason for the thiophene analogue dominating (50, 67%) in the organic sulfur in Number 9 coal seam. The thiophene analogue content increases along with the coal rank ($R_{o,ran}$ ranges from 0.96% for Number 9 coal seam to 1.09% for Number 15 coal seam). The high content of sulfone in Number 15 coal seam is probably related to the relative high content of exinite (w(exinite) = 1.6%).

03/00462 Calculation of the heat capacity of coals according to their elemental composition and the degree of aromaticity of the organic matter

Gagarin, S. G. and Gyul'maliev, A. M. *Khimiya Tverdogo Topliva (Moscow, Russian Federation)*, 2002, (3), 3–11. (In Russian)

The molar heat capacity of organic matter of brown, bituminous, and anthracite coals is detected according to the input for the C, H, O, N, and S atoms, with separating of the C atoms into aromatic, C_{ar} and aliphatic, C_{al}. These values were obtained by using the data for individual compounds, modelling the structure of the organic matter of mined coals. The specific (mass) heat capacity of a coal (on dry ash-free basis) is calculated using the values of molecular weight of the fragment containing 100 C atoms. The calculated values satisfactorily agreed with the experimental data.

03/00463 Combustion and NO_x emission behavior of Chinese coals

Chen, H. and Xie, K. *Chinese Journal of Chemical Engineering*, 2002, 10, (3), 333–338.

Seven Chinese coals ranking from anthracite to sub-bituminous from the Shanxi province were selected for study to forecast the combustion and NO_x emission behaviour. Three UK coals, one Indonesian and one South African coal were included in the study for reference. A flat flame-turbulent jet apparatus was employed to assess flame stability, ignition performance and NO_x emission behaviour for the initial stage of devolatilization and combustion. This apparatus can simulate particle heating rates, maximum temperatures and the influence of the turbulent fluid interactions on the fate of volatiles. To simulate processes occurring over longer residence time, additional devolatilization experiments were performed in a drop tube furnace. Char reactivity was studied through thermogravimetric analysis. Finally, fouling propensity was studied with the aid of a purpose-built laboratory combustor that enabled the characteristics of the ash deposit to be assessed empirically. The results show that Chinese coals do not appear to possess unusual features in respect of NO_x formation, flame stability and ignition, char burnout and ash slagging. The range of coals available in China appears sufficiently broad to suit all requirements. In particular, Shenfu coal, with its initial fast devolatilization and nitrogen release rates and its low initial nitrogen content and high char reactivity, will perform well when fired in industrial boilers as far as NO_x emission, flame stability and combustion efficiency are concerned. Pingshuo coal exhibits high char reactivity and an attractive slagging performance suggesting that this fuel represents a good compromise between NO_x emission and overall plant efficiency.

03/00464 Depositional evolution of Miocene coal successions in the Soma coalfield, western Turkey

Inci, U. *International Journal of Coal Geology*, 2002, 51, (1), 1–29.

Miocene alluvial and fluvial-lacustrine deposits comprising three lignite successions (Lower, Middle, and Upper) are exposed in the Soma coalfield in western Anatolia. The total thickness of the coal successions is about 900 m and they rest unconformably on Mesozoic carbonate and siliciclastic basement rocks. Several lithofacies are recognized and are arranged into 15 facies assemblages (FA1 to FA15) within coal successions. The lower coal succession (FA1 to FA3) has been interpreted as the deposits of alluvial fan to ephemeral lacustrine and forest lower mire system, resulting in a subbituminous coal, which averages a thickness of 20 m. The freshwater carbonate-dominated Middle Coal succession (FA4 to FA7) has been interpreted as the deposits of an anastomosed river system including shallow carbonate mudflats to lake and ponds and frequently drying poor forest mires depositing lignitic coal. The volcanic-influenced upper coal (UC) succession (FA8 to FA15) has been interpreted as the fluvial channel, floodplain, and allochthonous peat mire deposits (FA8 to FA10) associated with a braided river system that was rapidly buried and eroded by volcaniclastic apron deposits (FA11 to FA14) and culminated in large carbonate-dominated shallow lake deposits (FA15). The Miocene coal successions were probably deposited in a slowly subsiding and fault-controlled karst-based paleovalley and lowlands of the intramontane paleomorphology that resulted from the Early Tertiary collision of the Eurasian and Anatolian plates.

03/00465 Effect of mineral matter on coal combustion reactivity

Rojas, A. F. *et al. Proceedings of the International Technical Conference on Coal Utilization & Fuel Systems*, 2002, 1, (27), 325–331.

Effect of mineral matter on combustion reactivity was detected in two coals, golondrinas and guachinte, from the south-west Colombian area. Raw coal of three particle sizes and separated coal fractions (underflow) obtained by cyclone separations at two specific gravities, 1.3 and 1.4 were oxidized in a fluidized bed combustor at temperatures lower than 300°C. In order to detect mineral content in coals, oxidized samples were analysed by X-ray diffraction (XRD). Reactivity studies were carried out in a thermogravimetric analyser (TGA). Weighted mean activation energy (WMAE) was the parameter used for define reactivity of coals. A coal having lower WMAE is more reactive than another one. Coals having high content of minerals such as kaolinite, gypsum and calcite exhibited low figures of WMAE, which could indicate that those minerals act as catalyst agents in coal combustion. However, some coal samples containing high quartz concentration showed high value of WMAE, suggesting it works as inhibitor.

03/00466 Effects of fuel characteristics on the NO reduction during the reburning with coals

Zhong, B. J. *et al. Fuel Processing Technology*, 2002, 79, (2), 93–106.

This paper studies the effects of different kinds of pulverized coals and their chars on the reduction of NO in the rich-fuel reburning zone using a bench-scale flow reactor. Fuels chosen for the reburning in the experiment are the Chinese Xiaolongtan lignite, Fulaerki lignite and Datong bituminous coal and their chars. The Datong bituminous coal chars added with different catalysts are also used. Experiments were conducted under conditions with initial NO concentration of 1000 ppm and reaction-zone temperatures of 900 and 1100°C. The present experiments verify the results reported in available references, namely the NO reduction capacities of the lignites and lignite chars are appreciably stronger than those of the bituminous coals and bituminous coal chars. Experimental results also show that in the reburning with a coal as the fuel, heterogeneous mechanisms make a significant contribution to the reduction of NO. The specific surface area of char particles and the content of metal oxides in the char are all important factors, which affect appreciably the NO reduction.