01 SOLID FUELS

Sources, winning, properties

04/00001 Application of spectrometric nuclear borehole logging for reserves estimation and mine planning at Callide coalfields open-cut mine

Charbucinski, J. and Nichols, W. *Applied Energy*, 2003, 74, (3–4), 313–322.

Nuclear borehole logging is practically the only technique that has the capacity for providing quantitative in-situ coal quality information in real time. The SIROLOG gamma–gamma and neutron–gamma (PGNAA) borehole logging procedures have been providing vital characteristics of the coal seams at Callide coalfields since 1993. Together with an accurate delineation of coal seams, the SIROLOG procedures estimate ash content, density and some ash constituents accurately enough for relatively inexpensive rotary chip holes to be accepted as points of observation in calculations of reserves.

04/00002 Characterization of humic substances from lignite samples

Demirbas, A. *Energy Sources*, 2003, 25, (1), 23–32.

The conversion and product fractionation obtained from supercritical benzene extraction of five Turkish lignite samples have been investigated. The lignite samples differ considerably in mode of occurrence and in their physical and chemical properties, thus the variation in the amount of humic acids found in different deposits. Humic substances were extracted from the lignite samples. Phenolic substances such as humic acid derivatives were characterized with a gas chromatography-mass spectrometry (GC-MS) combined system. To identify phenolic substances in he benzene extracts from the lignite samples, a GC Hewlett-Packard 5790 and MS-VG 70-250-SE combined system was used. The column was a 25 m × 0.2 mm inner diameter with a film thickness of 0.25 μm Carbowax PEG 20 capillary glass.

04/00003 Determination of elemental affinities by density fractionation of bulk coal samples from the Chongqing coal district, Southwestern China

Zhuang, X. *et al. International Journal of Coal Geology*, 2003, 55, (2–4), 103–115.

The occurrence and distribution of major and trace elements have been investigated in two coal-bearing units in the Chonqing mining district (South China): the Late Permian and Late Triassic coals. The Late Permian coals have higher S contents than the Late Triassic coals due to the fixation of pyrite in marine-influenced coal-forming environments. The occurrence of pyrite accounts for the association of a large number of elements (Fe, S, As, Cd, Co, Cu, Mn, Mo, Ni, Pb, Sb, Se, and Zn) with sulfides, as deduced from the analysis of the density fractions. The marine influence is probably also responsible for the organic association of B. The REEs, Zr, Nb, and Hf, are enriched by a factor of two to three with respect to the highest levels fixed for the usual worldwide concentration ranges in coal for these elements. The content of these elements in the Late Permian coal is higher by a factor of five to 10 with respect to the Late Triassic coal. Furthermore, other elements, such as Cu, P, Th, U, V, and Y, are relatively enriched with respect to the common range values, with maximum values higher than the usual range or close to the maximum levels in coal. The content of these elements in the Late Permian coal is higher than the Late Triassic coal. These geochemical enrichments are the consequence of the occurrence, in relatively high levels, of phosphate minerals, such as apatite, xenotime, and monazite, as deduced from the study of the density fractions obtained from the bulk coal. The Late Triassic coal has a low sulfur content with a major organic affinity. The trace element contents are low when compared with worldwide ranges for coal. In this coal, the trace element distribution is governed by clay minerals, carbonate minerals, and to a lesser extent, by organic matter and sulfide minerals. Major differences found between late Permian and Triassic coals are probably related to the source rocks, given that the main source rock of the late Permian epicontinental marine basin is the Emeishan basalt formation, characterized by a high phosphate content.

04/00004 Geochemical and mineralogical anomalies of the late Permian coal in the Zhijin coalfield of southwest China and their volcanic origin

Dai, S. *et al. International Journal of Coal Geology*, 2003, 55, (2–4), 117–138.

This paper describes the influence of volcanic ash on the concentrations and occurrences of associated elements in coal in the Zhijin Coalfield in western Guizhou Province, China. Our studies reveal that the No. 9 coal seam in the Zhijin Coalfield has a very high content of Fe (4.34%), Cu (369.90 μg/g), U (49.6 μg/g), Mo (63.10 μg/g), Zn (33.97 μg/g), and Zr (841.80 μg/g). The studies have also found that elements, such as Fe and Cu, do not occur as sulfides in this coal seam, in sharp contrast to many other coal seams in China. The geochemical and mineralogical anomalies of the coal seam are attributed to synsedimentary volcanic ash. In addition to normal macerals and minerals in coal, a volcanic-influenced material (VIM) derived from volcanic ash, detrital material of terrigenous origin and organic matter was identified under polarized-light reflectance microscopy and scanning electron microscopy equipped with an energy-dispersive X-ray analyser. The volcanic-influenced material is the main carrier of the above elements in this coal. Six types of the volcanic-influenced material (VIM-1, VIM-2, VIM-3, VIM-4, VIM-5, and VIM-6) are further distinguished on the basis of their structures and compositions. To the best of our knowledge, this is the first report that presents a detailed classification of coal components with a high content of volcanic ash.

04/00005 Influence of mineral matter in coal on decomposition of NO over coal chars and emission of NO during char combustion

Zhao, Z. *et al. Fuel*, 2003, 82, (8), 949–957.

NO–char reaction and char combustion in the presence and absence of mineral matter were studied in a quartz fixed bed reactor. Eight chars were prepared in a fluidized bed at 950°C from four Chinese coals that were directly carbonized without pretreatment or were first deashed before carbonization. The decomposition of NO over these coal-derived chars was studied in Ar, CO/Ar and O_2/Ar atmospheres, respectively. The results show that NO is more easily reduced on chars from the raw coals than on their corresponding deashed coal chars. Mineral matter affects the enhancement both of CO and O_2 on the reduction of NO over coal chars. Alkali metal Na in mineral matter remarkably catalyses NO–char reaction, while Fe promotes NO reduction with CO significantly. The effect of mineral matter on the emission of NO during char combustion was also investigated. The results show that the mineral constituents with catalytic activities for NO–char reaction result in the decrease of NO emission, whereas mineral constituents without catalytic activities lead to the increase of NO emission. Correlation between the effects of mineral matter on NO–char reaction and NO emission during char combustion was also discussed.

04/00006 Iron sulfides in mudstones within the Carbonaceous sequence of Donets Basin

Kizilshtein, L. Y. and Nastavkin, A. V. *Lithology and Mineral Resources*, 2003, 38, (1), 31–35.

The genesis of local compact segregations of iron sulfide (pyrite) in mudstones at the roof of some coal seams in the Donets Basin (Donbas) is examined. Arguments presented in the work show that sulfides were formed as a result of bacterial sulfate reduction and hydrogen sulfide generation in zones of organic matter concentration. The lack of any signs of influx of alien components testifies to in situ sulfide accumulations at the syngenetic or early diagenetic stage in bottom sediments of the basin. The shape and structure of pyrite segregations suggest that they could be 'sulfide biocherms' occasionally subjected to mechanical deformation in a liquid mud under the influence of gravitational force or external mechanic (possibly seismic) loads. The obtained data can serve as an additional source of information pertaining to the formation conditions of sulfide ore deposits.

04/00007 Mechano-activation as initiation of self-ignition of coal

Medek, J. and Weishauptova, Z. *Energy & Fuels*, 2003, 17, (1), 159–163.

A new theory of the self-ignition of coal was developed, based on the principle of the spontaneous disintegration of coal resulting from the effect of potential energy, which is accumulated in the coal and causes mechanical stress. This gives microcracks where a part of the potential energy is dissipated to heat, which may evoke, in a thermally insulated system, large temperature increases and the initiation of microfires as primary centers of burning. The considered process is independent of the size of coal body, humidity of the coal, and the degree of previous oxidation. A fundamental difference between this theory and other theories lies in the fact that a gradual increase in the coal temperature is not considered and that latent microfires occur directly.

04/00008 Methods for characterization of inorganic and mineral matter in coal: a critical overview

Vassilev, S. V. and Tascon, J. M. D. *Energy & Fuels*, 2003, 17, (2), 271–281.