

00/00622 Structural changes of coals induced by loading cations

Sugano, M. *et al.* *Sekitan Kagaku Kaigi Happyo Ronbunshu*, 1997, 34, 21–24. (In Japanese)

Four deashed coals of different rank prepared in HCl and HF aqueous solutions were treated with acetate, chloride and hydroxide aqueous solutions of several metals (K^+ , Na^+ , Mg^{2+} , Ca^{2+} , Fe^{2+} , Fe^{3+} and Al^{3+}) to produce corresponding metal-loaded coals. In this paper the relations between the contents and the kind of loaded cations are investigated. Further, the structural changes of coals induced by cation exchange are also discussed from the pyridine extractability. For lower rank coals, such as Adaro and Black Thunder coals, almost linear relations between the contents of loaded cations and the decreased amounts in pyridine solubles of coals loaded cations were indicated.

00/00623 The structure and reactivity of density separated coal fractions

Gilfillan, A. *et al.* *Fuel*, 1999, 78, (14), 1639–1644.

Density separations of six world coals have been carried out. The coals were provided as pf samples and were screened to provide size fractions at $-38 + 20 \mu m$ from which tight density fractions (0.02 and 0.03 g cm⁻³ intervals) were produced in a heavy liquid medium using the float-sink procedure. Each density fraction was characterized by manual maceral analysis and a new automated image analysis technique called the reactivity assessment program. The chemical structure of each fraction was examined by ¹³C NMR and FTIR spectroscopies. The reactivity of the density fractions was assessed using a drop tube furnace at a temperature of 1300°C, residence time of 100 ms and 1 vol% oxygen atmosphere. The morphology of the chars produced in the drop tube furnace was examined manually and using an automated image analysis technique. This allowed the predicted reactivity of the fractions to be correlated against actual burnout characteristics.

00/00624 Structure determination of sulfur forms in coals by XANES

Shirni, M. *et al.* *Sekitan Kagaku Kaigi Happyo Ronbunshu*, 1997, 34, 57–60. (In Japanese)

In this study, X-ray absorption near edge structure (XANES) was applied to the direct determination of the chemical and structural environment of sulfur in coals. Third derivatives of the XANES spectra from model compounds provided fingerprints for interpreting sulfur forms in coals. High desulfurization arises from high rank Fu Rong coal, this can be explained by the presence of elemental sulfur as indicated by XANES analysis.

00/00625 Viscoelastic properties of coal in the thermoplastic phase

Nomura, S. *et al.* *Fuel*, 1999, 78, (13), 1583–1589.

The viscoelastic properties of coals in the thermoplastic phase during carbonization were measured with dynamic mechanical oscillation instrumentation. The temperature and frequency dependence of the viscoelastic properties of the coals in the thermoplastic phase were similar to those of polymers and thermosetting resins. The storage modulus (G') and the loss modulus (G'') showed minimum (10^4 – 10^5 Pa), the loss tangent ($\tan \delta = G''/G'$) showed a peak, and the complex viscosity (η^*) also showed a minimum (10^3 – 10^5 Pa s) near the temperature of maximum fluidity of coal. There was a close relationship between the caking characteristic parameters measured with conventional method and the rheological moduli obtained here. The complex viscosity (η^*) decreased as the frequency increased, which suggests that the conventional Gieseler plastometer overestimates the fluidity in the high fluidity range due to the high rotation speed. It proved promising to apply the dynamic viscoelasticity measurement technique to study the coal structural changes during the thermoplastic phase from analogy with polymers.

Preparation

00/00626 Adaptation of a briquetting machine for the dewatering and consolidation of fine coal

Dharman, T. *et al.* *Proc. Annu. Int. Pittsburgh Coal Conf.* [computer optical disk], 1998, 15, 599–600.

A novel coal preparation method for the recovery of high heating value Illinois coal containing high amounts of sulfur (in the form of pyrite), has been developed by the Illinois Clean Coal Institute (ICCI). Unfortunately, the new cleaning method, consisting of fine grinding the coal to liberate mineral matter, such as the pyrite, produced large amounts of high moisture ultrafine coal. The adaptation of a commercially available machine was suggested as an economically viable alternative to dewater and recover the fine coal, and a roll briquetting machine was chosen. The research effort at University of Missouri-Rolla has, in the past, been limited to dry material applications. Pilot-scale testing involved using an unmodified briquetting machine to dewater and consolidate wet coal fines and preliminary results indicated that robust briquettes with low moisture content could be produced under this configuration. However, two areas of concern were realized during the pilot-scale experiments: the arching and caking

problems resulted in inconsistent feeding of material; back drainage into the feed hopper resulted in varying the feed moisture. Design changes were conducted on the feed area of the machine, which resulted in the elimination of the problems encountered. Briquettes with consistent low moisture content and adequate strength characteristics could now be produced under the new configuration of the briquetting machine.

00/00627 Advanced electric power generation system—IGCC

Chung, W.-C. *Jishu Yu Xunlian*, 1998, 23, (6), 127–133. (In Chinese)

The integrated gasification combined cycle is discussed. The combination of technologies in IGCCs gives the advantage of adding steam power generation to gas power generation along with new coal gasification processes and breakthrough gas cleanup technologies. Because of this, IGCC is the most efficient and cleanest of the available technologies for coal-based electric power generation.

00/00628 Aerodynamics of chain link stoker mats

Horsley, M. E. *et al.* *Fuel*, 1999, 78, (14), 1763–1769.

This paper describes experimental work on the aerodynamic features of a chain grate stoker link mat and interprets and analyses the results of flow visualization and associated quantitative measurements. Particular attention was paid in the experimental work to local air flow characteristics by using smoke tracer techniques on an actual link mat and pulsed wire anemometry on an enlarged scale model mat. Examples of jetting flow, recirculation, wakes and eddies of long residence time have been recorded for typical chain grate combustion air flow rates. Such information represents a significant step forward from the traditional empirical development and allows the proposal of improved, commercially applicable grate link designs for the enhancement of the role of coal in a competitive fuels market where environmental legislation is ever tightening. The results are being used in a subsequent part of a project to develop a new design of stoker mat link.

00/00629 Behavior of coal macerals in initial stage of coal liquefaction

Okada, Y. *et al.* *Sekitan Kagaku Kaigi Happyo Ronbunshu*, 1997, 34, 99–102. (In Japanese)

The process supporting unit preheater was used to rapidly heat Tanito Harum coal slurry and the behaviour of coal macerals in the initial stage of coal liquefaction was investigated with petrographical analysis. The relationship between the vitrinite reflectance of the heated coal and products yield, residence time in preheater and H/C atomic ratio of toluene insoluble can be recognized. A fraction of coal maceral reacted in the initial stage of coal liquefaction. In conclusion, the progress of coal liquefaction during the preheating process is dependent on temperature and residence time of preheater.

00/00630 Biodesulphurization of Indian (Assam) coal using *Thiobacillus ferrooxidans* (ATCC 13984)

Dastidar, M. G. *et al.* *Energy Convers. & Manage.*, 2000, 41, (4), 375–388.

The pyritic sulfur removal from coal and pyrite by *Thiobacillus ferrooxidans* was studied in a batch reactor. Microbial oxidation of ferrous iron to the ferric form, the central step in the biodesulfurization process was found to be affected by the substrate and product concentration. Direct microbial oxidation of pyrite was dominant during the exponential phase, while indirect electrochemical oxidation was observed at the stationary phase of the growth. The effect of various parameters, such as pulp density, ferrous and ferric iron concentrations on the rate of biodesulfurization was studied. The rate of pyritic sulfur removal was retarded at higher concentrations of ferrous and ferric iron. Therefore, during the process, the concentrations of Fe(II) and Fe(III) iron in the bioreaction mixture need to be controlled to maintain high rates of pyritic sulfur removal.

00/00631 Coal conversion. Preparation of activated carbon from Spanish coal

Solano, A. L. *Eur. Comm., [Rep.] EUR*, 1999, (EUR 17440), 1–213. (In Spanish)

For the purpose of this study, a bituminous coal was carbonized in a furnace and then activated using steam or carbon dioxide in a fluidized bed. The porosity of the resulting carbon was examined as a result of the activation process. Using flotation for its removal, the mineral content of the coal was evaluated and related to structural properties of the resulting carbon. The activated carbon was effective in removal of phenols from aqueous solutions and sulfur dioxide from gas streams. The pilot plant studies confirmed the laboratory results.

00/00632 Coal liquefaction over Mn_2O_3 -NiO- H_3PO_4 catalysts

Yamamoto, M. *et al.* *Sekitan Kagaku Kaigi Happyo Ronbunshu*, 1997, 34, 341–344. (In Japanese)

The activities of Mn_2O_3 -NiO- H_3PO_4 (MNP) and pyrite catalysts for the liquefaction of Yallourn and Tanito-Harum coals were tested and compared by using a micro-autoclave apparatus. It was found that the liquefaction activity of MNP catalyst strongly depended on the rank of coal. Further, highly enhanced conversion, compared to pyrite catalyst, was obtained in the liquefaction of Yallourn brown coal in the whole range of reaction temperatures used. In addition, the atomic H/C ratios of asphaltene and preasphaltene obtained by the liquefaction were considerably higher with MNP catalyst than pyrite, indicating that the hydrogenation was promoted with MNP catalyst.