灰色关联原理在煤种聚类分析中的应用（1-4）

胡小芳1）王朋2）吴成宝3）

1) 教授、博士生导师，华南理工大学机械与汽车工程学院粉体工程实验室；华南理工大学聚合物成型加工工程教育部重点实验室，510640广州；2) 硕士；3) 博士生，华南理工大学机械与汽车工程学院粉体工程实验室，510640广州

摘要：运用灰色关联原理定量表征了煤的性能参数：硫分、挥发分、灰分和发热量对聚类分析结果的影响程度.结果表明，在不同权值条件下，可得到一致的结果，实验选取四种性能参数的相对关联系数的大小顺序恒为：硫分、挥发分、灰分、发热量.实验验证可得到一致结果.因此，在实际研究和聚类分析过程中，应该控制四个参数中硫分和挥发分的检测精度和准确度.

关键词：聚类分析，煤种，灰色关联分析

APPLICATION OF GREY RELATIONAL PRINCIPLE IN THE CLUSTER ANALYSIS OF COAL CATEGORY

Hu Xiaofang,Wang Peng and Wu Chengbao1

(1.Powder Engineering Laboratory of Mechanical and Automobile Engineering School, South China University of Technology；2.Key Laboratory of Polymer Processing Engineering, Ministry of Education, South China University of Technology, 510640 Guangzhou)

ABSTRACT：The quantitative effect of the four different property parameters of coal on the cluster analysis of coal category was investigated by grey relational principle in this paper. The results indicated that the relative order of effect of the four parameters from big to small at different weight was always sulfur content, volatile component, ash content and caloric value, respectively; and the verification test proved it to be right. Consequently, the detection accuracy and procession of sulfur content and volatile component of coal samples should be strictly controlled in experimental study and the cluster analysis of coal category.

KEY WORDS：cluster analysis, coal, grey relational analysis

煤加压热解过程中C和H的转变规律（5-9）

鞠付栋1)陈汉平2)杨海平3)沈应强4)张世红5)

1) 博士生；2) 教授、博士生导师；3) 副教授、硕士生导师；4) 硕士生；5) 教授，华中科技大学煤燃烧国家重点实验室，武汉430074

摘要：主要采用加压热天平进行了不同工况(压力、温度)下煤焦样品的制备，并利用元素分析仪对煤焦进行了元素分析，研究了不同热解压力和温度下煤热解过程中C和H的转变规律.在1 000 ℃时，随热解压力的增加（从常压到5 MPa）煤焦产量增加，煤焦中的*n*C/*n*H（C/H摩尔比）也增加，从而增加了转化到煤焦中的碳量Cchar，而Hchar则先减小而后趋于恒定.在常压和加压下（3 MPa）时，随着热解温度的提高（500 ℃~1 000 ℃），热解煤焦的产量都减少，煤焦中的*n*C/*n*H增加，转化到煤焦中的碳量Cchar和氢量Hchar都减小.但加压热解与常压热解相比，煤焦产量的减小速率要小，煤焦中的*n*C/*n*H在650 ℃~800 ℃的增加速率要大，从而使得转化到煤焦中的碳量Cchar较大.这主要是由加压热解加快了半焦和焦油的二次反应而引起的.*n*C/*n*H随热解压力的变化表明加压热解加快了煤焦微晶结构的有序化，这对煤焦的反应性将产生重要影响.

关键词：加压热解，二次反应，C和H的转化

CONVERSION OF C AND H DURING COAL PRESSURIZED PYROLYSIS

Ju Fudong,Chen Hanping,Yang Haiping,Shen Yingqiang and Zhang Shihong

(HUST,State Key Laboratory of Coal Combustion,430074 Wuhan)

ABSTRACT：The C and H conversion of coal during coal pressurized pyrolysis was investigated. It was found that the second pyrolysis of char and tar was enhanced with pressure increasing. At 1 000 ℃, with the increasing of pressure, the char production, and the *n*C/*n*H and the C quantity converted to char was increased, but the H quantity converted to char was firstly decreased and then showed no change with increasing pressure. At atmospheric and pressurized pyrolysis, with the increasing of temperature, the char production was decreased, and the *n*C/*n*H was increased, and the C quantity and H quantity converted to char was decreased. Comparing with atmospheric pyrolysis, the pressurized pyrolysis showed less decreasing ratio of char production, larger increasing ratio of *n*C/*n*H in the temperature range of 650 ℃800 ℃, and so more C was converted to char. It might be dued to the enhancing of second pyrolysis for pressurized pyrolysis. The variation of *n*C/*n*H with pressure showed that the ordering of crystalline structure was enhanced under pressure pyrolysis, which would influenced the char reactivity greatly.

KEY WORDS：pressurized pyrolysis,second pyrolysis,C and H conversion

还原性气氛下煤中硫热解迁移规律(Ⅰ)H2和N2气氛下煤中硫热解释出规律的比较（10-13）

王利花1)王素珍1)赵炜2)

1) 硕士生；2) 副教授，煤科学与技术教育部和山西省重点实验室，太原理工大学，030024太原

摘要：对煤中硫在还原性气氛下热解的迁移规律进行了实验研究.以一种中硫煤为研究对象，在一套常压固定床反应器上进行程序升温实验，热解产物在高温下与净化的空气混合后并充分燃烧，经由溶液吸收进行电解滴定，得到实验过程煤中硫的连续释出规律曲线.实验结果表明，煤中硫在H2气氛下的释出比例比在N2气氛下的释出比例要高，H2气氛下的释出比例为71.9%，N2气氛下的释出比例为32.8%.引起两者释出比例差异的主要原因是：在高于500 ℃的高温条件下，H2能够与煤（煤半焦）中的硫进行反应，而在N2气氛下煤（煤半焦）中的硫却不能随温度的升高而进一步释出.

关键词：煤，还原性气氛，热解

MIGRATION OF SULFUR IN COAL UNDER THE REDUCTIVE PYROLYSIS PART（Ⅰ） COMPARISON OF EXPERIMENTAL RESULTS UNDER H2 AND N2 ATMOSPHERE

Wang Lihua,Wang Suzhen and Zhao Wei

(Key Laboratory of Coal Science and Technology,Ministry of Education and Shanxi Province Taiyuan University of Technology,030024 Taiyuan)

ABSTRACT：The migration of sulfur and the coal reductive pyrolysis was studied used a fixed-bed reactor. First, coal sample was holding in the quartz reactor undergoing the temperature program pyrolysis. The product was mixed with the purify air and burnt under the high temperature, then be absorpted by the acidic solution for the coulometric titration. Therefore a continuous release curve of sulfur in coal under the reductive pyrolysis was obtained. Experimental results show that the release proportion of sulfur in coal in the atmosphere of H2 was higher than that in the atmosphere of N2, the release proportion of sulfur were 71.9% and 32.8% respectively at the atmosphere of H2 and N2. Mainly reason for the difference each other is caused by: when the temperature is over 500 ℃, H2 can react with sulfur in coal (semi-coke), but the atmosphere of N2 can not further react with the sulfur in coal (semi-coke) at this temperature.

KEY WORDS：coal,reductive atmosphere,pyrolysis

IGCC示范工程煤气化炉的数值模拟（14-19）

沈玲玲1)姜秀民2)王辉3)黄庠永4)

1) 硕士生；2) 教授、博士生导师；3) 博士后；4) 博士生，上海交通大学热能工程研究所，200240上海

摘要：采用Aspen Plus流程模拟软件对某拟建的IGCC示范工程的德士古煤气化炉进行数值模拟，通过考虑碳的不完全转换对计算流程进行了改进，并运用CPD模型预测煤热裂解的产物分布.研究了煤气化炉的重要操作参数（即水煤浆浓度、氧煤比、气化压力和气化温度）对气化结果的影响.在计算区间内，发现高浓度水煤浆浓度范围内，随浓度的增加，煤气的主要成分(H2+CO)的总含量增加.气化温度增大到1 400 ℃左右时，煤气的主要成分随气化温度的进一步增加会趋于一个恒定值.

关键词：Aspen Plus，IGCC，德士古气化炉

NUMERICAL SIMULATION OF GASIFIER IN AN IGCC DEMONSTRATION PROJECT

Shen Lingling,Jiang Xiumin,Wang Hui and Huang Xiangyong

(School of Mechanical Engineering,Shanghai Jiaotong University,200240 Shanghai)

ABSTRACT：Aspen Plus software is used to simulate a Texaco gasifier of an IGCC demonstration project. By considering incomplete carbon conversion to improve simulation flowsheet and using CPD model to predict production of coal thermal decomposition, the effect of some important operation parameters such as coal concentration of water coal slurry, oxygen/coal ratio, pressure and temperature in coal gasifier on the gasification production has been studied. The results show that within the calculation range, the percentage of main components increases as the coal slurry concentration increases within high coal concentration. And main components tend to be a constant value when temperature is about 1 400 centigrade.

KEY WORDS：Aspen Plus，integrated gasification combined cycle，Texaco gasifier

褐煤地下气化特性的实验研究（20-24）

李文军1)刘丽丽2)梁新星3)梁杰4)王伟5)

1) 博士生；2) 硕士生，中国矿业大学，100083北京；3) 工程师，新奥气化采煤有限公司，065001河北廊坊；4) 教授、博士生导师，新汶矿业集团有限责任公司，271233山东泰安；5) 工程师，中石化胜利油田东辛采油厂，257049山东东营

摘要：分别以富氧和富氧水蒸气为气化介质，进行了大雁褐煤的地下气化模型实验.研究了鼓风量和汽氧比对煤气组成、气化稳定性以及煤层气化速率的影响，并进行了富氧水蒸气地下气化过程的物料衡算.实验结果表明，通过采取合适的气化参数，大雁褐煤的地下气化过程可以稳定进行.

关键词：褐煤，地下气化，汽氧比，气化速率

EXPERIMENTAL STUDY ON THE CHARACTERISTICS FOR UNDERGROUND GASIFICATIONG OF LIGNITE

Li Wenjun,Liu Lili,Liang Xinxing,Liang Jie and Wang Wei\*\*\*

(China University of Mining and Technology Beijing，100083 Beijing；\* Xin'ao CGM Investment Company Limited,065001 Langfang,Hebei;\*\* Xinwen Coal Mining Group Corporation Limited,271233 Taian,Shandong;\*\*\* Information Center,Dongxin Oil Recovery Plant,SINOPEC Shengli Oil Field Company,257049 Dongying,Shandong)

ABSTRACT：With oxygen and oxygen-steam as gasification medium, the model test of underground gasification of Dayan lignite were conducted. The studies were focused on the influence of oxygen blast and steam/oxygen ratio on the gas composition, gasification stability and rate. In the same time, the mass balance of oxygen-steam gasification process was conducted. The results show that the underground gasification of Dayan lignite has high stability form to use suitable parameters.

KEY WORDS：lignite,underground gasification,steam/oxygen ratio,gasification rate

两种煤气化技术用于合成氨的能耗分析（25-27+90）

马连强1)

1) 硕士，中国寰球工程公司，100029北京

摘要：使用流程模拟的方法计算了两种煤气化技术用于合成氨的能耗并分析了能耗产生差异的原因，提出比较和选择煤气化技术要基于具体的应用场合并确定合理的比较范围，从能耗角度为选择煤气化技术提供依据.计算结果表明，在水蒸气含量高的反应气氛下，氧煤比由灰熔点控制，反之，由碳转化率控制；GEGP气化技术单位H2煤耗和氧耗均较高，多消耗的煤和氧转化成了煤气中的水蒸气，GEGP气化炉内发生了部分变换反应，降低了变换装置的负荷；GEGP气化技术单位H2的能耗低于SCGP气化技术.

关键词：SCGP气化，GEGP气化，合成氨，能耗，流程模拟

ENERGY CONSUPTION OF TWO KINDS OF GASIFICATION TECHNOLOGIES IN SYNTHERTIC AMMONIA INDUSTRY

Ma Lianqiang

(China Huanqiu Contracting and Engineering Corporation,100029 Beijing)

ABSTRACT：Based on process simulation, calculated and analyzed the energy consumption of two kinds of gasification technologies when they are used in synthetic ammonia industry, and indicated that choice and compare of gasification technologies should be in a specified application situation and proper compare scope. The calculated results show that when steam is excessive in reaction condition the oxygen-coal ratio is controlled by ash fusibility, or by carbon conversion ratio. GEGP technology consumes more coal and oxygen per unit hydrogen, and the more consumed coal and oxygen convert to steam in coal gas. More shift reaction occurs in GEGP gasifier and reduces the load of shift unit. GEGP technology consumes less energy per unit hydrogen relative to SCGP technology.

KEY WORDS：SCGP gasification, GEGP gasification, synthetic ammonia, energy consumption, process simulation

喷嘴入口位置对气化炉流场影响的实验研究（28-33+49）

于海龙1）董向元2）刘建忠3）郭淑青2）高洪亮1）李小民4）

1) 博士、副教授；2) 博士、讲师；4) 硕士、讲师，中原工学院能源与环境学院，450007郑州；3) 博士、教授，浙江大学能源洁净利用与环境工程国家重点实验室，310027杭州

摘要：为了考察气化炉炉侧喷嘴入口位置对炉内流场和颗粒浓度分布的影响规律，在新型水煤浆气化炉冷模三维实验台上进行了大量的实验研究，并与数值模拟计算结果进行了对比，结果表明，当喷嘴距气化炉顶部0.9 m时，气化炉炉内流场分布最合理，颗粒浓度分布最均匀；实验测试结果和数值模拟计算结果非常接近，进一步验证了数值模拟计算结果的准确性.实验测试结果为气化炉的设计和运行提供了参考.

关键词：水煤浆，气化炉，喷嘴，实验研究

EXPERIMENTATION STUDY ON NEW TYPE CWS GASIFIER AT COLD STATE

Yu Hailong,Dong Xiangyuan,Liu Jianzhong,Guo Shuqing,Gao Hongliang and Li Xiaomin

(School of Energy and Environment, Zhongyuan University of Technology,450007 Zhengzhou;\* Clean Energy and Environment Engineering Key Lab of China,Zhejiang University,310027 Hangzhou)

ABSTRACT：In order to examine the effect of different height of furnace side nozzle upon the distribution of flow field, particle concentration, the 3-D flow field in a new type CWS gasifier at cold state was analyzed using experimentation method, and contrasted this results with numerical simulation results. The optimization distribution was observed with the height 0.9 m far from the furnace top. Experimentation study results and numerical simulation results is very near, attest to the numerical simulation is exact, which can be seen as a guidance for designing and operating of this type gasifier.

KEY WORDS：coal water slurry,gasifiter,jet nozzle,experimentation study

低阶煤在煤液化衍生油中的热萃取性能（34-39）

石智杰1)张胜振2)邢凌燕3)刘卫兵3)史士东4)朱晓苏4)李春启5)

1) 硕士；4) 研究员，煤炭科学研究总院北京煤化工研究分院，100013北京；2) 博士；3) 硕士；5) 博士后，大唐国际化工技术研究院有限公司，100070北京

摘要：以煤液化油衍生油为溶剂，在热萃取装置上研究了大唐胜利褐煤等低阶煤的热萃取性能，考察了热萃取温度、热萃取时间、溶煤比、溶剂类型和煤种等因素对煤热萃取性能的影响，同时对大唐胜利褐煤在热萃取过程中氧元素的脱除情况进行了研究.结果表明：煤的热萃取率随温度升高而明显增加，由340 ℃时的18.7%（daf）增加到430 ℃时的59.5%（daf），而固体热萃取物回收率在390 ℃时达到最高值32.4%（daf），反应停留时间以60 min为宜，溶剂与煤的合适质量比为5∶1，在煤液化加氢循环溶剂中具有较高的热萃取率.热萃取过程中大唐胜利5#煤中氧元素的脱除率可达23%（daf）.

关键词：低阶煤，热萃取，脱氧，煤液化衍生

THERMAL EXTRACTION BEHAVIOR OF LOW RANK COAL IN THE COAL DERIVED LIQUIDS

Shi Zhijie,Zhang Shengzhen,Xing Lingyan,Liu Weibing, Shi Shidong,Zhu Xiaosu and Li Chunqi\*

(Beijing Research Institute of Coal Chemistry,China Coal Research Institute, 100013 Beijing;\* Datang International Chemical Technology Research Institute Company Limited,100070 Beijing)

ABSTRACT：Thermal extraction of some low rank coals was studied on thermal extraction device using coal derived liquids. The influences of temperature, residence time, solvent-coal ratio, solvent and coal rank on thermal extraction yield were studied. Furthermore, the deoxidization yield of coal in the process of thermal extraction was investigated as well. The results show that the thermal extraction yield of coal increased from 18.7%(daf) at 340 ℃ to 59.5%(daf) at 430 ℃. However, the maximal the solid extract yield 32.4%(daf) at 390 ℃ can be obtained . The optimal residence time and ratio of solvent to coal was 60 min and 5∶1 respectively. Using the coal liquefaction recycle solvent, higher coal thermal extraction yield was obtained. 23% oxygen content of Datang Shengli No.5 lignite was removed during the processing of thermal extraction at 390 ℃.

KEY WORDS：low rank coals,thermal extraction,deoxygenation,coal derived liquids

新疆黑山煤直接液化性能研究（40-43）

吴秀章1)李克健2)李文博2)

1) 博士生、 教授级高级工程师，中国石油大学(北京)，102249北京;神华集团有限责任公司，100001北京；2) 研究员，煤炭科学研究总院北京煤化研究分院，100013北京

摘要：神华集团有限责任公司为实施新疆煤炭转化战略，对位于新疆自治区吐鲁番州托克逊县的黑山煤进行了煤直接加氢液化研究，分别在0.5 L的高压釜和0.12 t/d的连续装置上进行了直接液化实验.结果表明，黑山煤具有良好的液化性能和优异的成浆性能，在可输送的黏度范围内可制得浓度高达50%的油煤浆，且能长周期稳定运转并取得较高的油收率和较低的气产率.高浓度煤浆的稳定输送特性可大大提高煤液化反应器的处理能力.

关键词：新疆黑山煤，直接液化，高浓度油煤浆

STUDY ON DIRECT LIQUEFACTION PERFORMANCE OF XINJIANG HEISHAN COAL

Wu Xiuzhang,Li Kejian and Li Wenbo3

(1. China University of Petroleum,102249 Beijing; 2. Shenhua Group Corporation Limited, 100001 Beijing; 3. Beijing Research Institute of Coal Chemistry, China Coal Research Institute, 100013 Beijing)

ABSTRACT：As a step of the implementation the coal conversion strategy of Shenhua Group Corporation in Xinjiang, direct liquefaction of the coal from Xinjiang Heishan district was carried out. The coal liquefaction tests were conducted in 0.5 L autoclave and 0.12 t/d continuous unit respectively. The test results show that Heishan coal can be easily liquefied and boasts such excellent performance as higher oil yield and lower gas yield while being made into coal slurry with a concentration as high as 50% (within the viscosity range ensuring good transportability) as well as enabling long-term stable running. The stable transportability of high concentration coal slurry can dramatically enhance the capacity of the reactors.

KEY WORDS：Xinjiang Heishan coal, direct coal liquefaction, high concentration coal slurry

H2O-CO介质下液化煤产物的表征（44-49）

赵荌荌1)潘铁英2)史新梅3)周丽芳3)徐熠4)张德祥5)高晋生5)

1) 硕士生；2) 高级工程师；3) 工程师，华东理工大学分析测试中心，200237上海；4) 硕士生；5) 教授，华东理工大学资源与环境工程学院，200237上海

摘要：用傅立叶变换红外光谱考察了水介质液化煤反应前后产物的变化，以1HNMR和GC-MS为手段考察了不同反应温度下液化产物结构组成的变化.实验结果表明，不同反应温度对产物组成变化存在影响，且在液化油中发现有酚类物质.用重水交换实验证实了产物中确实有酚类存在，对煤液化工艺条件的优化具有一定的指导意义.

关键词：液化煤，水介质，核磁共振，重水交换

COAL HYDROLIQUEFACTION PRODUCTION WITH H2O/CO

Zhao An’an,Pan Tieying,Shi Xinmei,Zhou Lifang,Xu Yi, Zhang Dexiang and Gao Jinsheng\*

(Analysis and Testing Center,East China University of Science and Technology,200237

Shanghai;\* College of Resource and Environmental Engineering,East China University of Science and Technology,200237 Shanghai)

ABSTRACT：The diversification of hydroliquefaction production after reaction were analyzed by FTIR. The change of structure and component with different reaction temperature were surveyed by 1HNMR and GC-MS. We could concluded that the production component is varied by reaction temperature and hydroxybenzene is found in oil. The existence of hydroxybenzene in the hydroliquefaction production is proved by 1HNMR spectra which added D2O into the sample solution. All above is very meaningful to hydroliquefraction craft.

KEY WORDS：liquified coal aqueous medium,NMR,exchange by D2O

氢气在煤焦油中平衡溶解度的研究（50-56）

牟学春1)凌开成2)张海军3)

1) 硕士生；2) 教授、博士生导师；太原理工大学化学化工学院，030024太原；3) 硕士，山西煤层气投资控股有限公司，030006太原

摘要：在温度323.2 K~623.2 K，压力2 MPa~10 MPa的反应条件下，根据气液平衡原理，利用高压反应釜测定了氢气在煤焦油中的平衡溶解度.讨论了温度和压力对氢气在煤焦油中平衡溶解度的影响.在不同的温度和压力条件下，氢气在各煤焦油中平衡溶解度的变化趋势不同.这些物性数据填补了国内数据库有关煤焦油方面的空白，为煤焦油在浆态反应器中催化加氢的工业化设计提供了基础物性数据.

关键词：氢气，煤焦油，平衡溶解度，温度，压力

STUDY ON EQUILIBRIUM SOLUBILITY OF HYDROGEN IN COAL TAR

Mu Xuechun,Ling Kaicheng and Zhang Haijun\*

(College of Chemistry and Chemical Engineering,Taiyuan University of Technology,

030024 Taiyuan;\* Shanxi Energy Coal-bed Methane Investment-holding Company Limited,030006 Taiyuan)

ABSTRACT：According to equilibrium principle of gas and liquid, equilibrium solubility of hydrogen in coal tar were measured using a high-pressure agitated autoclave over the temperature range from 323.2 K to 623.2 K and pressure range from 2 MPa to 10 MPa. The influence of temperature and pressures on equilibrium solubility of hydrogen in coal tar has been discussed. The changing current of hydrogen’s equilibrium solubility in different temperature and pressure are different in each coal tar. These data make up for the blank of the domestic data base about the field of coal tar oil, and provide the foundation data for the industrialization design of coal-tar oil catalyze hydrogenation in slurry reactor.

KEY WORDS：hydrogenation,coal tar,equilibrium solubility,temperature,pressure

焦炭颗粒增强沥青基炭复合材料的组织结构（57-60）

郭领军1)李贺军2)李克智2)郭琛3)

1) 博士、副教授；2) 博士、教授；3) 硕士生，西北工业大学凝固技术国家重点实验室，710072西安

摘要：利用模压半炭化成型工艺，在大气环境下制备了焦炭颗粒增强的沥青基炭复合材料，并借助光学显微镜和扫描电镜对其微观组织和断口形貌进行了观察.结果表明：根据焦炭颗粒增强沥青基炭复合材料的原料结构和制备工艺，利用光学显微镜和扫描电镜，可以清楚地辨别出沥青基炭复合材料中的增强体炭、基体炭和孔隙相三种基本相结构.而且黏结剂炭除了填充增强体炭中的孔隙外，还将每一个增强体颗粒包裹起来，从而在沥青基炭复合材料中形成了一个网络状的连续基体.

关键词：炭复合材料，焦炭颗粒，黏结剂沥青，微观结构

MICROSTRUCTURAL CHARACTERISTICS FOR COKE PARTICLES REINFORCED PITCHBASED CARBON COMPOSITES

Guo Lingjun,Li Hejun,Li Kezhi and Guo Chen

(State Key Laboratory of Solidification Processing,Northwestern Polytechnical University,710072 Xi’an)

ABSTRACT：Coke particles reinforced pitch-based carbon composites（CRPCCs） with high density and low cost were fabricated under atmospheric environment by an efficient mould pressing and semi-carbonization shaping technologies. And microstructures and fracture morphologies of the CRPCCs were observed under optical microscope and SEM. The results show that reinforcing carbon, matrix carbon and holes phase can be distinguished clearly under optical microscope and SEM according to raw material structures and fabrication processes of CRPCCs. And bonding carbon coats or wraps every reinforcing particle besides it fills the holes in the reinforcing particles; hence bonding carbon shapes a continuous network-like matrix in CRPCCs.

KEY WORDS：carbon composites，coke particles，coal-tar pitch，microstructure

焦炭高温热膨胀性能研究（61-64+84）

刘晓辉1)秦延军1)张琢2)吴信慈2)张睿3)凌立成4)杨俊和5)

1) 研究生，华东理工大学联合化学反应研究所国家重点实验室，200237上海；上海应用技术学院，200235上海；2) 高级工程师；5) 教授、博士生导师，上海应用技术学院，200235上海；3) 教授；4) 教授、博士生导师，华东理工大学联合化学反应研究所国家重点实验室，200237上海

摘要：以8种不同种类单种煤焦炭为原料，在氮气气氛下，测定了30 ℃～1 300 ℃范围内的焦炭热膨胀性能.依据焦炭自身的特性，提出了适合焦炭的热膨胀性能测定方法和热膨胀性能参数.根据测得的焦炭热膨胀性能参数，探索了焦炭热膨胀性能、焦炭热强度及煤变质程度之间的关系.研究发现，依据所提出的参数可以将焦炭热膨胀性能分为三个阶段，并且提出了焦炭收缩阶段为微裂纹产生的观点.在焦炭热膨胀对热强度影响方面，发现热膨胀性能参数与焦炭热强度成正比关系.在煤的变质程度对焦炭膨胀性能影响方面，发现最大线性膨胀*L*f与挥发分*V*daf成二次曲线关系，在*V*daf为30％左右*L*f取到最大值.最大线性膨胀*L*f与煤的黏结性成正比关系，但是会受到挥发分的影响.

关键词：焦炭，膨胀，热应力，反应性，反应后强度

STUDY ON THERMAL EXPANSION OF COKE

Liu Xiaohui,Qin Yanjun,Zhang Zhuo,Wu Xinci,Zhang Rui, Lin Licheng and Yang Junhe2

(1.Unilab,State Key Laboratory of Chemical Engineering,East China University of Science and Technology,200237 Shanghai;2.Department of Materials Science and Engineering,Shanghai Institute of Technology,200235 Shanghai)

ABSTRACT：The thermal expansion of 8 different coke was measured between 30 ℃1 300 ℃ in N2. Based on coke’s own characteristics, the parameter and measurement of coke expansion are given. Based on parameter measured, this paper explores the relationship between the expansion of coke and CSR, CRI, coal. Through research the result shows: 1) the thermal expansion of coke can be divided into three stages and pointing out the shrinkage stage means micro-cracks generating. 2) The parameters of thermal expansion are increasing with the increasing of coke heat strength. 3) The relation between *L*f and *V*daf is quadratic function. When *V*daf comes up to 30%, the *L*f can get maximum. *L*f is increasing with the increasing of Bond of coal, but which is affected by *V*daf.

KEY WORDS：coke, thermal expansion,shrinkage,CRI,CSR

过渡金属硫酸盐对煤粉燃烧的催化作用（65-67）

刘金刚1)程云飞1)王延庆2)

1) 助理工程师，湖北宜化化工股份有限公司，443007湖北宜昌；2） 讲师，中国矿业大学材料科学与工程学院，221116江苏徐州

摘要：将某型号无烟煤粉碎后浸渍过渡金属Cu和Co的硫酸盐溶液，经过烘干、焙烧及研磨处理，研究不同过渡金属硫酸盐催化剂对煤的燃烧性能的影响.采用燃点测定仪测其着火点，X射线衍射仪物相分析.结果表明，过渡金属硫酸盐能改变煤粉的燃烧反应历程，加速煤粉燃烧反应速率，大幅度降低着火点.

关键词：过渡金属硫酸盐，催化机理，氧传递，着火点

CATALYSIS OF TRANSITION METAL SULFATE ON COMBUSTION BEHAVIOR OF COAL

Liu Jin'gang,Cheng Yunfei and Wang Yanqing\*

(Hubei Yihua Chemical Industry Company Limited, 443007 Yichang, Hubei; \* School of Materials Science and Engineering, China University of Mining and Technology, 221116 Xuzhou, Jiangsu)

ABSTRACT：One type of anthracite powder was dried, roasted and grinded after being dipped by transition metal Cu and Co sulfate solution with the purpose of the research of impact on combustion properties resulted by the different transition metal sulfate. The results got from ignition point detector and X-ray diffraction phase analysis,showed that the transition metal sulfate changed coal combustion process, speeded up the coal combustion rate, significantly reduced ignition point.

KEY WORDS：transition metal sulfate，catalysis mechanism，oxygen transmission，ignition temperature

含氧煤层气脱氧过程中硫化物的脱氧特性（68-71）

张艳1)张永发2)张国杰3)

1) 硕士生；2) 教授，博士生导师；3) 讲师，教育部和山西省煤科学与技术重点实验室，太原理工大学，030024太原

摘要：为了充分利用含氧煤层气，采用硫化物氧化法，利用热重和固定床反应器研究了含氧煤层气脱氧过程中温度、流速及催化剂等因素的影响.研究结果表明，在固定床上，硫化钠作为脱氧剂，低于500 ℃的条件下，可有效降低含氧煤层气中的氧含量.利用硫化钠脱氧的过程中，分子筛相对其他金属离子催化剂有明显的催化效果.整个脱氧反应过程受外扩散影响较大，小流量有利于提高反应转化率，但Na2S反应转化率总体偏低.

关键词：含氧煤层气，脱氧，硫化物，催化剂

DEOXYGENATION CHARACTERISTIC OF SULFIDE OXIDATION IN THE PROCESS OF OXYGEN-BEARING COAL MINE METHANE

Zhang Yan,Zhang Yongfa and Zhang Guojie

(Key Laboratory of Coal Science and Technology,Ministry of Education and Shanxi Province Taiyuan University of Technology,030024 Taiyuan)

ABSTRACT：In order to make use of the oxygen-bearing coal mine methane (CMM) effectively, sulfide oxidation is introduced, and the impact of reaction temperature, flow velocity, catalyst and other factors on the deoxygenation process is investigated using TG technology and fixed-bed reator. The results show that oxygen content is obviously reduced by using Na2S as deoxygenation reagent under the temperature of 500 ℃. In the whole reaction process, molecular sieves, compared with other metal ion zeolite catalysts,have significant catalytic efficiency. The process of reaction is deeply influenced by external diffusion, and small flow velocity is propitious to improve the reaction rate of conversion, but it’s still a little low for Na2S.

KEY WORDS：oxygen-bearing coal mine methane,deoxygenation,sulfide,catalyst

炭／炭复合材料石墨化度的XRD表征方法（72-74）

艾艳玲1）杨延清2）王小宪3）

1) 工程师；2） 教授、博士生导师；3） 博士生，西北工业大学材料学院，710072西安

摘要：研究了X射线衍射（XRD）法测定炭/炭复合材料石墨化度的原理和方法.实验结果表明：由于试样中含有不同石墨化度的组分，致使碳石墨的衍射线呈现明显的不对称，用不同方法所确定的峰位得到的石墨化度值差异很大，比较而言，通过拟合定位更接近材料真实情况，考虑了各组元的信息；另外，对C(002)峰进行多重峰分离处理，以各子峰的相对含量作权重，可以很明显地看出试样中不同石墨化度成分所占的比例，最终得到一个较为合理的石墨化度值.

关键词：XRD，C/C复合材料，石墨化度

MEASUREMENT OF GRAPHITIZATION DEGREE OF CARBON-CARBON COMPOSITES BY X-RAY DIFFRACTION

Ai Yanling,Yang Yanqing and Wang Xiaoxian

(Northwestern Polytechnical University, 710072 Xi’an)

ABSTRACT：The principle and measurement method for graphitization degree of carbon-carbon（C/C）composites by X-ray diffraction were investigated. The results show that there exist different graphitized components in C/C composite, and so the profiles of diffraction pattern are asymmetrical. Graphitization degree has more obvious differences among different methods of search peaks，and the common characterizes of the graphitization degree are only evaluated by the best graphitized component of all C/C components. Considering hard graphitized component, it is more suitable to fit profile of peaks. In addition, through multiple-peak separating, the separated peaks could be used to calculate graphitization degree directly. The integral intensity obtained from every single-peak could be calculated according to the relate content of every component, and it is very reasonable to investigate the true graphitization degree of C/C composite．

KEY WORDS：XRD,C/C composites,graphitization degree

LaF3对固体超强酸性质及催化萘齐聚反应的影响（75-79）

房永征1）金鸣林1）钱湛芬2）

1） 博士、教授，上海应用技术学院材料系，200233上海；2） 教授、博士生导师，安徽工业大学化工与环境学院，243002安徽马鞍山

摘要：研究了稀土化合物LaF3的引入对固体超强酸催化剂SO2-4/ZrO2性质的影响.用热台偏光显微镜及X射线衍射方法分析了固体超强酸在焙烧过程中形态结构变化及晶相转变过程.研究发现，LaF3引入对固体超强酸形态结构及晶相转变产生了影响.使用差示扫描量热（DSC）及热重（TG）技术分析了固体超强酸的热稳定性.引入LaF3提高了固体超强酸的结晶温度及催化剂中SO2-4分解温度.红外光谱分析表明，引入LaF3后固体超强酸更易于脱除其中所含的水分.同时考察了LaF3引入对固体超强酸酸强度、SO2-4含量及萘齐聚反应的影响.

关键词：固体超强酸，晶相转变，热稳定性，齐聚反应

EFFECT OF LaF3 INTRODUCTION ON PROPERTIES OF SOILD SUPERACID SO2-4/ZrO2 AND ITS APPLICATION TO NAPHTHALENE OLIGOMERIZATION

Fang Yongzheng,Jin Minglin and Qian Zhanfen\*

(Materials Engineering Department, Shanghai Institute of Technology, 200233 Shanghai; \* School of Chemistry and Chemical Engineering, Anhui University of Technology, 243002 Maanshan,Anhui)

ABSTRACT：The effect of LaF3 introduction on properties of solid superacid SO2-4/ZrO2 was studied in this paper. The crystal transformation and morphology of solid superacid SO2-4/ZrO2 and SO2-4/ZrO2-LaF3 were investigated with polarized microscope and XRD when they were calcinated. It was found that there was some influence of LaF3 introduction on crystal transformation and morphology of solid superacid. The thermal stability of solid super acid was determined by using DSC and TG technique. The crystal transforming temperature of ZrO2 and decomposing temperature of SO2-4 increased sharply due to LaF3 introduction. The IR analysis showed that water in solid super acid containing LaF3 was easy to removed. The effect of LaF3 introduction on acid strength, SO2-4 concentration and naphthalene oligomerization were also investigated in this paper.

KEY WORDS：solid superacid,crystal transformation,thermal stability,oligomerization

煤系高岭土吸附城市生活污水中磷的影响（80-84）

沈王庆1)王碧2)覃松3)

1) 讲师、硕士生；2) 教授；3) 副教授，内江师范学院化学与生命科学学院，641112四川内江

摘要：为了拓宽煤系高岭土的应用前景，利用正交实验考察了反应条件对煤系高岭土吸附城市生活污水中磷的影响，确定了各因素对煤系高岭土吸附城市生活污水中磷的影响顺序依次为：煤系高岭土的用量、搅拌速度、反应时间、反应温度、pH值和生活污水的相对浓度，得到了最佳的反应条件为煤系高岭土的用量为6 g，搅拌速度为45 r/min，反应时间120 min，反应温度35 ℃，生活污水pH为4，生活污水相对浓度为0.50.在此条件下煤系高岭土吸附城市生活污水中的磷含量达96.80%.

关键词：煤系高岭土，正交实验，污水，吸附

EFFECTS OF REACTIVE CONDITIONS ON PHOSPHORUS OF THE URBAN DOMESTIC SEWAGE ADSORBED BY COAL-SERIES KAOLINITE

Shen Wangqing,Wang Bi and Qin Song

(College of Chemistry and Life Science，Neijiang Normal University，641112 Neijiang，Sichuan)

ABSTRACT：There are abundant coal-series kaolinite in our country, but these resources have not been utilized reasonably. For widening applied prospect of the coalseries kaolinite, effects of reactive conditions on phosphorus of the urban domestic sewage absorbed by coal-series kaolinite were inspected in this article by the orthogonal experiment, and effect order of all factors were determined: the dosages of the coal-series kaolinite, the stir velocity, the reactive time, the reactive temperature, pH, relative thickness of the domestic sewage, in the same time, the first-rank reactive conditions were obtained: the factors were respective 6 g/mL, 45 r/min, 120 min, 35 ℃, 4, and 0.50. Under these conditions, the contents of the phosphorus in the urban domestic sewage absorbed by coal-series kaolinite could be up to 76.80%.

KEY WORDS：coal-series kaolinite,orthogonal experiment,sewage,absorption

基于煤气化的CO2零排放煤基能源系统研究进展（85-90）

唐志国1)李永玲2)唐超君2)邢献军3)林其钊4)

1) 博士生、讲师，中国科学技术大学热科学和能源工程系，230026，合肥；合肥工业大学机械与汽车工程学院，230009合肥；2) 硕士生；3) 教授级高级工程师；4) 教授、博士生导师，中国科学技术大学热科学和能源工程系，230026合肥

摘要：燃煤排放的CO2是温室效应的最大贡献者，煤基能源系统也就成为实现CO2零排放的重点研究对象.分析了国内外零排放煤基能源系统的研究进展，归纳了目前煤基能源系统实现CO2零排放的三种途径：基于IGCC系统的开拓研究，包括燃烧后分离与回收、燃烧前合成煤气处理与分离以及以IGCC为基础的煤基动力化工多联产系统；CO2接受体气化法为基础的煤基能源系统和化学链式煤气化煤基能源系统.

关键词：零排放，煤气化，IGCC，CO2接受体法气化，化学链式气化

PROGRESS OF RESEARCH ON COAL-BASED ENERGY SYSTEM WITH CO2 ZERO EMISSION BASED ON COAL GASIFICATION

Tang Zhiguo,Li Yongling，Tang Chaojun，Xing Xianjun and Lin Qizhao1

(1.Department of Thermal Science and Energy Engineering,University of Science and Technology of China,230009 Hefei;2.School of Mechanical and Automobile Engineering,Hefei University of Technology,230026 Hefei)

ABSTRACT：Greenhouse effect mostly results from CO2 emission by coal combustion, so coal-based energy system is the main fields to realize near zero emissions. The international situation of coal-based energy systems with near zero emissions currently was analyzed, and concluded that there are three approaches to realize CO2 near zero emission of coal-based energy systems: exploit study of IGCC, including recovery and separation after combustion, disposal and recovery of synthesis gas before combustion, and coal-based poly-generation system for power and chemical products based on IGCC; coal-based energy system based on CO2 acceptor gasification and that on chemical-looping gasification.

KEY WORDS：zero emissions,coal gasification,IGCC,CO2 acceptor gasification,chemical-looping gasification

V2O5-WO3/TiO2 SCR催化剂的失活机理及分析（91-96）

云端1)宋蔷2)姚强3)

1) 硕士生；2) 博士、副研究员；3) 博士、教授，清华大学热能工程系，热科学与动力工程教育部重点实验室，北京100084

摘要：催化剂是SCR烟气脱硝技术的核心，减缓催化剂的失活速率，延长催化剂的寿命对于降低SCR系统的运行成本有着非常重要的意义.描述了国内外文献中涉及的SCR催化剂的失活现象，列举了导致催化剂失活的各项因素，比较了碱金属、碱土金属、As和P及HCl等物质的影响规律及因素，并在此基础上总结了各类文献中提到的中毒机理：碱金属通过减少Bronsted酸性位的数量和削弱Bronsted酸性位的酸性导致催化剂中毒，碱土金属则能够在催化剂表面沉积进而造成孔结构的堵塞，催化剂的砷中毒是由气态的砷的化合物不断聚积，堵塞进入催化剂活性位的通道引起的，而磷对于催化剂的影响体现在其能够减小活性位的数量上.针对特定的失活机理，可以通过优化催化剂的特性来减缓催化剂的失活速率.

关键词：SCR，催化剂，失活

MECHANISM AND ANALYSIS OF SCR CATALYST DEACTIVATION

Yun Duan，Song Qiang and Yao Qiang

(Key Laboratory for Thermal Science and Power Engineering，Ministry of Education of China,Department of Thermal Engineering,Tsinghua University,100084 Beijing)

ABSTRACT：Catalyst is the core of SCR de-NO*x* technology, to decrease the deactivation rate and prolong catalyst life has significant meanings on decreasing the operation cost of SCR system. This paper has described the phenomenon of catalyst deactivation, given all the influence factors of deactivation, specialized effects of alkaline metal, alkalineearth metal, As, P, Pb and HCl on SCR catalyst, and based on the effects, deactivation mechanism is discussed. The conclusions are that alkaline metal could decrease the quantity of Bronsted acid sites and change surface acidity of Bronsted active sites, alkaline-earth metal could block the pore structure of the catalyst, deactivation of arsenic is caused by accumulation of gaseous arsenic compounds, and phosphorus has obvious effects on catalyst active sites. Aimed at specific deactivation mechanisms, we can optimize catalyst performance to decrease the deactivation rate.

KEY WORDS：SCR,catalyst,deactivation

氧射频等离子体中洋葱状富勒烯的原位修饰（1-4）

郭明聪1)杨永珍2)任文芳1)刘旭光3)许并社4)

1) 硕士生；3) 教授、博士生导师，新材料界面科学与工程教育部重点实验室，太原理工大学；太原理工大学化学化工学院；2) 讲师；4) 教授、博士生导师，太原理工大学材料科学与工程学院，030024太原

摘要：利用射频等离子体，在淮南气煤中加入二茂铁制备洋葱状富勒烯（OLFs），然后加入不同体积分数的氧气对OLFs进行表面氧化修饰.生成的产物用场发射扫描电子显微镜、高分辨透射电子显微镜和红外光谱进行分析，结果表明，由淮南煤和二茂铁在射频等离子体条件下可生成内包铁纳米颗粒的OLFs；经含氧等离子体修饰后，OLFs表面被氧化，当氧气体积分数为3%和4%时，OLFs的表面引入了新的羟基和羧基官能团，且氧气体积分数为4%时引入的官能团最多.简单分析了其生成机理.

关键词：洋葱状富勒烯，射频等离子体，原位修饰

IN-SITU MODIFICATION OF ONION-LIKE FULLERENES USING OXYGEN PLASMA

Guo Mingcong，Yang Yongzhen，Ren Wenfang，Liu Xuguang and Xu Bingshe\*

(Key Laboratory of Interface Science and Engineering in Advanced Materials, Ministry of Education, Taiyuan University of Technology; College of Chemistry and Chemical Engineering, Taiyuan University of Technology; \* College of Materials Science and Engineering, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：Onion-like fullerenes (OLFs) were prepared in radio frequency plasma (Ar atmosphere) from Huainan coal with ferrocene as catalyst precursor, and then modified by in-situ oxidation through the introduction of oxygen into Ar plasma. The morphologies and structures of the products were characterized by field emission scanning electron microscopy, high resolution transmission electron microscopy and Fourier transform infrared spectroscopy. The results reveal that the OLFs formed in Ar plasma were oxidized when the content of oxygen in atmosphere was increased to a threshold value. OLFs(OH)n and OLFs(COOH)n were formed when the percent of volume of O2 was 3% or 4%, with more functional groups introduced when the percent of volume of O2 was 4%. The formation mechanisms of the modified products were also discussed.

KEY WORD：Sonion-like fullerenes,radio frequency plasma,in-situ modification

还原性气氛下煤中硫热解迁移规律（Ⅱ）氢气气氛与煤半焦中有机硫反应的动力学研究（5-9）

王素珍1)王利花1)赵炜2)

1) 硕士生；2) 副教授，煤科学与技术教育部和山西省重点实验室，太原理工大学，030024太原

摘要：在常压固定床反应器上考察了氢气分压对煤热解残焦中硫释出的影响，并通过差减微分法求取了反应的宏观动力学参数.研究结果表明：不同的氢气分压对反应具有一定的影响.氢气分压在0.02 MPa～0.1 MPa范围内，较高的氢气分压条件下，煤焦中有机硫与氢气的反应速率较快.通过动力学计算得出：不同的氢气分压下对应的反应级数、活化能和指前因子均不相同.实验结果表明，氢气与热解残焦中硫的作用是一个复杂的过程，反应过程可能受气体扩散控制.

关键词：加氢热解，脱硫，动力学，半焦

MIGRATION OF SULFUR IN COAL UNDER THE REDUCTIVE PYROLYSIS PART （Ⅱ） THE KINETICS STUDY ON THE REACTION OF HYDROGEN AND ORGANIC SULFUR IN COAL CHAR

Wang Suzhen，Wang Lihua and Zhao Wei

(Key Laboratory of Coal Science and Technology, Ministry of Education and Shanxi Province, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：A fixed-bed reactor has been used to study the effect of the hydrogen partial pressure on the removing of sulfur in char. The kinetic parameters were calculated used differential method and the results shows that the hydrogen partial pressure has the effect on the reaction of hydrogen and organic sulfur in coal char. Under the hydrogen partial pressure from 0.02 MPa to 0.1 MPa, the higher hydrogen partial pressure lead the faster reaction rate of hydrogen and organic sulfur in char. Calculation results also shows that under the different hydrogen partial pressures corresponded the different reaction order and the activation energy, so the experimental results indicate that the reaction of hydrogen and organic sulfur in char is a complex process, and the reaction is controlled by the diffusion of hydrogen from gas flow to particle surface of coalchar.

KEY WORDS：hydropyrolysis,desulfurization,kinetics,char

煤炭地下气化过程中半焦孔隙结构的变化规律（10-13）

李文军1)罗娟娟2) 梁新星3)梁杰4)王伟5)

1) 博士生；2) 硕士生，中国矿业大学，100083北京；3) 工程师，新奥气化采煤有限公司，065001河北廊坊；4) 教授、博士生导师，新汶矿业集团有限责任公司，271233山东泰安；5) 工程师，中石化胜利油田东辛采油厂，257049山东东营

摘要：在煤炭地下气化过程中，热解反应生成的半焦孔隙结构性质是影响气化过程的重要因素.对大雁褐煤、协庄烟煤、昔阳无烟煤及其热解半焦的比表面积、孔容积和孔径进行了测定,总结出了不同煤种、不同热解温度和不同热解气氛下半焦孔隙结构变化的规律.结果表明，半焦的表面结构特性受热解温度和热解气氛双方面的影响，改变热解终温或气氛，孔径分布特征变化幅度不大.

关键词：煤炭地下气化，半焦，比表面积，孔容积

RULE OF POROUS STRUCTURE OF SEMI-COKE IN THE UNDERGROUND COAL GASIFICATION

Li Wenjun，Luo Juanjuan，Liang Xinxing，Liang Jie and Wang Wei\*\*\*

(China University of Mining and Technology, 100083 Beijing; \* Xin'ao CGM Investment Company Limited, 065001 Langfang, Hebei; \*\* Xinwen Coal Mining Group Corporation Limited, 271233 Taian, Shandong; \*\*\* Dongxin Oil Recovery Plant, SINOPEC Shengli Oil Field Company, 257049 Dongying, Shandong)

ABSTRACT：In the process of underground coal gasification, the pore structures of semi-coke are the impact of the important factors. In this paper, the specific surface area, pore volume and aperture of Dayan brown coal, Xiezhuang bituminous coal and Xiyang anthracite were determined, the author have summed up the various laws of the pore structures of semi-coke at various temperatures and in the reactive atmosphere. The results showed that the pore structures of semi-coke were influenced by the temperature and the atmosphere. Changed the end of the temperature and the atmosphere, the aperture had not changed distinctly.

KEY WORDS：underground coal gasification,semicoke,specific surface area,pore volume

费托合成油品脱酸和含氧化合物过程模拟（14-17）

董立华1)郝栩2)曹立仁2)李永旺3)

1) 硕士生；2) 研究员、硕士生导师；3) 研究员、博士生导师，中国科学院山西煤炭化学研究所煤转化国家重点实验室，030001太原

摘要：提出了三种从费托合成油品中脱酸和含氧化合物工艺.借助Aspen Plus模拟软件对三种工艺进行了优化设计，并对三种工艺的优劣进行了比较.结果表明，萃取精馏法工艺比较复杂；共沸精馏法在工艺上比萃取精馏法简单，而且达到同样的分离目标所需的工艺条件温和，节约了成本；非均相共沸精馏与均相共沸精馏相比，所需的溶剂比较低，而且溶剂回收更容易实现，从而降低了成本，但是，非均相共沸精馏的缺点在于其溶剂回收率不如均相共沸精馏高.

关键词：费托合成，脱酸，脱含氧化合物，Aspen Plus模拟

PROCESS SIMULATION OF REMOVING ACIDS AND OXYGENATES FROM OIL OF FISCHER-TROPSCH SYNTHESIS

Dong LihuaHao XuCao Liren and Li Yongwang

(State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, Chinese Academy of Sciences, 030001 Taiyuan)

ABSTRACT：Three technologies of removing acids and oxygenates from oil of Fischer Tropsch synthesis were developed. The advantages and disadvantages of these technologies were compared by Aspen Plus simulation software. The results show that the azeotropic distillation process is easier than extractive distillation process. Because of its milder process parameters, the equipment cost is lower. Compared with homogeneous azetropic distillation, the ratio of solvent to feed is lower, and the solvent can be recovered easily. But the recovery ratio of solvent for hete

rogeneous azetropic distillation is lower than that for homogeneous azetropic distillation.

KEY WORDS：F-T synthesis,removing acids,removing oxygenates,Aspen Plus simulation

陕北半焦炭化过程能耗分析（18-21+32）

兰新哲1)杨勇2)宋永辉3)张秋利3)尚文智4)罗万江2)

1) 教授、博士生导师；2) 硕士生；3) 副教授，西安建筑科技大学贵金属工程研究所，陕西省冶金工程技术研究中心， 710055西安；4) 高级工程师，三江煤化工董事长，719300陕西榆林

摘要：主要对SJ型低温干馏炉生产半焦的过程进行了物料、热量衡算及过程能耗分析.结果表明，SJ型内热式低温干馏炉的半焦理论转化率为63.926%，焦油产率为6.079%，煤气产率为598 m3/t；炉体的热效率为88.90%，热工效率为84.08%，且炉体散热损失仅为4.82%，过程能耗在13.38%～17.92%之间，结合所用低变质煤的成分特征，可说明该过程属于低能耗、高产率、高附加值的洁净生产过程，适合该煤种的综合利用.

关键词：低温干馏炉，物料衡算，热量衡算，能耗

ENERGY CONSUMPTION ANALYSIS OF CARBONIZATION PROCESS OF SEMI-COKE IN NORTHERN SHAANXI

Lan XinzheYang YongSong YonghuiZhang QiuliShang Wenzhi\* and Luo Wanjiang

(Institute of Precious Metals Engineering of Xi'an University of Architecture and Technology, Shaanxi Province Metallurgical Engineering and Technology Research Centre, Xi'an 710055；\* Shaanxi Shenmu Sanjiang Coal Chemical Liability Company Limited, 719300 Yulin, Shaanxi)

ABSTRACT：It’s mainly analyzed that the material balance, heat balance calculation and energy consumption of the production process of semi-coke by SJ-low-temperature carbonization furnace. The results showed that, the theoretical semi-coke yield of SJ-low-heat oven is 63.926%, tar yield is 6.079%, gas yield is about 598 m3/t; with thermal efficiency of 88.90%, heat efficiency of 84.08%, and heat loss of furnace surface of 4.82%, and the energy consumption for process is between 13.38% and 17.92%. Compared the composition characteristics of the low metamorphic coals, it’s real a low energy consumption, high-yield, high value-added clean production process for the comprehensive utilization of this coal, which has great guiding significance to the sustainable development of the semicoke industry in Northern Shaanxi.

KEY WORDS：low-temperature carbonization furnace,material balance,heat balance calculation,energy consumption

神华煤加氢增塑产物工业性质的分析（22-24+70）

黄澎1)王东升2)杜铭华3)李克健3)

1) 博士；2) 硕士，煤炭科学研究总院北京煤化工研究分院，100013北京；3) 研究员，中国神华集团煤制油公司，100011北京

摘要：通过中度加氢，可以使无黏结性的神华煤转变为具有较强黏结性产物，反应具有良好的脱氧效果，并使产物的热值得到了提高.显微组分照片表明有中间相小球体的产生，结合产物THF不溶物焦油产率计算发现，中度加氢过程中生成了可以在热解过程中产生胶质体的新的活性组分，配煤实验表明，产物可以在炼焦工业得到应用.

关键词：神华煤，黏结性，中度加氢，配煤

PRODUCTS’ CHARACTERISTICS INVESTIGATION OF SHENHUA COAL HYDROGENATION TO INCREASE PLASTICITY

Huang PengWang DongshengDu Minghua\* and Li Kejian\*

(China Coal Reasearh Institute, Beijing Coal Chemistry Reasearch Institute, 100013 Beijing; \* Shenhua Group Corporation Limited, Coal Liquefaction Company, 100011 Beijing)

ABSTRACT：According to moderate hydrogenation Shenhua coal which is low rank and none caking ability can converse to product with high caking ability, what’s more, the oxygen in the raw coal was better removed, and the heat of the product was improved. Under the microscope, the mesophase small sphere could be seen, combine with the calculation of tar yield of the THF insoluble, it indicated that new active component which could converse to plastic mass was generated. The products were blended with coal and the result proved that it can be useful in the coking industry.

KEY WORDS：Shenhua coal,caking,moderate hydrogenated,coal blending

从洗油中分离和精制β-甲基萘的新工艺（25-27）

姚润生1)薛永强2)王志忠2)

1) 博士生；2) 教授、博士生导师，太原理工大学化学化工学院，030024太原

摘要：采用二次精馏-结晶法和精馏-共沸精馏法研究了从洗油中分离精制β-甲基萘.结果表明：1) 仅通过普通二次精馏的方法或二次精馏冷却结晶的方法很难从洗油中分离出较高纯度的β-甲基萘；2) 利用适当的共沸剂，采用精馏共沸精馏的方法，可以从洗油中分离精制出较高纯度的β-甲基萘；3) 提出的精馏共沸精馏法，具有工艺简单、产物纯度高、没有污染、共沸剂可以循环使用和成本低等特点.

关键词：煤焦油，洗油，β-甲基萘，精馏，共沸精馏，分离，精制

A NEW PROCESS OF SEPARATING AND REFINING β-METHYLNAPHTHALENE FROM GAS ABSORBER OIL

Yao RunshengXue Yongqiang and Wang Zhizhong

(Chemistry and Chemical Engineering College, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：β-methylnaphthalene is an important chemically raw material which exists mainly in gas absorber oil distillation cut of coal tar. A new process of separating and pefining β-methylnaphthalene from gas absorber oil was investigated by birectification-crystallization and rectification-azeotropic distillation in the paper. The results show that it is very difficult to obtain acenaphthene with high purity from gas absorber oil only by rectification time after time or by birectification-crystallization, and yet acenaphthene with high purity can be obtained from gas absorber oil easily by means of the process of combining rectification with azeotropic distillation, and that the process has many characteristics such as simple process, higher purity, no pollution, recycle use of azeotrope former, lower cost and so on.

KEY WORDS：coal tar,gas absorber oil,β-methylnaphthalene,rectification,azeotropic distillation,separation,fine purification

煤焦油蒸馏工序的能耗分析（28-32）

徐兵1)梁玉祥2)易美桂3)李春桃1)刘经星1)刘洪杰1)

1) 硕士生；2) 教授；3) 副教授，四川大学化学工程学院，610207成都

摘要：对某厂17.5万t/a焦油加工装置的蒸馏工序近两年生产的热量供应情况进行跟踪调查，利用夹点原理的热级联算对两年的数据进行分析，发现有0.289 6 GJ/t以上的热量可以被回收利用，根据该厂目前的情况，提出了使用热管换热器来回收低位能量，利用夹点技术来设计改造工程的换热网络，加强保温设备的安装，仅蒸馏工序，全年可产生110多万元的节能效益.

关键词：煤焦油，夹点技术，热管换热器，节能

ANALYSIS OF ENERGY SUPPLY OF COAL TAR DISTILLATION SECTION

Xu BingLiang YuxiangYi MeiguiLi ChuntaoLiu Jingxing and Liu Hongjie

(Chemical Engineering College of Sichuan University, 610207 Chengdu)

ABSTRACT：Used the heat-grade unite calculation of the pinch technology to analyse the dates of the two years' production heat supply of a factory with 175 000 t annual processing plant in tar distillation section, it was found that more than 0.289 6 GJ/t energy can be reused. According to the present situation, heat-pipe technology was advanced to recover the exhaust heat and low potential energy, the pinch technology to design the heat exchange network of the new project and stress on the installation of the heat preservation fixture, only the working procedures of distillation can produce the energy benefit of one million and onehundred thousand yuan annual.

KEY WORDS：coal tar, pinch technology, heat pipe exchanger, energy saving

内在矿物质对煤焦燃烧特性影响的实验研究（33-36）

李梅1)吕硕2)焦向炜3)

1) 讲师；2) 副教授，北方民族大学化学与化学工程学院；3) 讲师，北方民族大学科研处，750021银川

摘要：以宁夏地区两种烟煤和两种无烟煤为原料，用浮沉方法得到灰分在40％左右的煤粉，然后在马弗炉900 ℃制焦，再用HCl-HF酸制取脱灰焦.通过比较煤焦脱灰前后热重燃烧曲线的特征参数的变化和转化速率的快慢，分析了内在矿物质对煤焦燃烧特性的影响.结果表明，内在矿物对两种烟煤焦前期的着火有阻碍作用，对后期燃尽有一定促进作用；内在矿物质对两种无烟煤焦的着火有促进作用，对后期燃尽有阻碍作用.

关键词：宁夏煤，内在矿物质，燃烧特性，热分析

EXPERIMENTAL STUDY ON INFLUENCE OF INCLUDED MINERALS ON THE CHAR COMBUSTION CHARACTERISTICS

Li MeiLü Shuo and Jiao Xiangwei

(College of Chemistry and Chemical Engineering, North University of National, 750021 Yinchuan)

ABSTRACT：Four different metamorphic degree Ningxia coals were selected for this study. The ash content of coal about 40% obtained with float-sink method and prepared chars in muffle furnace at 900 ℃, then acid-washed by HCl-HF. The effect of included minerals on char combustion characteristics were analyzed by comparing burning curves and their characteristics indexes of the four chars and their demineralized chars. The result indicated that included minerals in the bituminous chars hampered ignition and accelerated burnout, but the included minerals in the anthracite chars accelerated ignition and hampered burnout.

KEY WORDS：Ningxia coals,included minerals,combustion characteristics,thermal analysis

镁基助熔剂对刘桥二矿混煤灰熔融特性的影响（37-40）

李继炳1)沈本贤2)赵基钢3)王基铭4)

1) 博士生、教授级高级工程师，华东理工大学化学工程联合国家重点实验室，200237上海；中国石油化工股份有限公司安庆分公司，246001安徽安庆；2) 教授、博士生导师；3) 讲师，华东理工大学化学工程联合国家重点实验室，200237上海；4) 中国工程院院士、教授、博士生导师，华东理工大学化学工程联合国家重点实验室，200237上海；中国石油化工集团公司，100029北京

摘要：研究了镁基助熔剂对皖北刘桥二矿混煤（AQ007）灰熔融特性的影响，并在添加镁基助熔剂前后分别对AQ007煤灰在不同热处理温度下的矿物组成进行了XRD和红外光谱分析.结果表明：导致AQ007煤灰熔点高的主要原因是1 000 ℃以上形成的莫来石引起的；加入镁基助熔剂可以降低AQ007煤灰的熔融温度；在高温下镁基助熔剂与煤灰中其他铝硅酸盐矿物发生反应，生成钙镁橄榄石、镁铝石、镁橄榄石和堇青石等低温共熔化合物，从而使煤灰熔点明显下降.

关键词：煤，灰熔融特性，镁基助熔剂

EFFECT OF MAGNESIUM-BASED FLUX ON THE MELTING CHARACTERISTICS OF COAL ASH FROM COAL BLENDS USING THE LIUQIAO No.2 COAL MINE

Li Jibing1，2Shen Benxian1Zhao Jigang1 and Wang Jiming1，3

(1.State Key Laboratory of Chemical Engineering, East China University of Science and Technology, 200237 Shanghai; 2.Anqing Branch Company, SINOPEC, 246001 Anqing, Anhui; 3.China Petrochemical Corporation, 100029 Beijing)

ABSTRACT：The effect of calcium-based flux on the melting characteristics of coal ash from coal blends using the Liuqiao No.2 Coal Mine in Wanbei (AQ007) was investigated. The change of the compositions of mineral under various temperatures before and after adding magnesium-based flux into AQ007 was employed by XRD and FT-IR. Results shows that mullite formed under over 1 000 ℃ has an effect on increasing the melting point of coal-ash, and this is the major reason which leads to high melting point of AQ007 coal-ash. The coal ash fusion point will be decreased by adding magnesium-based flux. The low temperature eutectic mixtures such as monticellite, ringwoodite and pyrope are easily formed between magnesium and compounds under high temperature, which will remarkably decrease coal ash fusion point.

KEY WORDS：coal,melting characteristic,magnesium-based flux

胜利煤与木屑共液化研究（41-44）

许德平1)邓庆德2)董敏2)王金凤2)王一卉2)王永刚1)

1) 教授；2) 硕士生，中国矿业大学化学与环境工程学院，100083北京

摘要：以胜利煤与木屑为原料，采用Fe2O3催化剂和S助催化剂，用高压反应釜，研究了配比、温度、反应时间及初始氢压等因素对两者共液化的影响.研究结果表明，木屑能促进煤的转化，当木屑与煤的质量比为1∶9时，油产率达到最大值；在实验条件范围内，转化率和油产率均随反应温度、反应时间和初始氢压的增大而增大.

关键词：胜利煤，木屑，共液化，油产率

STUDY ON CO-LIQUEFACTION OF SHENGLI COAL AND SAWDUST

Xu DepingDeng QingdeDong MinWang JinfengWang Yihui and Wang Yonggang

(School of Chemical and Enviromental Engineering, China University of Mining and Technology, 100083 Beijing)

ABSTRACT：Shengli coal and the sawdust were selected as the experiment materials. The impacts of the ratio, the reaction temperature, the reaction time and the initial cool hydrogen pressure on the co-liquefaction were investigated in the batch autoclave with the addition of the hydrogen donor solvent and the catalyst. The results indicate that the best weight ratio of sawdust∶Shengli coal is 1∶9 according to the oil yield, and the conversion and oil yield of the co-liquefaction increase with the temperature, reaction time and hydrogen pressure.

KEY WORDS：Shengli coal,sawdust,co-liquefaction,oil yield

焙烧温度对高温Mn-Fe-Ca脱硫剂脱硫性能的影响（45-49）

唐建春1)郭曙强2)潘晋波1)王安友1)丁伟中3)

1) 硕士生；2) 副教授；3) 教授、博士生导师，上海市现代冶金及材料制备重点实验室，上海大学，200072上海

摘要采用机械混合法制备了Mn-Fe-Ca脱硫剂，通过XRD，SEM和H2-TPR等手段研究了焙烧温度对脱硫剂的织构、物相和还原性能的影响，并在固定床反应器中考察了焙烧温度对脱硫剂脱硫性能的影响.结果表明，1 050 ℃下焙烧后的脱硫剂有较好的机械强度和脱硫性能，脱硫精度最高可达4×10-6，硫容量可达33.3%.焙烧温度的改变，可以改变脱硫剂的微观结构和反应活性.

关键词：锰基脱硫剂，高温煤气，焙烧温度，脱硫性能

EFFECT OF CALCINATION TEMPERATURE ON DESULFURIZATION PERFORMANCE OF Mn-Fe-Ca SORBENTS FOR HOT GOAL GAS DESULFURIZATION

Tang JianchunGuo ShuqiangPan JinboWang Anyou and Ding Weizhong

(Shanghai Key Laboratory of Modern Metallurgy and Materials Proceeing, Shanghai University, 200072 Shanghai)

ABSTRACT：Desulfurization of coal-gas at high temperature is the critical technology improving energy utilizing efficiency. Mn-Fe-Ca sorbents were prepared by mixing methods and effect of calcination temperature on texture, phase, reducibility of Mn-Fe-Ca sorbents was investigated by XRD, SEM and H2-TPR. The effect of calcination temperature on desulfurization performance of Mn-Fe-Ca sorbents were studied in fixed bed reactor. The experimental results show that H2S could be desulfured to 4×10-6 and sulfur content was 33.3% by the sorbents calcined at 1 050 ℃ which also had good mechanical intensity and desulfurization performance. The change of calcination temperature can effects the micro-structure and reactivity of the sorbents.

KEY WORDS：manganese-based sorbent,hot gas,calcination temperature,desulfurization performance

Ni-Zn-Fe复合氧化物脱硫剂的制备及成型研究（50-53）

李为1)黄戒介2)赵建涛3)张永奇3)王洋2)

1) 硕士生；2) 研究员；3) 副研究员，中国科学院山西煤炭化学研究所，030001太原

摘要：用溶胶凝胶自燃法制备了具有纳米特性的Ni-Zn-Fe复合氧化物脱硫剂，在300 ℃～500 ℃具有较高的脱硫活性.考察了不同煅烧温度下前驱体粉末的活性、不同高岭土添加量以及不同淀粉添加量对成型脱硫剂有效硫容的影响.结果表明，前驱体粉末的煅烧温度为500 ℃时硫容最高，高于500 ℃煅烧活性下降；高岭土加入脱硫剂中可以防止粉化，且在30%～40%添加量时脱硫剂有效硫容最高；脱硫剂中加入淀粉可以提高硫容，若添加量过高则会使脱硫剂严重粉化，5%的淀粉加入量为最好.

关键词：成型脱硫剂，溶胶凝胶法，煅烧温度，高岭土，淀粉

STUDY ON PREPARATION AND SHAPING OF Ni-Zn-Fe BASED OXIDE DESULFURIZER

Li WeiHuang JiejieZhao JiantaoZhang Yongqi and Wang Yang

(Institute of Coal Chemistry, Chinese Academy of Sciences, 030001 Taiyuan)

ABSTRACT：A kind of Ni-Zn-Fe based oxide desulfurizer of nano-properties was prepared by sol-gel self-combustion method, which has a higher reactivity at 300 ℃500 ℃. The activity of precursor powder at different calcination temperatures and the influence of kaolin and starch additional on the effective sulfur capacity of shaped desulfurizer were investigated. The results indicate that the precursor has a maximum sulfur capacity as the calcination temperature is 500 ℃. As kaolin addition amounts to 30%-40%, the effective sulfur capacity of shaped desulfurizer is the highest. 5% starch can function most effectively.

KEY WORDS：shaped desulfurizer,sol-gel method,calcination temperature,kaolin,starch

田庄选煤厂分选产品燃烧过程中汞的释放规律（54-57）

刘红缨1)冯立品2)樊俊杰3)高亚平4)

1) 副教授；2) 博士，中国矿业大学（北京）化学与环境工程学院，100083北京；3) 博士，上海理工大学动力工程学院，200093上海；4) 教授级高级工程师，田庄选煤厂，467000河南平顶山

摘要：通常煤中含有0.1×10-6~0.15×10-6的汞，在燃烧和气化过程中被排放到空气中.由于其高挥发性和毒性，特别是会对神经系统造成影响，所以成为人们关注的一种重要的重金属元素.对河南省田庄选煤厂的一种T煤进行了分选，根据分选产品的TGA和DTG曲线分析了煤样的燃烧特性，通过对不同温度段元素汞和氧化态汞的采集和测定，研究了不同分选产品的汞释放行为.结果表明，末原煤、末中煤和末精煤具有相似的燃烧和汞释放行为.烟气中元素汞的含量大于氧化态汞的含量.通过物理分选，煤样中部分无机汞可以被富集到重产品中.

关键词：燃烧，汞排放，选煤

EMISSION BEHAVIOR OF MERCURY FOR DIFFERENT PRODUCTIONS OF TIANZHUANG COAL PREPARATION PLANT DURING COMBUSTION

Liu HongyingFeng LipinFan Junjie\* and Gao Yaping\*\*

(School of Chemical and Environmental Engineering,China University of Mining and Thechology,100083 Beijing;\* College of Power Engineering,University of Shanghai for Science and Technology,200093 Shanghai;\*\* Tianzhuang Coal Preparation Plant,

467000 Pingdingshan, He'nan)

ABSTRACT：Mercury is contained in coal (about 0.1×10-6-0.15×10-6) and it is emitted to the atmosphere in the process of combustion and gasification. Mercury ( Hg ) is a major concern among hazardous heavy metals because of its high volatility and high toxicity, especially due to its neurological health impacts. A bituminous coal was processed at the Tianzhuang Coal Preparation Plant in He'nan Province. The objective of this study is to conduct detail studies that analyze the charateristic combustion of different products by TGA-DTG and the emission behavior of Hg by collecting and detecting the concentration of elementary mercury and the oxidized mercury at different range of temperature in smoke. The results indicateded that the fine raw coal, the fine middling coal and the fine cleaned coal have the similar rule of combustion and emission behavior of mercury. The content of elemental mercury is more than oxidized mercury in smoke. By physical separation method mercuric inorganic compound is enriched in middling coals.

KEY WORDS：combustion,mercury emission,coal preparation

利用燃烧指数分析生物质型煤的燃烧特性（58-61）

浮爱青1)谌伦建2)杨洁3)朱振忠4)

1) 工程师；3) 高级工程师；4) 教授级高级工程师，重庆地质矿产研究院，400042重庆；2) 教授，河南理工大学研究生处，454000河南焦作

摘要：分别选用焦作无烟煤、山西烟煤、陕西神木烟煤、平顶山烟煤四种原煤和其生物质型煤，通过不同煤种原煤和生物质型煤的热重分析实验，计算原煤和生物质型煤的着火、稳定燃烧和燃尽特性指数.分析得出：灰分和挥发分是影响生物质型煤燃烧特性及其燃烧特点的主要因素.

关键词：热重分析，生物质型煤，燃烧指数，燃烧特性

ANALYSIS OF THE COMBUSTIONS CHARACTERISTIC OF THE BIOMASS BRIQUETTES BY COMBUSTION PARAMETERS

Fu AiqingChen Lunjian\*Yang Jie and Zhu Zhenzhong

(Chongqing Institute of Geology and Mineral Resources,400042 Chongqing;\* Department of Graduate,He'nan Polytechnic University, 454000 Jiaozuo,He'nan)

ABSTRACT：In order to study on the ignition characteristic, combustibility and burnout characteristic of the biomass briquette, the combustion parameters was studied of the Jiaozuo anthracite, Shanxi bituminous, Shaanxi Shenmu bituminous, Pingdingshan bituminous and their briquettes by the thermo-gravimetric analysis, and it was found that the ash and volatility were main effects on combustions of the biomass briquettes and the biomass briquettes’ combustions characteristic.

KEY WORDS：thermo-gravimetric analysis,biomass briquette,combustion parameter,combustion characteristic

循环流化床锅炉燃烧固氟技术的应用研究（62-65）

武芳冰1)齐庆杰2)刘建忠3)曹欣玉3)周俊虎3)岑可法3)

1) 硕士生；2) 教授、博士生导师，辽宁工程技术大学资源与环境工程学院，123000阜新；3) 教授、博士生导师，能源洁净利用与环境工程教育部重点实验室，浙江大学热能工程研究所，310027杭州

摘要：循环流化床锅炉是一种高效低污染的先进燃烧设备，应用广泛.但由于其具有煤种适用性广和燃烧稳定的特点，广泛用于燃烧劣质煤、石煤和煤矸石，因此，二氧化硫和氟化物排放污染控制问题不容忽视.75 t/h和200 t/h循环流化床燃烧固氟技术应用表明，流化床燃烧燃烧温度十分适合石灰石燃烧固硫固氟的要求，在循环流化床锅炉燃烧时添加石灰石可显著降低锅炉出口烟气中二氧化硫和氟化物的排放浓度及排放量，具有同时脱出二氧化硫和氟化物的作用，具有显著的经济效益、环境效益和社会效益.

关键词：煤燃烧，循环流化床，氟化物排放，固氟固硫，工业应用

CIRCULATING FLUIDIZED BED COMBUSTION BOILER TECHNOLOGY-APPLICATION OF FLUORIDE

Wu FangbingQi QingjieLiu Jianzhong\*Cao Xinyu\*Zhou Junhu\* and Cen Kefa\*

(College of Resource and Environment Engineering, Liaoning Technical University, 123000 Fuxin, Liaoning; \* Institute of Thermal Engineering, National Key Lab of MOE

Clean Energy and Environment Engineering, Zhejiang University, 310027 Hangzhou)

ABSTRACT：Circulating fluidized bed combustion boiler is an efficient lowpollution combustion of the art equipment, wide range of applications. However, due to its wide applicability of coal, combustion stability characteristics of the widely used low quality coal combustion, and coal gangue, the fluoride emissions of sulfur dioxide pollution control and can not be ignored. 75 t/h and 200 t/h circulating fluidized bed combustion technology-fluoride: fluidized bed combustion temperature is very suitable for burning limestone burning sulfur-fluoride requirements in the circulating fluidized bed combustion boiler add limestone can significantly reduce the export of boiler smoke emission of sulfur dioxide and fluoride concentrations and emissions at the same time with fluoride and sulfur dioxide away from the limitations of the role, with significant economic, environmental and social benefits.

KEY WORDS：coal combustion,circulating fluidized bed,fluoride emissions,solid sulfur fluoride,industrial applications

物理-化学耦合活化法制煤基活性炭（66-70）

杨晓霞1)张亚婷2)杨伏生3)曲建林4)汪广恒2)周安宁5)

1) 硕士生；2) 讲师；3) 副教授；4) 高级工程师；5) 教授、博士生导师，西安科技大学化学与化工学院，710054西安

摘要：以神府3#煤为原料，氢氧化钾为化学活化剂，水蒸气为物理活化剂，探讨了物理化学耦合活化法制备煤基活性炭的工艺条件和耦合活化机理，考察了氢氧化钾与煤的浸渍比、活化温度及总活化时间对活性炭性能的影响.结果表明，当活化温度为700 ℃，碱渍比为0.5，活化时间为60 min时，活性炭的性能较好，碘吸附值为837 mg/g，亚甲基蓝吸附值为409 mg/g， BET比表面积943 m2/g，总孔容积达0.31 cm3/g，煤副产氢气约58 mmol/g.

关键词：活性炭，耦合活化，煤，活化机理

PREPARATION OF ACTIVATED CARBON FROM COAL BY PHYSICAL-CHEMICAL COUPLED ACTIVATION

Yang XiaoxiaZhang YatingYang FushengQu JianlinWang Guangheng and Zhou Anning

(College of Chemistry and Chemical Engineering, Xi'an University of Science and Technology, 710054 Xi'an)

ABSTRACT：Activated carbons were prepared by KOH activation combined with steam activation from Shenfu 3# coal. Coupling-activation mechanism was also discussed. Effects of ratio of KOH to the coal, heat treatment temperature, total activation time on activated carbons perfor-mance were studied. The results indicated that iodine number, methylene blue adsorption value, BET surface area and total pore volume of the activated carbon prepared at 700 ℃ for 60 min, with addition of KOH which ratio to the coal is 0.5, are 837 mg/g, 409 mg/g, 943 m2/g and 0.31 cm3/g respectively. Also, a large amount of hydrogen about 58 mmol for each gram of coal is released during the activation, up to more than 60% of total gaseous products.

KEY WORDS：activated carbon，coupling-activation，coal，activation mechanism

无烟煤的物理性质对其型煤抗压强度的影响（71-74）

顾小愚1)钟心2)

1) 硕士、高级工程师，中国神华能源股份有限公司煤炭销售中心，100010北京；2) 助理工程师，中国神华能源股份有限公司广州煤炭销售分公司，510610广州

摘要：以无烟粉煤为原料，采用有黏结剂冷压成型方法，制备了几种型煤产品，并对无烟粉煤的显微硬度、可磨性、真密度、视密度、孔隙率最高内在水分和孔结构等物理性质进行了分析测试，重点研究了无烟煤的物理性质对型煤抗压强度的影响.结果表明，随无烟煤的反射率、显微硬度、真密度和视密度等指标的增加与可磨性的降低，型煤抗压强度均显示出增加的趋势，这与高压无黏结剂成型时，型煤强度与显微硬度关系相反.无烟煤的物理性质体现了煤的变质程度，因此，型煤抗压强度也与无烟煤的变质程度密切相关.研究结果还表明，不同煤阶无烟煤的孔结构分布和最高内在水分不尽相同，都影响无烟煤被黏结剂黏结的程度，从而影响无烟煤型煤的抗压强度.

关键词：无烟煤，物理性质，型煤，抗压强度

PHYSICAL PROPERTIES OF ANTHRACITE AND THEIR EFFECT ON COMPRESSIVE STRENGTH OF BRIQUETTE

Gu Xiaoyu and Zhong Xin\*

(Coal Distribution Center of China Shenhua Energy Corporation, 100010 Beijing; \* Guangzhou Coal Sale Branch of China Shenhua Energy Corporation, 510610 Guangzhou)

ABSTRACT：Several briquettes were prepared using fine anthracite and binder with cold briquetting process. The physical properties of anthracites such as micro hardness, hardgrove grindability index, true relative density, apparent relative density, porosity, moisture holding capacity and pore structure and so on have been analyzed. The effects of physical properties of anthracites on compressive strength of briquette have also been researched. The results show that hardgrove grindability index decreases, compressive strength of briquette increases with increasing reflectance of coal maceral, microhardness, true relative density and apparent relative density of anthracite. The physical properties of anthracites reflect coal rank. Therefore, compressive strength of briquette relatives well also with coal rank. The results also show that pore volume distribution of anthracites with different ranks and moisture holding capacity are different from each other, which effects the caking degree between anthracite and binder, thus effects the compressive strength of briquette. The results above will have great significance on developing differrent briquettes using anthracites, improving quality of briquettes and selecting briquette binders.

KEY WORDS：anthracite,physical properties,briquette,compressive strength

选前低温热处理微粉煤磁性实验研究（75-78）

潘兰英1)郑环2)王慧香2)

1) 硕士、副教授；2) 本科生，河南理工大学材料科学与工程学院，454001河南焦作

摘要：对山东兖州矿业集团北宿煤样进行热处理实验研究，利用振动样品磁强计VSM，测定在不同加热温度条件下微粉煤的比磁化率.通过对粉磨并经过热处理的100目以下的微粉煤进行比磁化率测定，以及对煤质进行分析，发现加热温度及加热环境对粉煤比磁化率有着一定的影响，微粉煤热处理后煤质变化对其磁性的影响较为显著.实验结果为干法磁选脱硫选前磁性强化提供了有价值的实验研究理论依据.

关键词：微粉煤，振动样品磁强计，低温热处理，比磁化率

EXPERIMENTAL STUDY ON LOW TEMPERATURE HEAT TREATMENT TO FINE COAL ABOUT MAGNETISM INFLUENCE BEFORE SEPARATION

Pan LanyingZheng Huan and Wang Huixiang

(School of Material Science and Engineering, He'nan Polytechnic University, 454001 Jiaozuo, He'nan)

ABSTRACT：Sample of Shandong Yanzhou Coal Mining Group North places by heat treatment was for a pilot study. Using vibrating sample magnetometer VSM, the magnetic susceptibility of micro-pulverized coal was measured at different heating temperature conditions. Through trial and after grinding heat treatment of 100 mesh of the following micro-pulverized coal than for susceptibility determination, as well as coal quality analysis, it was found that the pilot heating temperature and heating coal on the environment than a certain magnetic susceptibility, micro-pulverized coal heat treatment after the coal quality change its magnetic effects are more significant. The result would provide the basis of studying the dry magnetic separation which will be used in desulfurization from fine coal.

KEY WORDS：fine coal,vibration sample magnetometer,low temperature heat treatment,quality magnetic susceptibility

粉煤灰提取硫酸铝的残渣制备4A分子筛（79-82）

白光辉1)徐鹏2)滕玮2)王香港2)邢远清3)

1) 副教授；2) 硕士生；3) 讲师，西安建筑科技大学理学院，710055西安

摘要：利用粉煤灰酸法提取硫酸铝的残渣为原料，采用固相合成法进行4A分子筛的合成.并对其制备工艺条件和产品性能进行了实验研究，得到相应的较佳工艺条件为：粉煤灰酸渣∶氢氧化铝∶氢氧化钠=10∶4∶15；焙烧温度800 ℃～860 ℃，焙烧时间2 h～3 h；凝胶形成温度为55 ℃，时间2 h；晶化温度90 ℃～95 ℃，时间4 h～6 h.并对产品进行了XRD，SEM及IR等结构表征，与标准4A分子筛进行比较，结果显示所合成的产品为4A分子筛.

关键词：4A分子筛，粉煤灰，固相反应，XRD，SEM

PREPARATION 4A-MOLECULAR SIEVE WITH SULFATE RESIDUE FROM FLY ASH EXTRACTION

OF ALUMINUM

Bai GuanghuiXu PengTeng WeiWang Xianggang and Xing Yuanqing

(School of Science, Xi'an University of Architecture and Technology, 710055 Xi'an)

ABSTRACT：The paper studies the process of preparation of 4A-molecular sieve with sulfate residue as raw material from fly ash extraction of aluminum, using solid-phase synthesis method to compose 4A-molecular sieve. The paper also studies the better corresponding conditions of preparation and performance is fly ash acid residue∶aluminum hydroxide∶sodium hydroxide=10∶4∶15; baking temperature is 800 ℃-860 ℃, baking time 2 h-3 h; gel formation temperature is 55 ℃, time 2 h; crystallization temperature is 90 ℃-95 ℃, time 4 h to 6 h. The products structural characterization tested by XRD, SEM, IR and so on. Comparison with standard 4A-molecular sieve, the results showed that the synthetic product is the 4Azeolite.

KEY WORDS：4A-molecular sieve,coal fly ash,solid-state reaction,XRD,SEM

水热一步法合成矸石基吸附剂的研究（83-85+89）

秦华1)袁丽艳2)

1) 教授、硕士生导师；2) 硕士生，黑龙江科技学院资源与环境工程学院，150027哈尔滨

摘要：以煤矿的废弃物煤矸石为原料，研究了368 K~400 K温度范围内，煤矸石在水热体系中自转变合成了纯度和结晶度均较高的矸石基吸附剂的过程，并对其吸附性能作了初步探讨.用氮吸附静态容量法，测得该矸石基吸附剂的氮吸附等温线、比表面和孔分布曲线.通过矸石基吸附剂对苯酚的吸附实验，给出矸石基吸附剂对它的吸附等温线. 并指出合理的吸附温度、大的比表面和适当的膜化工艺对提高矸石基吸附剂的吸附量都是有效的.

关键词：矸石基吸附剂，吸附，吸附等温线，煤矸石，水热合成

STUDY ON GANGUETYPE ADSORBENT BY SELF-TRANSFORMATION OF GANGUE IN A HYDROTHERMAL PHASE

Qin Hua and Yuan Liyan

(Institute of Resource and Environment Engineerring Heilongjiang Institute of Science and Technology, 150027 Harbing)

ABSTRACT：The study that porous glass beads were synthesized using the gangue was used as raw in this experiment to study the process that the zeolite-based adsorbent with high crystallinity and purity was synthesized by self-transformation of gangue in vapor phase of ethylamine and water at a range of 368 K-400 K and the preliminary study on its adsorption feature was made. The adsorption properties of the zeolite-based adsorbent were characterized by adsorption isotherm, specific surface area and pore distribution with the help of N2 adsorption. The zeolite-based adsorbent was investigated with XRD and small-opening consideration and so on. And the adsorption isotherm of whom to phenol was obtained. Results indicated that the zeolitebased adsorbent synthesized from the transformation process was gray and had better adsorption. The paper pointed out that the proper adsorbing temperature and larger specific surface area were effective means to increase the adsorption of the zeolite-based adsorbent.

KEY WORDS：gangue-based adsorbent,adsorption,adsorption isotherm,gangue,hydrothermal treatment

聚丙烯腈基炭纳米球的制备（86-89）

杨光智1)杨俊和2)刘洋3)贾润萍4)徐日升3)王霞5)凌立成6)

1) 博士生，华东理工大学化学工程联合反应国家重点实验室，200237上海；上海理工大学材料学院，200093上海；2) 教授，上海理工大学材料学院，200093上海；3) 硕士生；6) 教授，华东理工大学化学工程联合反应国家重点实验室，200237上海；4) 副教授；5) 教授，上海应用技术学院材料工程系，200235上海

摘要：采用低浓度水相分散聚合的方法合成了粒径在230 nm~250 nm的聚丙烯腈球，对其依次经过冷冻干燥、氧化及炭化工艺，用扫描电镜对炭化后的样品形貌进行了观察.结果表明，聚丙烯腈球炭化后转化为粒径在170 nm~190 nm之间的炭纳米球.炭纳米球经1 500 ℃，2 300 ℃及2 800 ℃的高温处理后，X射线衍射仪分析表明，在2 300 ℃处理温度以上可以得到石墨化度明显增加的炭纳米球.

关键词：聚丙烯腈，炭纳米球，热处理

PREPARATION OF POLYACRYLONITRILE-BASED CARBON NANOSPHERES

Yang Guangzhi1，2Yang Junhe2Liu Yang1Jia Runping3 Xu Risheng1Wang Xia3 and Ling Licheng1

(1.UNILAB, State Key Laboratory of Chemical Engineering, East China University of Science and Technology, 200237 Shanghai; 2.College of Materials Science and Engineering, University of Shanghai for Science and Technology, 200093 Shanghai; 3.Department of Materials Science and Engineering, Shanghai Institute of Technology, 200235 Shanghai)

ABSTRACT：Polyacrylonitrile(PAN) nanospheres latex with an average diameter size between 230 nm and 250 nm was synthesized by dispersion polymerization. After freeze drying, the PAN particles were stabilized in air at 250 ℃ and then carbonized in nitrogen at 1 000 ℃. Scanning electron microscopy study showed that all PAN nanospheres were carbonized to carbon nanospheres with the diameter range of 170 nm190 nm. The carbon nanospheres were also treated at 1 500 ℃, 2 300 ℃ and 2 800 ℃ respectively. X-ray diffraction study showed that above 2 300 ℃ the graphitization degree of the samples appeared a distinct increase.

KEY WORDS：polyacrylonitrile,carbon nanospheres,heat treatment

快速加热预处理提高原煤黏结性的研究（90-95）

黄定国1)吴玉敏2)马明杰1)

1) 博士、教授；2) 高级工程师，河南理工大学材料科学与工程学院，454001河南焦作

摘要：黏结性是评价炼焦用煤结焦性的一项重要指标.近年来通过动态黏弹性测定、针入度测定和高温in-situ NMR等煤黏结性评价方法，考察了加热速度对煤高温熔融特性的影响.研究发现，对原煤快速加热预处理至330 ℃～380 ℃，可以大大提高原煤黏结性.通过溶剂萃取等研究，认为快速加热预处理改善原煤黏结性的机理可能是减弱了煤大分子聚合强度，使其在高温熔融阶段可以产生更多的低分子物质.

关键词：煤，快速加热预处理，黏结性

EFFECT OF RAPID PREHEATING TREATMENT ON COAL THERMOPLASTICITY

Huang DingguoWu Yumin and Ma Mingjie

(School of Materials Science and Engineering, He'nan Polytechnic University, 454001 Jiaozuo, He'nan)

ABSTRACT：Thermoplascity is an important index to evaluate the caking properties of coal. In recent years, the effect of heating rate on coal fusibility to higher temperature was studied using several evaluation method, such as dynamic viscoelasticity, needle penetrometry and high temperature in-situ NMR imaging. It was found that the thermoplascity of coals was enhanced when the coals are rapidly preheated to 330 ℃-380 ℃. By the studies such as solvent extraction, it was speculated that aggreagated structure of coal can been weakened by rapid preheating and produce more low molecular weight substances when the slow heating rate was applied through the following thermoplastic stages.

KEY WORDS：coal,rapid preheating,thermoplascity

西部煤的热解特性及动力学研究（1-5）

王俊宏1)常丽萍2)谢克昌3)

1) 博士生；2) 教授、博士生导师；3) 中国工程院院士、教授、博士生导师，太原理工大学煤科学与技术教育部和山西省重点实验室，030024太原

摘要：采用热重和红外分析法从升温速率与样品粒径的相关性等方面对平朔煤和神东煤的热解特性进行研究，并从动力学上进行分析.结果表明，随升温速率增大，煤样热解反应的初始温度、终止温度以及最大失重速率对应的温度都逐渐升高，但对粒径较小的煤样来说，这些特性温度增加的幅度较大，而最大失重率没有表现出一定的规律性；煤样粒径对热解也有一些影响，但最大失重速率与样品粒径的关系不大.随升温速率增大，热解活化能和频率因子呈现出先增大后减小的趋势.

关键词：热重技术，红外分析，西部煤，热解，动力学

STUDY ON THE PYROLYSIS AND KINETICS OF COAL OF WESTERN CHINA

Wang JunhongChang Liping and Xie Kechang

(Key Laboratory of Coal Science and Technology, Ministry of Education and Shanxi Province, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：The pyrolysis characteristics of Pingshuo coal and Shendong coal were studied in detail from the relativity of heating rate and coal particle size and kinetics aspects by means of TG-DTG and FTIR technique. The results show with heating rate increasing the reaction characteristic temperature of coal pyrolysis, such as the initiative, terminative and maximum rate temperature increase gradually, and yet, the final weight loss percent does not indicate definite rule. The change trend of characteristic temperature is more obvious for the coal samples with small particle size than that for big particle size samples, but the biggest weight loss rate has nearly nothing to do with the sample sizes. As pyrolysis rate increase the activation energy and frequency factor increase firstly and then decrease.

KEY WORDS：TG-DTG technique, FTIR analysis, coal of Western China, pyrolysis, kinetics

义马煤焦CO2气化反应性研究（6-8）

谷小虎1)曹敏2)王兰甫3)张爱民3)

1) 硕士生，河南理工大学材料科学与工程学院，454000河南焦作；义马煤业集团股份有限公司，472300河南义马；2) 副教授，河南理工大学材料科学与工程学院，454000河南焦作；博士后，义马煤业集团股份有限公司博士后工作站，472300河南义马；3) 高级工程师，义马煤业集团股份有限公司，472300河南义马

摘要：运用等温热重技术，以CO2为气化剂，在常压和1 000 ℃～1 300 ℃温度范围内，考察了义马煤焦的气化反应性.结果表明，随着气化温度的提高，义马煤焦的反应性和反应速度呈现出增加的趋势，但在灰熔融温度附近出现不同的情况.碳还原率为50%时，1 000 ℃～1 100 ℃和1 100 ℃～1 300 ℃的气化反应活化能分别为140.97 kJ/mol与20.84 kJ/mol.

关键词：义马煤焦，等温热重分析，气化反应性

CO2 GASIFICATION REACTIVITY OF YIMA COAL CHAR AT ELEVATED TEMPERATURE

Gu Xiaohu1，2Cao Min1，2Wang Lanfu1 and Zhang Aimin1

(1.Yima Coal Industry Group, 472300 Yima, He′nan;2.Department of Material Science and Technology, He′nan Polytechnic University, 454000 Jiaozuo, He′nan)

ABSTRACT：The CO2 gasification reactivity of Yima coal char were investigated by an isothermal thermo-gravimetric analysis at ambient pressure and at temperatures from 1 000 ℃ to 1 400 ℃. The results showed that general gasification reactivity and reaction of chars increased with gasification temperature, but some different phenomenon appeared near coal ash fusion point. When conversion was 50%, the average apparent activation energies of chars respectively were 224.03 kJ/mol and 31.47 kJ/mol at 1 000 ℃-1 100 ℃ and 1 100 ℃-1 300 ℃.

KEY WORDS：Yima coal char, isothermal thermo-gravimetric analysis, gasification reactivity

生物质与煤在CO2气氛下共气化特性的初步研究（9-12）

张科达1)步学朋2)王鹏3)文芳4)梁大明2)董卫果3)杨忠仁3)

1) 硕士生；2) 研究员；3) 工程师；4) 高级工程师，煤炭科学研究总院北京煤化工研究分院，100013北京

摘要：利用热重分析仪研究了CO2气氛下的生物质半焦、煤焦及其混合焦的反应性，结果表明，在相同条件下，木屑半焦的气化反应性明显高于褐煤半焦.且参与反应的两种半焦，其反应性均随反应速率而提高，而温度也是影响其气化活性的重要因素.研究还发现，在温度高于1 173 K的条件下，混合物半焦的气化反应性较单一组分半焦的反应性差.

关键词：生物质，煤，二氧化碳，共气化

EXPERIMENTAL STUDY ON CO-GASIFICATION OF BIOMASS AND COAL IN AN ATMOSPHERE OF CO2

Zhang KedaBu XuepengWang PengWen FangLiang Daming Dong Weiguo and Yang Zhongren

(Beijing Research Institute of Coal Chemistry, China Coal Research Institute, 100013 Beijing)

ABSTRACT：The gasification of biomass coke, char and the mixture of biomass and coal in a thermogravimetric apparatus(TGA) was investigated．The results show that under the same conditions, the reactivity of sawdust char was significantly higher than that of lignite char. And the reactive of two char increased with the conversion rate, and the temperature also affect the gasification activity heavily. At the same time, the study also found that when the temperature is higher than 1 173 K, the mixture of semi-coke gasification reactivity is worse than that of single-component semi-coke.

KEY WORDS：biomass, coal, carbon dioxide, co-gasification

焦炉煤气直接氧化制合成气工艺条件优化（13-18）

赵辉1)陈倩倩2)陈宏刚3)张永发4)

1) 博士、讲师；2) 硕士生；3) 教授、博士，中国石油大学重质油国家重点实验室，257061山东东营；4) 教授、博士，太原理工大学煤科学与技术教育部和山西省重点实验室，030024太原

摘要：为进一步优化焦炉煤气非预混燃烧直接制备合成气的工艺参数，对焦炉煤气在贫氧条件下发生非预混燃烧的过程进行数值模拟研究，得到了反应器内温度及产物组成分布的详细分布状况.模拟结果表明，反应在靠近氧气入口的区域内发生.从数值模拟的结果来看，反应器壁温对反应结果有非常重要的影响：提高反应器壁温有利于提高合成气的选择性，但是煤气中甲烷的转化率有所降低.因此，反应器壁温是能够控制本工艺总体反应效果的重要参数，工艺优化过程中应该特别注意.

关键词：非预混燃烧，部分氧化，合成气

NUMERICAL SIMULATION AND OPTIMIZATION OF SYNGAS PRODUCTION BY PARTIAL OXIDATION OF COKE OVEN GAS IN NON-PREMIXED CONDITION

Zhao HuiChen QianqianChen Honggang and Zhang Yongfa\*

(State Key Laboratory of Heavy Oil Processing China University of Petroleum, 257061 Dongying, Shandong；\* Key Laboratory of Coal Science and Technology of Shanxi Province and Ministry of Education, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：Non-premixed combustion of coke oven gas under low oxygen condition was investigated through computational fluid dynamic (CFD) simulation coupled with radiation heat transfer. Temperature profile and product distribution in reactor were obtained from simulation. Calculated temperature profile indicates that oxygen react strongly with coke oven gas in region near the oxygen nozzle and the temperature in this region increase sharply. Noticeable influence of reactor wall temperature on product distribution could be found in simulation results. Higher selectivity of syngas could be archived at higher reactor wall temperature, while conversion rate of methane in coke oven gas was suppressed simultaneously. So reactor wall temperature should be treated as a key parameter and optimized well in this process.

KEY WORDS：non-premixed combustion, partial oxidation, syngas

焦炉煤气非催化部分氧化的数值模拟（19-22）

范江1)王淼2)王巧荣2)苗茂谦3)

1) 副教授；2) 硕士生，太原理工大学电气与动力工程学院；3) 教授、博士生导师，太原理工大学煤化工研究所，030024太原

摘要：用Fluent软件对焦炉煤气非催化部分氧化制取合成气的反应器内的温度场、浓度场和平衡气体组成进行了数值模拟.结果表明，氧气与焦炉煤气比是决定气化温度和出口合成气成分的关键.随着氧气与焦炉煤气比的增加，气化温度升高.在氧气与焦炉煤气质量比为0.14时,反应器出口的有效气体(H2+CO)含量达到最大值，焦炉煤气中的CH4几乎完全转化.在距反应器喷嘴0.05 m处反应器内达到了最高温度3 300 K，在0.1 m处H2和CO及CO2均达到平衡，CH4在该点降到最低点.

关键词：焦炉煤气，数值模拟，有效气体

NUMERICAL SIMULATION OF NON-CATALYTIC PARTIAL OXIDATION FOR COG

Fan JiangWang MiaoWang Qiaorong and Miao Maoqian\*

(Electrical and Power Engineering Institute, Taiyuan University of Technology;\* Research Institute of Chemical Engineering of Coal, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：The temperature field ,concentration field and equilibrium gas composition in reactor which is used to produce syngas by the method of non-catelytic partial oxidation for COG were simulated by the software Fluent. The results show that the oxygen to COG mass ratio is a key factor to deciding the gasification temperature and syngas composition at the export. By the increasing of the ratio, the gasification temperature improves also. When the ratio is 0.14, the content of effective gas (H2+CO) reaches to the maximum, the CH4 in COG almost transformed completely. The temperature in the reactor reaches to the maximum 3 000 K when it is 0.05 m from the nozzle of the reactor, the contents of H2, CO and CO2 become to be balanced while the distance increased to 0.1 m, and CH4 decreased to the minimum.

KEY WORDS：coke-oven gas, numerical simulation, effective gas

IGCC系统中气化炉特性研究（23-25+34）

王颖1)吴少华2)邱朋华3)李振中4)王阳5)庞克亮6)陈小利6)陈雷6)

1) 硕士生；2) 教授、博士生导师；3) 副教授、硕士生导师；4) 教授；5) 高级工程师；6) 工程师，哈尔滨工业大学燃烧工程研究所，150001哈尔滨

摘要：气化炉是IGCC系统中的关键部件之一，与其他部件紧密相关.基于整个IGCC系统研究气化炉特性，首先利用Thermoflex软件对某200 MW级IGCC示范工程建立系统模型，从系统的角度出发，对不同气化参数（水煤浆浓度、气化压力、氧煤比和碳转化率）的IGCC系统进行计算，并分析对气化结果的影响.结果表明，水煤浆浓度和氧煤比对气化结果的影响较大.

关键词：IGCC，气化炉，气化参数，气化结果，气化特性

STUDY ON GASIFIER CHARACTERISTICS IN IGCC SYSTEM

Wang YingWu ShaohuaQiu PenghuaLi ZhenzhongWang Yang Pang KeliangChen Xiaoli and Chen Lei

(Combustion Engineering Institute, Harbin University of Technology, 150001 Harbin)

ABSTRACT：The gasifier is one of the most important equipments in IGCC system, and it closely related with the others, so the study of the gasifier characteristics is based on the whole IGCC system. The system model of 200 MW IGCC demonstration project was established using Thermoflex software firstly, from the view of the system, the IGCC systems with different gasification parameters (coalwater slurry concentration, gasification pressure, O/C ratio and the carbon conversion) were calculated, the effects on the gasification result were analyzed. It shows that the coal-water slurry concentration and the O/C ratio have great effect on the gasification result.

KEY WORDS：IGCC, gasifier, gasification parameters, gasification result, gasifier characteristics

费托合成体系气体-高碳烷烃的相平衡计算（26-30）

曾志勇1)徐元源2)郝栩3)吴宝山3)李永旺2)

1) 博士生，中国科学院研究生院，100049北京；中国科学院山西煤炭化学研究所煤转化国家重点实验室，030001太原；2) 研究员；3) 副研究员，中国科学院山西煤炭化学研究所煤转化国家重点实验室，030001太原

摘要：选取Peng-Robinson（PR）方程与perturbed-chain SAFT（PC-SAFT）方程，采用单流体混合规则，重点考察了在费托合成工艺条件下的小分子气体(CO，H2，CO2，N2，CH4和C2H6)与高碳烷烃（C20，C28和C36）体系的气液相平衡.结果发现，在对不同碳数高碳烷烃溶剂采用单一交互作用参数时，PC-SAFT与PR方程计算的液相浓度与实验值的总平均偏差分别为1.39%与1.98%.而不考虑交互作用参数时，其误差分别为25.18%与16.195%.对各系统的交互作用参数进行了研究，结果表明，随温度和烷烃碳数的升高，PC-SAFT方程的交互作用参数缓慢升高，而PR方程的交互作用参数则下降，且幅度较大.因此，考虑交互作用参数时，PC-SAFT方程具有更好的计算精度和可外推性.

关键词：PR方程，PC-SAFT方程，气液相平衡，气体-烷烃体系

COMPARISON OF EQUATIONS OF STATE IN CALCULATING THE VAPOR-LIQUID EQUILIBRIA OF GAS-HEAVY ALKANE SYSTEMS

Zeng Zhiyong1，2Xu Yuanyuan1Hao Xu1Wu Baoshan1 and Li Yongwang1

(1.State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, the Chinese Academy of Sciences, 030001 Taiyuan;2.Graduate University of Chinese Academy of Sciences, 100049 Beijing)

ABSTRACT：This work has investigated the gas (including CO, H2, CO2, N2, CH4 and C2H6)-heavy alkane （C20，C28 and C36）systems in the condition of Fischer-Tropsch synthesis. Peng-Robinson (PR) equation of state (EOS) and perturbed-chain SAFT (PC-SAFT) EOS are used to calculate the vapor-liquid data with van der Walls one-fluid mixing rule. The results show that the total absolute average deviations are 1.39% and 1.98% with one optimized interaction parameter, 25.18% and 16.19% with no interaction parameter for PC-SAFT and PR EOS respectively. Moreover, the temperature and carbon number (CN) of solvent effect on the interaction parameter has been studied for the considered systems. With the temperature and CN increasing, the interaction parameters of PC-SAFT EOS increase mildly and these of PR EOS decrease distinctly. Therefore, PC-SAFT EOS with one interaction parameter is more accurate and predictive in estimating the vapor-liquid equilibrium of gas-heavy alkane systems.

KEY WORDS：Peng-Robinson EOS, perturbed-chain SAFT, vapor-liquid equilibrium, gasheavy alkane

采用NEDOL法计算煤液化油窄馏分样品的准确性（31-34）

吴艳1)史士东2)王伟1)

1) 硕士、助理工程师；2) 研究员、博士生导师，煤炭科学研究总院北京煤化工分院，100013北京

摘要：在对比大量样品和实验数据的基础上对煤直接液化油窄馏分样品的计算方法进行了研究和讨论，通过与冰点降低法分析结果相比，考察了NEDOL法计算煤直接液化油窄馏分样品分子量的准确性.结果表明，用NEDOL法计算四种煤直接液化油窄馏分样品的分子量时，47个样品的计算结果与冰点降低法测定结果十分接近，对神华油样品来说，两种方法的平均误差为-1.7；对胜利油样品来说，两种方法的平均误差为-1.3；对内蒙油样品来说，两种方法的平均误差为-3；对黑山油样品来说，两种方法的平均误差为-2.7.NEDOL法可直接用于计算液化油平均分子量.

关键词：煤液化油，窄馏分，NEDOL法，分子量，冰点降低法

PRECISION OF NEDOL METHOD FOR CALCULATING COAL LIQUEFACTION OIL NARROW BOILING RANGE FRACTIONS MOLECULAR WEIGHTS

Wu YanShi Shidong and Wang Wei

(China Coal Research Institute, Beijing Coal Chemistry Institute, 100013 Beijing)

ABSTRACT：In order to meet the needs of the rapid industrialization of direct coal liquefaction project, the calculation method for molecular weights of direct coal liquefaction oil narrow boiling range fractions were studied based on the comparison of a great deal of experimental solvent samples and their molecular weights. In comparison with the results of freezing point depress method, the precision for calculating the molecular weights of coal liquefaction oil by NE-DOL method was investigated. For Shenhua oil, average error is -1.7 between results of NEDOL method and freezing point depress method. For Shengli oil, average error is -1.3. For Neimeng oil, average error is -3. For Heishan oil, average error is -2.7. The calculation results by NEDOL method are close to that of freezing point depress method. NEDOL method can be used to calculate molecular weights of direct coal liquefaction oil narrow boiling range fractions.

KEY WORDS：coal liquefaction oil, narrow boiling range fraction, NEDOL method, molecular weights, freezing point depress method

煤的理化特性对其成浆性能的影响（35-39）

李艳昌1)周志强2)程军3)周俊虎4)刘建忠4)岑可法5)

1) 讲师；2) 副教授，辽宁工程技术大学安全科学与工程学院，123000辽宁阜新；3) 副教授；4) 教授；5) 中国工程院院士、教授，浙江大学能源清洁利用国家重点实验室，310027杭州

摘要：通过对21种不同变质程度的煤种进行成浆性能的实验，分析了煤种的不同理化特性对煤样的成浆性能的影响.结果表明，水煤浆的粒度堆积效率都能达到较好的堆积效率，各水煤浆样在低剪切速率条件下的表观黏度差别较大，最大为埔连塔煤11.71 s-1，4 235 mPa·s.各煤样的成浆浓度随其可磨性指数的增加而呈曲线上升趋势，随其内水分的升高而降低.各水煤浆样的稳定性都很好，都超过了60 d，半数达到了90 d.

关键词：水煤浆，理化特性，成浆性能

INFLUENCE OF THE COAL’S PHYSICAL CHEMISTRY PROPERTY TO ITS SLURRYING QUALITY

Li YanchangZhou ZhiqiangCheng Jun\*Zhou Junhu\*Liu Jianzhong\* and Cen Kefa\*

(College of Safty Sicence and Engineering, Liaoning Technical University, 123000 Fuxin, Liaoning；\* State Key Laboratory of Clean Energy Utilization, Zhejiang University, 310027 Hangzhou)

ABSTRACT：The slurrying experiments are done with 21 different metamorphose coals. The influence of coal’s physical chemistry property to its slurrying quality is analysed. The results show that all the CWS samples have high particle accumulation efficiency. The CWS’ apparent viscosity differ sharply from each other at 11.71 s-1. The Bulianta coal’s CWS has the highest apparent viscosity, which is 4 235 mPa·s. The slurrying concentration is high when the coal’s HGI is high. The slurrying concentration is low when the coal’s *M*ad is high. The CWS have good stability, all samples’ stability is over 60 d, and half of the samples’ stability is over 90 d.

KEY WORDS：CWS (coal water slurry), physical chemistry property, slurrying quality

离子液体-煤浆体黏度的研究（40-43+51）

曹敏1)谷小虎2)张爱芸3)马嫚4)

1) 博士后，义马煤业集团股份有限公司博士后工作站，472300河南义马；副教授，河南理工大学材料科学与工程学院，454000河南焦作；2) 硕士生，河南理工大学材料科学与工程学院，454000河南义马；义马煤业集团股份有限公司，472300河南义马；3) 教授；4) 硕士生，河南理工大学材料科学与工程学院，454000河南焦作

摘要：离子液体作为一种新型的工业溶剂，尚未应用到煤化工领域.以离子液体——[Emim]BF4作为煤直接液化的溶剂，选用神华煤样和胜利煤样，在常压低温条件下，测定离子液体煤浆体黏度，为离子液体中煤的液化作基础研究.结果表明，煤油比越小，煤浆体系初始黏度越低，且黏度随温度的升高而降低；在50 ℃～65 ℃之间煤浆黏度受溶胀的影响，发生明显的变化.

关键词：离子液体，煤，油煤浆，黏度

STUDY ON RHEOLOGICAL PROPERTIES ABOUT IONIC LIQUID AND COAL SLURRY

Cao Min1，2Gu Xiaohu1，2Zhang Aiyun2 and Ma Man2

(1.Yima Coal Industry Group, 472300 Yima, He′nan;2.He′nan Polytechnic University, 454000 Jiaozuo, He′nan)

ABSTRACT：Ionic liquid is a new kind of solvent, but it has not been applied to coal chemical industry. Ionic liquid was firstly used as coal-direct liquefaction solvent in this paper. Viscosity of Shenhua coal slurry and Shengli coal slurry was measured at atmospheric pressure. The results show that viscosity is lower with more solvent and temperature has an influence to it. When temperature increases, viscosity of coal slurry declined. Because of swelling viscosity has a special situation between 50 ℃ and 65 ℃.

KEY WORDS：ionic liquids, coal, coal slurry, viscosity

胜利褐煤在液化预反应中氧脱除的初步研究（44-47）

赵鹏1)刘立麟2)高占先3)史士东4)

1) 硕士、工程师；2) 工程师；4) 研究员、博士生导师，煤炭科学研究总院煤化工研究分院，100013北京；3) 工程师，鞍钢股份化工总厂，114000辽宁鞍山

摘要：采用X光电子能谱法（XPS）研究了我国内蒙胜利褐煤中有机氧的赋存形态，将其分为碳氧单键类、羰基基团和羧基基团三种类型，与元素分析法结合得到不同形态含氧官能团在胜利褐煤中的绝对含量，与化学分析法测试煤中含氧官能团进行比较.在容积为0.5 L震荡式高压釜中对内蒙胜利褐煤在液化预反应阶段氧的脱除进行了研究，实验所选温度为330 ℃，360 ℃，400 ℃和430 ℃，分别考察三种催化剂（MnO2，Fe2O3和MoO3）的脱氧效果，并与无催化剂的脱氧效果进行比较，结果表明，氢压1 MPa无催化剂在360 ℃～400 ℃的液化预反应条件下，脱氧率较高.

关键词：XPS，含氧官能团，褐煤，液化，脱氧

PRELIMINARY STUDY ON OXYGEN ELIMINATION IN SHENGLI LIGNITE DURING LIQUEFACTION PREREACTION

Zhao PengLiu LilinGao Zhanxian\* and Shi Shidong

(Beijing Coal Chemistry Research Institute, China Coal Research Institute, 100013 Beijing；\* Chemical General Factory of Anshan Iron and Steel Company Limited, 114000 Anshan, Liaoning)

ABSTRACT：The forms of organic oxygen in Shengli lignite are studied by XPS. Three kinds of oxygen functional groups are classified in the method: single-bond, carbonyl group and carboxyl group. The absolute content of different oxygen functional groups is obtained by XPS combined with ultimate analysis and compared with chemistry analysis. The elimination limit of CO and CO2 has been calculated during coal liquefaction prereaction. The elimination of oxygen functional group in Shengli lignite during preliquefaction is studied in 0.5 L shaking-style autoclave at the temperature range of 330 ℃, 360 ℃, 400 ℃ and 430 ℃. Deoxidization effect at the presence of three kinds of catalysts including MnO2, Fe2O3 and MoO3 is observed and compared with that of non-catalyst. The results show that higher oxygen elimination is obtained at H2 pressure 1 MPa, temperature range 360 ℃-400 ℃，non-catalysts.

KEY WORDS：XPS, oxygen functional group, lignite, liquefaction, oxygen elimination

中/低温煤焦油催化加氢制备清洁燃料油研究（48-51）

张晔1)赵亮富1)

1) 副研究员，中国科学院山西煤炭化学研究所，030001太原

摘要：以中/低温煤焦油460 ℃以下馏分为原料，在30 mL小试加氢反应装置上对其进行加氢改质，制备清洁燃料油.加氢反应过程中系统压力为8 MPa～15 MPa，反应温度为400 ℃～460 ℃，氢/油体积比为1 800～2 000，煤焦油原料全部转化，产品油平均体积收率大于106％，进一步分离后获得汽油馏分（≤170 ℃）和柴油馏分(>170 ℃)，其中汽油馏分和柴油馏分分别占总体积的22.75％和77.25％（该比例随不同煤焦油来源而不同），无任何尾油残留，且均达到国家标准中93#汽油和0#柴油规定的各项技术指标；此外，煤焦油和产品中硫含量的分析结果表明，产品油中硫的含量大大降低，完全可以达到清洁燃料油的标准.

关键词：煤焦油，催化加氢，清洁燃料油

STUDY ON HYDRO-CATALYSIS OF MIDDLE/LOW-TEMPERATURE COAL TAR TO CLEAN FUEL

Zhang Ye and Zhao Liangfu

(Institute of Coal Chemistry, Chinese Academy of Sciences, 030001 Taiyuan)

ABSTRACT：Clean fuel was prepared from the middle/low-temperature coal tar via hydro-catalysis route on a 30 mL hydrogenation reactor under the effect of series of catalysts. The pressure and temperature as well as H2/oil ratio were set as 8 MPa-15 MPa, 400 ℃-460 ℃, 1 800-2 000 respectively during the reaction. All of the coal tar was converted and the volume receive of clean oil product was higher than 106%. And then the product oil was separated as gasoline and diesel with the ratio as 22.75% and 77.25% respectively (the ratio is changeable with the different raw coal tar). There was no residual oil left during the hydrogenation process. The obtained gasoline and diesel was up to the grade of national standard. In addition, the analysis result of the sulfur content was greatly decreased compared to the raw material during the conversion process which could be used as clean fuel.

KEY WORDScoal tar, hydrocatalysis, clean fuel

炭化条件对针状焦结构的影响（52-54）

程兴磊1)王保成2)

1) 硕士；2) 教授，太原理工大学材料科学与工程学院，030024太原

摘要：以除去喹啉不溶物的中温煤沥青为原料，分别在不同的反应温度和保温时间下制备了中间相炭微球(MCMB)；在磁场条件下制备了有序结构针状焦；通过扫描电镜(SEM)考察了不同反应条件下中间相炭微球和针状焦的形貌，讨论了中间相形成影响因素对针状焦结构的影响.结果表明，中间相形成阶段的反应温度、保温时间和体系黏度对针状焦的结构和性能具有重要影响，磁场对针状焦的流线型结构有促进作用.

关键词：中间相炭微球(MCMB)，针状焦，结构，磁场

EFFECTS OF CARBONIZATION CONDITIONS ON THE STRUCTURE OF NEEDLE COKE

Cheng Xinglei and Wang Baocheng

(College of Material Science and Engineering, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：In this paper a series of mesophase carbon microbead(MCMB) were prepared from a coal tar pitch without quinoline insoluble at different temperature by varying the holding time. The needle coke was prepared from a coal tar pitch without quinoline insoluble under magnetic field. By analyzing morphologies of MCMB and needle coke with scanning electron microscope, the effect of mesophase formation factors on structure of needle coke were discussed.The results showed that the structure and properties of needle coke were determined by the temperature holding time as well as viscosity of forming mesophase. The magnetic field has a promoting effect for streamlined structure of needle coke.

KEY WORDS：mesocarbon microbead(MCMB), needle coke, structure, magnetic field

富氧气氛下煤粉燃烧及动力学特性的实验研究（55-59）

唐强1)王丽朋2)闫云飞3)

1) 副教授；2) 硕士生；3) 讲师，重庆大学动力工程学院，400030重庆

摘要：采用综合热分析仪研究了两种煤粉在三种不同粒径范围下氧浓度对其燃烧特性参数的影响，并计算得到各工况下的动力学参数.结果表明，随着氧浓度增加，燃烧DTG曲线向低温区移动，着火及燃尽温度降低，燃尽时间缩短，综合燃烧指数明显提高，燃烧特性得到改善，尤其对粒径较大的煤粉改善更为明显；煤粉燃烧反应低温段的反应活化能和频率因子比高温段低，反应级数较小；不同氧浓度下，煤粉燃烧活化能和频率因子间存在动力学补偿效应.

关键词：富氧燃烧，热重法，燃烧特性，动力学，补偿效应

STUDY ON COMBUSTION AND KINETIC CHARACTERI-STICS OF PULVERIZED COAL IN OXYGEN-ENRICHED ENVIRONMENTS

Tang QiangWang Lipeng and Yan Yunfei

(College of Power Engineering, Chongqing University, 400030 Chongqing)

ABSTRACT：Non-isothermal combustion experiments of two types of pulverized coal with three different particle size were conducted by synthesized thermogravimetry analyzer in different oxygen concentration. The changes of combustion characteristic parameters of pulverized coals in different atmospheres are analyzed and the kinetic parameters of every condition are calculated. The results show that DTG curves of coal combustion move to low temperature zones when O2 concentration increases. It indicates that both ignition and burnout temperature are lower, burnout time decreases, combustion characteristic index obviously increases, and combustion performance of pulverized coals are improved,especially for the larger particle size of pulverized coal. Activation energy, frequency factor and reaction order of low-temperature stage are lower than that of high-temperature stage. Kinetic compensation relationship exists between combustion activation energy and frequency factor in different atmospheres.

KEY WORDS：oxygen-enriched combustion, thermogravimetry, combustion characteristics, kinetics, compensation effect

荷电器内煤粉荷电颗粒运动轨迹仿真（60-64）

刘伟军1)陈拴柱2)张书华3)

1) 博士、教授；3) 博士、副教授，上海工程技术大学化工学院，201620上海；2) 硕士、助理工程师，北京航天万源煤化工工程技术公司，100176北京

摘要：从单个荷电颗粒的受力分析入手，建立了线筒型荷电器内适合FLUENT软件求解的单个煤粉颗粒运动轨迹的数学模型.模型涉及的方程包括：颗粒荷电方程、电场与电荷守恒方程、气体质量与动量守恒方程、颗粒质量与动量方程等.根据模型，利用FLUENT软件对荷电器中荷电颗粒的运动轨迹进行模拟，通过用户自定义函数-UDF编程引入电场力，最终得到不同颗粒粒径、荷电电压、射流流速下的运动轨迹仿真，并得出规律性结论.

关键词：煤粉，荷电，仿真，运动轨迹

MOTION TRAJECTORY SIMULATION OF A CHARGED PARTICLE OF PULVERIZED COAL IN THE CHARGING APPARATUS

Liu WeijunChen Shuanzhu\* and Zhang Shuhua

(Mechanical Engineering College, Shanghai University of Engineering Science, 201620 Shanghai;\* Beijing Wanyuan Chemical Engineering Technology Company Limited, 100176 Beijing)

ABSTRACT：According to the force operating on a charged particle, built a mathematical model for the particle’s trajectory in the line-cylinder charging apparatus. The model involves in particle charging equation, electric field and charge conservation equation, gas conservation equations of mass and momentum, particle mass and momentum equation. Loading electrostatic field force into the model by the compiled UDF (user-defined function) and using the discrete phase model of the FLUENT software for simulation, shows the trajectory regularity about a charging particle of pulverized coal on different pole positive voltage, mean sieving particle size and jet flow velocity, and summaries some regular conclusions.

KEY WORDS：pulverized coal, corona charge, simulation, motion trajectory

双通道低氮煤粉燃烧器飞灰碳形成机理的研究（65-67+77）

王启民1)张海2)吕俊复3)岳光溪3)

1) 副教授，沈阳工程学院动力工程系，110136沈阳；2) 副教授；3) 教授，清华大学能源工程系，100084北京

摘要：为克服燃煤发电过程排放的NO*x*对人体和环境的危害，低氮煤粉燃烧器得到广泛的使用.但如果低氮煤粉燃烧器利用不当，会造成飞灰碳的大幅增加.利用筛分法和烧失量法研究双通道低氮煤粉燃烧器飞灰碳的分布特性，利用压汞仪和XRD分析飞灰碳的失活程度，从而研究双通道低氮煤粉燃烧器飞灰碳升高的原因.结果表明，双通道低氮煤粉燃烧器飞灰碳为双峰分布，小粒径飞灰碳失活不明显，大粒径飞灰碳失活明显.分析原因后认为：小粒径煤粉颗粒在燃烧区域停留时间过短，没有完全燃烧；大粒径煤粉颗粒在高温乏氧区域停留时间过长导致的失活是双通道低氮煤粉燃烧器飞灰碳升高的主要原因.

关键词：双通道低氮煤粉燃烧器，飞灰碳，失活，真密度

INVESTIGATION OF DUAL CHANNEL LOW NOx PULVERIZED COAL COMBUSTOR FLY ASH CARBON FORMATION

Wang QiminZhang Hai\*Lu Junfu\* and Yue Guangxi\*

(Department of Power Engineering, Shenyang Institute of Engineering, 110136 Shenyang;\* Department of Thermal Engineering, Tsinghua University, 100084 Beijing)

ABSTRACT：In order to decreasing the pulverized coal thermal power plant NO*x* emission damage to human and environment, low NO*x* pulverized coal combustors are utilized widely. But if the low NO*x* pulverized coal combustors are operated incorrectly, the fly ash carbon will increase significantly. In the paper, the screen separation and loss of ignition are used to study the fly ash carbon distribution, mercury intrusion and X-ray diffraction are used to study the fly ash carbon inactivation, so as to analysis the reasons of the very high fly ash carbon in dual channel low NO*x* pulverized coal combustors. It is showed that the dual channel low NO*x* pulverized coal combustor fly ash carbon distribution has two pinks and the big particle size fly ash carbon inactivation is more significant than that of the small. The author believed that incomplete combustion due to short residence time in combustion zone of small pulverized coal particle and the inactivation due to long residence time in anaerobic and high temperature zone of big pulverized coal particle lead to the increasing of fly ash carbon in some dual channel low NOx pulverized coal combustors.

KEY WORDS：dual channel low NO*x* pulverized coal combustor, fly ash carbon, inactivation, skeleton density

煤的含硫率对煤中汞的分布特性影响模型研究（68-72）

高威1)刘清才2)鹿存房3)魏春梅3)

1) 博士生；2) 教授、博士生导师；3) 博士生，重庆大学材料科学与工程学院，400044重庆

摘要：通过对全国部分省市（地区）煤田煤样中总硫和汞含量的研究分析，以及对煤中硫与汞的赋存状态、不同成煤时期硫与汞的含量分布进行探究，发现高硫煤中的汞与硫化物关系密切，且与黄铁矿存在密切的伴生关系.结果表明，煤中汞的含量一般为100 ng/g～450 ng/g，平均含量220 ng/g.利用数学统计分析方法和数学软件等对煤样中的总硫与汞含量进行相关性模型研究，探索了煤中总硫与汞含量的数学模型，结果表明，在置信度为0.95条件下（*α*=0.05），煤样中的汞含量与含硫量存在很好的相关关系.

关键词：含硫率，汞含量，赋存状态，相关性

STUDY ON MODEL OF SULFUR CONTENTS ON THE MERCURY DISTRIBUTION CHARACTERISTIC IN COALS

Gao WeiLiu QingcaiLu Cunfang and Wei Chunmei

(College of Material Science and Engineering of Chongqing University, 400044 Chongqing)

ABSTRACT：Sulfur and mercury content in coal fields from some regions in China were analyzed. In addition, occurrence mode and the distribution of sulfur and mercury in coal were discussed, most likely occurrences modes of Hg in high-sulfur and high-Hg coals are in solid solution in pyrite. It is concluded that most Hg values in coal samples range from 100 ng/g to 450 ng/g, averaging 220 ng/g. Mathematical model about relation both total sulfur and mercury was gained by mathematical statistical method, the result showed that they had better dependency correlation in all coal samples at a 95% confidence.

KEY WORDS：sulfur contents, mercury contents, occurrence, correlation

低温热解强化煤粉磁选脱硫效果的实验研究（73-77）

王灿1)焦红光2)陈清如3)李沙1)路阳4)

1) 硕士生；2) 博士、副教授；3) 中国工程院院士、教授；4) 讲师，河南理工大学材料学院，454003河南焦作

摘要：采用自制热解装置对北宿煤进行热解，此装置与传统热解装置相比具有处理量大和操作简便等优势，能够与磁选实验相结合，热解温度400 ℃～700 ℃，氮气流量0.1 L/min，保温时间为30 min，主要研究热解温度对煤粉磁选脱硫效果的影响.结果表明：适当提高热解温度对磁选脱硫是十分有利的，且500 ℃时效果最佳，热解后半焦与原煤相比磁选脱硫率提高近40%；利用XRD分别对原煤、500 ℃半焦及半焦磁选后的精煤进行分析，发现半焦中有强磁性矿物磁黄铁矿（Fe1-*x*S）生成，精煤中已无黄铁矿，说明热解磁选脱硫技术能够有效脱除煤中无机硫.依据GB/T215-2003分析试样中硫的形态，发现煤中有机硫含量高且以噻吩硫形式存在，给实现北宿煤低温预处理磁选高效脱硫造成了困难.

关键词：热解，磁选，黄铁矿硫，脱硫率

EXPERIMENTAL STUDY ON LOW-TEMPERATURE PYROLYSIS FOR IMPROVING COAL DESULFURIZATION EFFECT OF MAGNETIC SEPARATION

Wang CanJiao HongguangChen QingruLi Sha and Lu Yang

(School of Material Science and Engineering, He′nan Polytechnic University, 454003 Jiaozuo, He′nan)

ABSTRACT：Beisu coal was pyrolyzed in a pyrolysis device, which was studied the desulfurization effect of magnetic separation under different pyrolysis temperatures at 400 ℃-700 ℃. The nitrogen flow was 0.1 L/min and the holding time was 30 min.Compared with the traditional pyrolysis devices, it has many advantages, such as large capacity, easy operation and can combine with the magnetic separation experiments. The experiment results showed that appropriately increasement of pyrolysis temperatures were favorable for the magnetic desulfurization rate and especially pyrite sulfur was reduced well at 500 ℃, compared untreated sample to raise nearly 40%. According to XRD analysis of the raw coal, 500 ℃ semi-coke, the refined coal and the tailing coal after semi-coke magnetic separation respectively, it can find strong magnetic mineral pyrrhotite(Fe1-*x*S) in semi-coke, and no pyrite in refined coal. It demonstrates that pyrolysis-magnetic separation can remove the inorganic sulfur in coal. According to Chinese standards(GB/T215-2003), it found that organic sulfur existed considerably in the form of thiophene, so it is diffcult to improve Beisu coal magnetic desulfurization rate by low-temperature pyrolysis.

KEY WORDS：pyrolysis, magnetic separation, pyrite sulfur, desulfurization rate

TiO2负载四苯基卟啉钴催化CO还原NO*x*研究（78-81）

张俊丰1)秦旭东2)

1) 博士、副教授；2) 硕士生，湘潭大学环境工程系，411105湖南湘潭

摘要：将四苯基卟啉钴负载于纳米TiO2上得到的催化剂催化CO还原NO.在空速为10 000 h-1，NO和CO进口浓度分别为500 mg/m3和5 000 mg/m3，O2含量为4%时取得了85%的转化率.SO2对催化剂的毒化作用不明显；H2O的竞争吸附使反应活性有所降低，但脱附H2O后可以恢复；SO2和H2O同时存在时，催化剂活性缓慢下降，但真空热处理后可以基本恢复.反应机理分析表明，NO2较NO更容易被CO还原，NO的还原产物为N2O和N2，随着温度的升高，生成N2的选择性增强；NO2的还原产物为N2.该催化剂可用于不同时含有SO2和H2O的一些烟（废）气NO催化CO还原.

关键词：Co-TPP，CO，NO，催化还原

CATALYTIC ACTIVITY OF COBALT TETRAPHENYLPORPHYRIN SUPPORTED ON NANOMETER TITANIA FOR REDUCTION OF NO BY CO IN THE PRESENCE OF O2

Zhang Junfeng and Qin Xudong

(Department of Environmental Engineering, Xiangtan University, 411105 Xiangtan, Hu′nan)

ABSTRACT：The reduction of NO by CO in the presence of oxygen in gas mixture and the dependence from reacting condition have been investigated on Co-TPP supported on nanometer titania catalysts. The results show that this catalyst yielded 85% NO conversion at 100 ℃ when the volume fraction of feeding gas is NO 500 mg/m3, CO 5 000 mg/m3, O2 4%, space velocity 10 000 h-1. In addition, only SO2 has little effect on NO reduction. At the same time, the competed adsorption of H2O reduced the NO conversion slowly, but the catalyst can be recycled after H2O desorption. In the presence of both SO2 and H2O, the catalyst was poisoned slowly but can be recycled after vacuum heat treatment. Mechanism of the reduction was also investigated, NO2 is more easily to reduce than NO, both N2O and N2 were the products of NO reduction, and N2 occupied a higher proportion with increasing temperature. N2 is the dominant product of NO2 reduction. The Co-TPP /TiO2 catalyst can be used for NO reduction with CO in the absence of either SO2 or H2O.

KEY WORDS：Co-TPP, CO, NO, catalytic reduction

天然焦基活性炭的制备及其电化学性能（82-85）

张传祥1)王海娟2)段玉玲3)杨俊和4)

1) 博士、副教授；2) 讲师；3) 副教授，河南理工大学材料科学与工程学院，454000河南焦作；4) 博士、教授，上海应用技术学院，200235上海

摘要：以永城天然焦为前驱体，KOH为活化剂制备高比表面积活性炭，并将其作为超级电容器的电极材料.采用N2吸附和X射线衍射（XRD）对活性炭的比表面积、孔结构及微晶结构进行了表征，用恒流充放电、循环伏安和交流阻抗等电化学测试手段评价了其电化学特性.在碱炭比为4∶1，800 ℃活化1 h的条件下制备出比表面积2 441 m2/g，孔容1.5 cm3/g，中孔率67 %的活性炭.该活性炭电极在3 M KOH水溶液及1 M (C2H5)4NBF4/碳酸丙烯酯（PC）电解液中具有高的比电容（分别达到252 F/g，163 F/g），低的扩散阻抗（分别为0.5 Ω和6.8 Ω）.

关键词：活性炭，电化学电容器，天然焦，比表面积

ACTIVATED CARBONS PREPARED FROM NATURAL COKE AND ITS ELECTROCHEMICAL PERFORMANCE AS ELECTRODE FOR EDLCS

Zhang Chuanxiang Wang HaijuanDuan Yuling and Yang Junhe\*

(He′nan Polytechnic University, 454000 Jiaozuo, He′nan;\* Shanghai Institute of Technology, 200235 Shanghai)

ABSTRACT：Natural coke from Yongcheng was activated by KOH to prepare high-performance activated carbons as electrodes for electric double-layer capacitors (EDLCs). Specific surface area and pore structure of activated carbons was investigated and their EDLC properties were measured in 3 M KOH aqueous solution and 1 M (C2H5)4NBF4/propylene carbonate (PC) solution. The asprepared activated carbons exhibit large surface areas (2 441 m2/g), high capacitances (252 F/g in 3 M KOH aqueous electrolyte,163 F/g in 1 M (C2H5)4NBF4/ PC electrolyte) and low AC impedance.

KEY WORDS：activated carbon, electrochemical capacitor, natural coke, specific surface area

粉煤灰基吸附剂合成动力学模型的拟合分析（86-89）

徐岩1)任瑞晨2)丁淑芳3)

1) 教授，黑龙江科技学院资源与环境工程学院，150027哈尔滨；硕士生，辽宁工程技术大学资源与环境工程学院，123000辽宁阜新；2) 教授，辽宁工程技术大学资源与环境工程学院，123000辽宁阜新；3) 助教，黑龙江科技学院资源与环境工程学院，150027哈尔滨

摘要：以鸡西矿区粉煤灰为原料，详细研究了合成粉煤灰基吸附剂的方法及其合成动力学模型，分析了不同反应时间内产品的结晶度.通过待定系数法确定出各方程速率常数和整合动力学方程，最终得到用粉煤灰制备粉煤灰基吸附剂的动力学模型.采用模型方程，对实验晶化曲线进行拟合，得到如下结论：粉煤灰基吸附剂结晶反应发生在凝胶后期；此外，在晶化后期，凝胶溶解速率的快慢决定了晶体生长速率和在有限晶化时间内产品结晶度的大小.从整体动力学实验数据来看，能与模型曲线较好地吻合，说明此动力学模型能较好地描述实际晶体生长规律.

关键词：粉煤灰，粉煤灰基吸附剂，XRD，动力学模型

STUDY ON KINETIC MODEL OF SYNTHESIS WITH FLY ASH-BASED ADSORBENT

Xu Yan1，2Ren Ruichen2 and Ding Shufang1

(1.College of Resource and Environment Engineering, Heilongjiang Institute of Science and Technology, 150027 Harbin；2.College of Resource and Environment Engineering, Liaoning Technical University, 123000 Fuxin, Liaoning)

ABSTRACT：This article discusses in detail the synthetical method, and synthetical kinetic model of fly ash-based adsorbent with fly ash in Jixi, and then it analyzes crystallization degree of production within the different time. This paper uses the undetermined coefficient method to determine velocity constant of each equation and merge the kinetic equations. Finally, the kinetic model of fly ash-based adsorbent with fly ash was obtained. Then using the model equation to merge testing crystallization curve, conclusions can be drawed that the crystallization reaction of fly ash-based adsorbent will happen in the later gel formation. Furthermore, the dissolve velocity of gel is either quick or slow, which decides the crystal growing rate and the crystallization degree within the limited time. From the whole testing data, it can consist with model curve fairly good, and it shows that the model can describe preferably the growth law of actual crystal.

KEY WORDS：fly ash, fly ash-based adsorbent, XRD, kinetic model

吸附于CuO/AC及其AC上的苯胺和苯的TPD研究（90-94）

李秉正1)雷智平2)苏军划3)黄张根4)

1) 博士生，中国科学研究生院，100049北京；中国科学院山西煤炭化学研究所煤转化国家重点实验室，030001太原；2) 副教授，安徽工业大学，240093安徽马鞍山；3) 博士后，北京大学环境模拟与污染控制重点联合实验室，100871北京；4) 副研究员，中国科学院山西煤炭化学研究所煤转化国家重点实验室，030001太原

摘要：以苯胺和苯为模型，考察了其在载体活性炭（AC）和炭基金属吸附催化剂（CuO/AC）上的吸附行为，并对吸附了苯胺和苯的AC和CuO/AC进行程序升温脱附实验（TPD）.结果表明，CuO/AC的苯胺脱附量显著小于AC，且起始脱附温度高于AC的脱附温度.CuO的担载改变了苯胺的吸附状态，使得苯胺和CuO/AC之间的吸附更加牢固；CuO担载前后的苯的脱附行为差别不大，表明其吸附状态没有变化.

关键词：CuO/AC，AC，苯胺，苯，TPD

STUDY ON TPD OF ADSORBED ANILINE AND BENZENE ON ACTIVATED CARBON AND CuO DOPED ACTIVATED CARBON

Li Bingzheng1，2Lei Zhiping3Su Junhua4 and Huang Zhanggen1

(1.State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, Chinese Academy of Sciences,030001 Taiyuan;2.Graduate University of Chinese Academy of Sciences, 100049 Beijing;3.Anhui University of Technology, 240093 Maanshan, Anhui; 4.Key Combined Laboratory of Enviroment Simulation and Pollution Control, Beijing University, 100871 Beijing)

ABSTRACT：In this paper, the adsorption and temperature-programmed desorption behaviors of aniline and benzene (as model compounds) on activated carbon (AC) and a copper oxide doped activated carbon (CuO/AC) were investigated. Results show that aniline desorption amount from CuO/AC is significantly lower than that from AC, and initial desorption temperature of aniline from CuO/AC is higher than that from AC. CuO addition changes adsorption state of aniline, which can make adsorption interaction between aniline and catalysts be stronger. CuO has no significant effect on desorption behavior of benzene, which shows state of benzene does not change.

KEY WORDS：CuO/AC, AC, aniline, benzene, TPD

快速加热预处理对煤黏结性的影响（1-4）

黄定国1)李利娟2)马明杰1)

1) 博士、教授；2) 硕士生，河南理工大学材料科学与工程学院，454000河南焦作

摘要：用自制的KFM-A 型煤粉快速加热装置在空气氛围下对兖州煤等六种煤样从室温快速加热到380 ℃左右.对处理后的煤粉进行了黏结指数的测定，发现快速加热可以明显提高不黏煤和弱黏煤的黏结性.通过CS2和CS2-NMP混合溶剂萃取实验，发现快速加热处理后煤样的溶剂萃取率都有所提高，且萃取率变化和煤的黏结性变化有良好的相关关系.由此推断，快速加热预处理可以弱化煤大分子之间以及分子内部的凝聚结构，使其在高温域时，可以生成更多的流动性低分子物质，导致黏结性的改善.

关键词：煤，快速加热，黏结性

EFFECT OF RAPID PREHEATING TREATMENT ON COAL THERMOPLASTICITY

Huang Dingguo，Li Lijuan and Ma Mingjie

(School of Materials Science and Engineering, He’nan Polytechnic University, 454000 Jiaozuo, He’nan)

ABSTRACT：Six kinds of non or low-coking coals were rapidly preheated from room temperature to about 380 ℃ using KFM-A rapid preheator at atmosphere. It was found that the coking index of coals increased markedly by the rapid preheating. Solvent extraction experiment showed that CS2 and CS2-NMP extraction yield of coals was enhanced by rapid preheating and was relative with the coking index clearly. It can be speculated that cohesion structure of coal is relaxed by rapid preheating and the kinetic property of coal molecule increases and so produce more low molecular weight substances when the slow heating rate was applied through the following thermoplastic stages.

KEY WORDS：coal,rapid preheating,thermoplasticity

甲醇萃取对大雁褐煤孔隙结构的影响（5-7）

李文军1)焦子阳2)刘丽丽2)王伟3)梁杰4)

1) 博士生； 2) 硕士生；4) 教授、博士生导师，中国矿业大学，100083北京；3) 工程师，中石化胜利油田东辛采油厂，257049山东东营

摘要：采用压汞法和氮气吸附容量法测试了甲醇萃取前后大雁块状褐煤的微孔结构，结果表明，萃取后大雁褐煤孔隙率从16.4%增加到了18.53%，在3 nm～80 nm的微孔径范围内，比表面积增加了2.6倍，孔容增加了2倍，但随孔径的分布却和原煤具有相似的规律，比表面积和孔容的增加只是微孔数量增加的结果.根据分析得到煤中微孔的最可几孔径，利用煤的胶态分子团结构模型观点，计算出大雁褐煤基本结构单元的粒径在8.9 nm左右.同时发现，在煤炭地下气化过程中，使用甲醇不仅能够提高气化煤层的渗透性，而且煤比表面积的增加也使得气化反应活性得到增强，提高了地下气化效率.

关键词：褐煤，溶剂萃取，比表面积，孔容，煤炭地下气化

EFFECT OF METHANOL EXTRACTION ON PORE CHARACTER OF DAYAN LIGNITE

Li Wenjun，Jiao Ziyang，Liu Lili，Wang Wei and Liang Jie

(China University of Mining and Technology, 100083 Beijing; \* Dongxin Oil Recovery Plant SINOPEC Shengli Oil Field Company, 257049 Dongying, Shandong)

ABSTRACT：Before and after being extracted by methanol, the micro-pore structure of block Dayan lignite of China was investigated using mercury intrusion porosimetry (MIP) and nitrogen gas adsorption method. The results show that the porosity goes from 16.4% up to 18.53%. In the micropore diameter range from 3 nm to 80 nm, the specific surface area and pore volume increased by 2.6 folds and 2 folds. But the methanol extraction could not change the micropore distribution obviously. The enlargement of the specific surface area and the pore volume of coal was mainly due to the increase of pore number in different pore size range. The radius of Dayan lignite colloid structure unit was calculated to 8.9 nm according to the most probability of pore radius. Due to the coal seam permeability and the specific surface area were enhanced by using methanol, then the reaction activity and efficiency of underground coal gasification were increased.

KEY WORDS：lignite, solvent extraction, specific area, pore volume, underground coal gasification

热解条件对淮南煤焦孔隙结构的影响（8-12）

李兴龙1)许慎启2)周志杰3)于广锁4)

1) 工程硕士，江苏索普（集团）有限公司，212006江苏镇江；2) 博士生；3) 副教授；4) 教授、博士生导师，华东理工大学煤气化教育部重点实验室，200237上海

摘要：用N2等温吸附（77 K）法考察了热解条件对淮南煤焦孔隙结构的影响.测量了淮南原煤、淮南快焦和淮南慢焦的BET比表面积，并由BJH模型计算得到了孔容积、平均孔径及孔径分布.结果表明，快速热解和慢速热解都可以使煤孔隙结构发达，加速孔的生成和发展，且热解温度越高，趋势越明显，但慢速热解对煤焦孔隙结构的影响更加显著.应用分形维数的概念，结合吸附/脱附曲线得到了煤焦的分形维数，结果表明快速热解和慢速热解都可以增加煤焦的分形维数.

关键词：BET，孔径分布，吸附/脱附等温线，分形维数

EFFECT OF PROLYSIS CONDITION ON THE PORE STRUCTURE OF HUAINAN COAL CHAR

Li Xinglong，Xu Shenqi，Zhou Zhijie and Yu Guangsuo\*

(Jiangsu Sopo Corporation (Group) Limited, 212006 Zhenjiang, Jiangsu; \* Key Laboratory of Coal Gasification, Ministry of Education, East China University of Science and Technology, 200237 Shanghai)

ABSTRACT：The effect of pyrolysis condition on pore structure of Huainan coal was investigated by N2 adsorption principle at 77 K. Specific surfaces of Huainan coal and char were mea-sured by BET model. Total pore volume, average pore size and pore size distribution were also obtained by BJH model. The results show that rapid pyrolysis and slow pyrolysis both can increase the specific area and pore volume and the tendency is more notable with the increase of the pyrolysis temperature. The effect of slow pyrolysis on pore development is stronger than rapid pyrolysis. Fractal theory was applied to describe the surface and pore structure of samples and the fractal dimensions were obtained by FHH equation. Results show that the rapid pyrolysis and slow pyrolysis both can increase the fractal dimension of coal.

KEY WORDS：BET,pore size distribution,adsorption/desorption isotherm,fractal dimension

溶剂类型对煤微波辅助抽提率及组成的影响（13-16）

秦丽娜1)李建伟2)鱼娅1)任文文1)杨菌菌3)

1) 硕士生；2) 副教授，西安科技大学化学与化工学院，710054西安；3) 助理工程师，神华宁煤集团，750410银川

摘要：以神府煤和攀枝花煤为对象进行煤微波辅助抽提研究，所用溶剂有甲醇、乙醇、丙酮、乙酸、四氢呋喃、乙二胺和DMF等.结果表明，前四种溶剂对攀枝花煤的抽提率较高，后三种溶剂对神府煤的抽提率较高，其中乙二胺对神府煤的抽提率可达70.76%.抽提残煤的元素分析、官能团测定及FT-IR分析表明，各残煤H/C和O/C比略有降低而N/C明显升高；含氧官能团含量较脱灰煤有所增加，总酸性基及羟基含量提高；另外，利用GC/MS检测脱灰神府煤四氢呋喃抽提物，正己烷可溶物含较多的脂肪烷烃，甲苯可溶物中则含各种芳香族化合物，四氢呋喃可溶物中只检测到一种含氧杂原子化合物.

关键词：煤，抽提，微波辅助，FT-IR，GC/MS

IMPACT OF SOLVENT’ TYPES ON MICROWAVE-ASSISTED EXTRACTION OF COAL’ YIELD AND ITS CHEMICAL COMPONENT

Qin Li’na，Li Jianwei，Yu Ya，Ren Wenwen and Yang Junjun

(College of Chemistry and Chemical Engineering, Xi’an University of Science and Technology, 710054 Xi’an)

ABSTRACT：The microwave-assisted extraction of Shenfu coal and Panzhihua coal have been discussed, using the following solvents: methanol, ethanol, acetone, acetic acid, THF, ethylene diamine and DMF. The experiment results showed that the extraction yield of Panzhihua coal using former four solvents were higher, and Shenfu coal’s using later three solvents were higher, extraction yield of ethylene diamine was 70.76%. Dry ash-free basis coal and its residues were examined with ultimate analysis, functional group, and FTIR, which indicated that H/C and O/C ratio of residues had a little decrease, and N/C ratio significantly increased. Compared to the deashed coal, oxygen-containing functional groups content of residues increased, total acidity and hydroxyl content enhanced. THF extracts of Shenfu coal were analyzed with GC/MS: hexane contained more alkanes, and more aromatic compounds in toluene, while only one oxygen-containing heteroatomic compound in THF.

KEY WORDS：coal, extraction, MAE, FT-IR, GC/MS

褐煤低温改质过程中的换热特性（17-19）

刘振强1)苗文华2)白中华3)

1) 教授级高级工程师；2) 高级工程师；3) 工程师，中国电力科学研究院电站辅机技术研究所，100070北京；北京国电富通科技发展有限责任公司，100070北京

摘要：为研究褐煤低温改质过程中气固两相间换热特性，以大型CFD数值模拟软件Fluent为平台，采用SIMPLE算法和Eulerian模型, 以锡林浩特10 mm小颗粒褐煤为例，对气固两相流动的传热传质特性进行了数值模拟.模拟结果与实际工况基本一致，气相流速对炉内各截面的温度分布影响较大，对研究发生炉内的换热特性具有一定的理论指导意义.

关键词：褐煤，数值模拟，换热，均匀性

HEAT EXCHANGE CHARACTERISTIC OF LIGNITE DURING UPGRA-DING PROCESS WITH LOW TEMPERATURE

Liu Zhenqiang，Miao Wenhua and Bai Zhonghua

(Department of Power Station Auxiliary Equipments Technology of CEPRI, 100070 Beijing；Beijing Guodianfutong Science and Technology Development Corporation Limited, 100070 Beijing)

ABSTRACT：To study heat exchange characteristic of lignite during upgrading process with low temperature, using the software of CFD based on Fluent platform, with SIMPLE algorithm and Eulerian model, taking Xilinhaote lignite particles of 10 mm as example, with the numeric analogue of computer, proceeded numeric research of G-S two phases heat exchange characteristic. The results of numerical simulation are almost corresponding with the operating mode, velocity of G-phases is the main factor effecting distribution of section temperature inside furnace body, providing theoretical guide for studying heat exchange characteristic in producer.

KEY WORDS：lignite,numerical simulation,heat exchange,evenness

山西浑源烛煤富氧低温热解气态烃解析动力学（20-25）

于水军1)张玉贵1)郑立刚2)余明高1)

1) 教授，河南理工大学安全科学与工程学院；河南理工大学河南省煤矿瓦斯与火灾防治重点实验室；2) 讲师，河南理工大学安全科学与工程学院，454003河南焦作

摘要：利用煤低温氧化实验系统，研究了在温度为293 K~673 K，空气流量为100 mL/min和程序升温速率为3 K/min的条件下，山西浑源烛煤发生热解时C1~C4低分子有机烃的临界解析温度*T*m，解析速率*ψ*和解析表观活化能*E*a.结果表明，CH4，C2H6，C2H4，C3H8，C3H6，*i*-C4H10和*n*-C4H10 7种有机烃的*T*m为：473 K，521 K，433 K，526 K，498 K，503 K和529 K；ln*ψ*与1/*T*之间满足直线关系，符合典型的Arrhenius S A动力学特征；其*E*a为28.492 kJ/mol，13.506 kJ/mol，28.096 kJ/mol，41.786 kJ/mol，68.489 kJ/mol，76.763 kJ/mol和73.287 kJ/mol. 7种有机烃的*T*m，*ψ*和*E*a具有不同的变化特征，根据这些特征，可用来预测煤的富氧低温热解特征及其自燃倾向性.

关键词：浑源烛煤，富氧，低温热解，气态烃，解析，动力学

KINETIC STUDY ON GASEOUS HYDROCARBONS RELEASE OF SHANXI HUNYUAN CANNEL COAL DURING LOW TEMPERATURE PYROLYSIS PROCESS IN O2-ENRICHED CONDITIONS

Yu Shuijun，Zhang Yugui，Zheng Ligang and Yu Minggao1,2

(1.School of Safety Science and Engineering, He’nan Polytechnic University; 2.He’nan Province Key Laboratory of Prevention and Cure of Mine Methane and Fires, 454003 Jiaozuo, He’nan)

ABSTRACT：It will provide a theoretical suggestion for preventing the coal spontaneous combustion to investigate the low temperature pyrolysis characteristics of coal in O2-enriched conditions. The gas release critical temperatures Tm, the gas release rates ψ and the gas release apparent activation energies Ea of seven C1~C4 low-weight molecular hydrocarbons for Shanxi Hun-yuan cannel coal under the temperature range of 293 K~673 K and the air-supply flow rate of 100 mL/min were investigated by using a coal self-heating experimental facility. The results show that the gas release critical temperatures Tm for CH4，C2H6，C2H4，C3H8，C3H6，i-C4H10 and n-C4H10 were 473 K，491 K，423 K，513 K，490 K，503 K and 523 K respectively. The logarithmic release rates of hydrocarbons (lnψ) were linearly correlated with the reciprocal of absolute temperature (1/T), which were consistent with typical Arrhenius S A kinetic characteristics. The apparent activation energies were 28.492 kJ/mol，13.506 kJ/mol，28.096 kJ/mol，41.786 kJ/mol，68.489 kJ/mol，76.763 kJ/mol and 73.287 kJ/mol respectively. Tm，ψ and Ea for seven gaseous hydrocarbons demonstrated different characteristics, which will be useful for predicting the low temperature pyrolysis characteristics of coal in O2-enriched conditions and the property to coal spontaneous combustion.

KEY WORDS：Hunyuan cannel coal,oxygen enriched,low temperature pyrolysis,gaseous hydrocarbons,release,kinetics

聚四氟乙烯罐消解-HG-AFS法测定煤中砷（26-29+51）

刘瑞卿1)杨建丽2)肖勇3)

1) 博士生；2) 研究员；3) 助理研究员，中国科学院山西煤炭化学研究所煤转化国家重点实验室，030001山西太原

摘要：建立了一个新的测定煤中砷含量的方法，其消解过程在自制聚四氟乙烯消解罐烘箱中完成.对煤样的消解条件（温度、时间及试剂等）、氢化发生的条件（硼氢化钾浓度、酸性介质的种类与浓度）及煤本体中其他元素的干扰进行了详实的考察，确定了最佳分析条件.用标准参考煤样（GBW11116）中砷含量对该方法进行了验证，本方法的测定值为33.30 μg/g，而标准参考值为(34±2) μg/g，结果十分一致.用本方法也测定了5种煤中砷含量，相对标准偏差均小于5%.此方法可靠，定量准确，经济性好，利于推广应用.

关键词：消解， 氢化物发生原子荧光光谱法，煤，砷

DETERMINATION OF ARSENIC IN COAL BY DIGESTION AND HYDRIDE GENERATION-AFS

Liu Ruiqing，Yang Jianli and Xiao Yong

(State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, Chinese Academy of Sciences, 030001 Taiyuan, Shanxi)

ABSTRACT：A method for the determination of arsenic (As) in coal by the process of digestion and HG(hydride generation)-AFS (atomic fluorescence spectrometry) was presented in this paper. A home-made sealed Teflon container and an oven were used in the digestion process. The effects of the digestion conditions, including the digesting temperature, time and digesting agent, were discussed. The effects of hydrogenation conditions and interferences of other elements in coals, including the concentration of KBH4 and acid used, were also investigated. Optimum analysis conditions were ascertained. The method was validated by analysis of As content in standard reference coal (GBW11116) with satisfactory result and was successfully applied to the determination of As content in five coals with RSD<5%. The method is simple and precise and may be popularized.

KEY WORDS：digestion，HG-AFS，coal，arsenic

Texaco气化炉炉渣基本特性与应用研究（30-33）

尹洪峰1)汤云2)任耘3)张军战3)

1) 教授；2) 硕士生；3) 副教授，西安建筑科技大学西部建筑科技国家重点实验室培育基地，710055西安

摘要：利用X-射线荧光分析仪、X-射线衍射仪、光学显微镜、扫描电子显微镜等手段研究了Texaco气化炉炉渣的化学组成、物相组成、岩相结构和显微结构；并利用气化炉渣为主要原料制备了墙体材料，采用碳热还原氮化法合成了sialon粉体，结果表明：1) Texaco煤气化炉炉渣主要化学成分为SiO2，Al2O3，CaO和残余碳，其中含有很高的玻璃相和不定形物质；2) 气化炉渣为多孔结构，残余碳多为海绵状多孔结构，不定形玻璃相较为致密；3) 当气化炉渣磨细粉添加量达到70%时经烧成可制得MU7.5以上墙体材料，烧成试样体积密度较低，可望保温隔热；4) 利用气化炉渣为主要原料，通过碳热还原氮化可合成主要成分为Ca-α-sialon和β-sialon的粉体.

关键词：气化炉渣，组成，显微结构，墙体材料，赛隆

STUDY ON THE CHARACTERISTIC AND APPLICATION OF GASIFICATION SLAG FROM TEXACO GASIFIER

Yin Hongfeng，Tang Yun，Ren Yun and Zhang Junzhan

(State Key Lab of Western Architecture and Technology (Cultivating Base), Xi’an University of Architecture and Technology, 710055 Xi’an)

ABSTRACT：X-ray fluorescence spectrometry(XRF), X-ray powder diffractometry(XRD), optical microscope(OM),scanning electron microscopy(SEM)were used to investigated the chemical composition, phase constituents, petrographical structure and microstructure of gasification slag from Texaco gasifier. Building materials were fabricated using gasification slag as main raw materials. Sialon powders were synthesized by carbothermal reduction nitrodation of gasification slag. The results showed that: 1) The main chemical constituents of gasification slag are SiO2, Al2O3, CaO and residual carbon. The main phase are vitreous glass and amorphous carbon, minor phase are quartz and calcite; 2) Gasification slag is porous. Residual carbon is sponge-like structure and vi-treous glass is dense; 3) Building materials above MU7.5 can be manufactured when 70% gasification slag fine is added. The sample fired which has lower volume density has characteristic of thermalresistance; 4) Sialon powders with Ca-α-sialon and β-sialon as main crystalline phases can be synthesized by carbothermal reduction method using gasification slag as raw materials.

KEY WORDS：gasification slag, composition, microstructure, building materials, sialon

新型煤气化炉制备富含CO燃气及载能材料研究（34-38）

王爱民1)白妮1)王晓刚2)

1) 硕士、讲师，榆林学院化学与化工学院，719000陕西榆林；2) 博士生导师、教授，西安科技大学材料科学与工程学院，710054西安

摘要：为了实现煤炭的高效洁净转化，利用自行发明的电热还原煤气化炉，以煤和石英砂为原料制备大量富含CO的燃气，同时伴生高附加值的载能材料，研究了煤种和气化工艺对燃气的组成及酸碱性的影响，并用XRD和SEM对载能材料进行测试.结果表明，燃气中以CO气体为主，平均含量可达70%，CO+H2平均含量达85%，CO+H2+CH4平均含量达90%，使用无烟煤、烟煤焦炭或焙烧料法可提高燃气中CO气体的含量.载能材料是SiC，含量为98.45%，其中3C-SiC占4.12%，6H-SiC占89.81%，4H-SiC占4.42%，晶体的自形程度也比较高，多为厚板状结晶.

关键词：煤气化炉，一氧化碳，碳化硅，载能材料

PREPARATION OF FUEL GAS RICH IN CO AND ENERGY CARRIER MATERIAL BY NEW COAL GASIFICATION FURNACE

Wang Aimin，Bai Ni and Wang Xiaogang\*

(Department of Chemistry and Chemical Engineering, Yulin College, 719000 Yulin, Shaanxi; \* Department of Material Science and Engineering, Xi’an University of Science and Technology, 710054 Xi’an)

ABSTRACT：Self-inventing multi-heat silicon carbide furnace is used in order to convert coal high-efficiently and cleanly, in which much fuel gas rich in CO is produced by using raw materials of coal and quartz. Meanwhile, high added value material is being produced. We not only study the influence of coal and gasification technology on gas products, but also test energy carrier material through XRD and SEM. The results show that fuel gas is mainly composed of carbon monoxide(CO), the average content of CO reaches up to 70%, the average content of the CO+H2 and CO+H2+CH4 reach to 85% and 90% respectively. We can improve the content of CO by using anthracite, coke or roasting method. The energy carrier material SiC (content of 98.45%) is obtained, among which the yields of 3C-SiC, 6H-SiC, 4H-SiC are 4.12%, 89.81% and 4.42% respectively. The crystal has a relatively high euhedral degree, most of which is thickly platelike crystal.

KEY WORDS：coal gasification furnace,carbon monoxide,silicon carbide,energy carrier material

酒精发酵废液煤浆气流床气化实验研究（39-43）

邵守言1)郭庆华2)陈雪莉3)刘海峰4)王辅臣4)凌晨5)唐晓亮6)黄诚6)李兴龙6)曹宏兵6)

1) 博士生，华东理工大学煤气化教育部重点实验室，200237上海；江苏索普(集团)有限公司，212006江苏镇江；2) 讲师；3) 副教授；4) 教授，华东理工大学煤气化教育部重点实验室，200237上海；5) 高级工程师；6) 工程师，江苏索普（集团）有限公司，212006江苏镇江

摘要：在多喷嘴对置式气化炉热模实验平台上，利用内窥式工业电视、高温热偶和质谱仪等，研究了酒精发酵废液煤浆的气化特性.结果表明，酒精废液煤浆所形成的撞击火焰结构稳定，气化效果良好，随着氧煤比的增加，气化温度与合成气有效成分均相应升高.由此证明将酒精发酵废液与煤混合制浆气化是解决发酵废液污染排放的有效途径.

关键词：发酵废液煤浆,多喷嘴对置气化炉,气流床气化

EXPERIMENTAL STUDY OF COAL ALCOHOL FERMENTATION WASTEWATER SLURRY ENTRAINED-FLOW GASIFICATION

Shao Shouyan， Guo Qinghua，Chen Xueli，Liu Haifeng，Wang Fuchen，Ling Chen，Tang Xiaoliang，Huang Cheng，Li Xinglongand Cao Hongbing2

(1.Key Laboratory of Coal Gasification of Ministry of Education, ECUST, 200237 Shanghai；2.Jiangsu Sopo(Group) Corporation Limited, 212006 Zhenjiang, Jiangsu)

ABSTRACT：On hot-model experimental platform of opposed multi-burner gasifier, gasification characteristics of coal alcohol fermentation wastewater slurries were studied by using endoscopic industrial TV, high temperature thermocouples, mass spectrograph. The results showed that the impinging flames generated by the coal wastewater slurries were stable and the gasification efficiency was well; the gasification temperature and available gas component increased correspondingly with increasing the ratio of oxygen to coal. Therefore, it has been proven that cogasification of fermentation wastewater and coal is an effective method to solve the wastewater pollution.

KEY WORDS：coal fermentation wastewater slurry，opposed multi-burner gasifier，entrained flow gasification

生物质与煤共气化特性研究（44-46）

宋新朝1)王芙蓉1)赵霄鹏1)张永奇2)毕继诚2)

1) 硕士，山西晋城无烟煤矿业集团有限责任公司，048006山西晋城；2) 教授，中国科学院山西煤炭化学研究所，030001太原

摘要：在热天平装置中研究了生物质焦、煤焦以及生物质焦与煤焦混合物的水蒸气气化特性.采用程序升温热重法对生物质焦（稻秆焦、高粱秆焦和玉米秆焦）、神木煤焦以及生物质焦与煤焦混合物进行了水蒸气气化实验.结果表明，生物质焦和煤焦在一定温度下的气化速率为：高粱焦>稻秆焦>玉米焦>神木煤焦.并对三种生物质焦、煤焦、生物焦和煤焦混合物的水蒸气气化反应进行了动力学分析，分析认为，连续反应模型可以在一定程度上反应焦样的水蒸气气化反应动力学.

关键词：生物质，煤，共气化

THERMOGRAVIMETRIC STUDY ON CO-GASIFICATION OF BIOMASS AND COAL

Song Xinchao，Wang Furong，Zhao Xiaopeng，Zhang Yongqi and Bi Jicheng\*

(Jincheng Anthracite Mining Group of Shanxi, 048006 Jincheng, Shanxi；\* Institute of Coal Chemistry, Chinese Academy of Sciences, 030001 Taiyuan)

ABSTRACT：Steam gasification characteristic of biomass char, coal char and the mixture of them was investigated in a thermogravimetric apparatus (TG). The results showed that the various chars behave various reaction rate as follows: Shenmu coal char < cornstalk haulm char < rice haulm char < broomcorn haulm char. The steam gasification reaction kinetics analysis of them showed that the homogeneous model reflected the char gasification kinetics with steam to some extent.

KEY WORDS：biomass, coal, co-gasification

优化后的油煤浆常温常压流变特性的研究（47-51）

赵鹏1)

1) 硕士、工程师，煤炭科学研究总院北京煤化工研究分院，100013北京

摘要：油煤浆的黏度变化是煤直接液化工艺设计的重要参数之一.实验配制油煤浆的溶剂为催化裂化(FCC)油浆（或回炼油）与循环溶剂的掺混体，与传统的循环溶剂差异较大.研究了常温常压条件下各因素对这类油煤浆黏度的影响规律，得到油煤浆浓度为45%和50%条件下FCC油浆（或回炼油）掺混体系满足液化输送的配制条件.分析了FCC油浆（或回炼油）的掺混比、油煤浆浓度、温度对油煤浆黏度的影响规律，结果表明，煤浆的黏度随溶剂黏度的增大而增大，随油煤浆浓度增大而升高.温度对浆体的黏度影响较大，黏度随温度升高而降低，通过对实验数据的数学回归，建立了一定温度范围内黏度随温度变化的定量关系式.

关键词：煤炭液化，油煤浆，FCC油浆，FCC回炼油，流变特性

STUDY ON RHEOLOGICAL PROPERTIES OF OPTIMIZING COAL OIL MIXTURE AT NORMAL TEMPERATURE AND ATMOSPHERE

Zhao Peng

(Beijing Research Institute of Coal Chemistry, China Coal Research Institute, 100013 Beijing)

ABSTRACT：Viscosity of coal oil mixture(COM) is one of an important technological parameters during coal direct liquefaction. In this paper，FCC slurry(recycle oil) and recycle solvent mixture different from traditional recycle solvent were chosen for COM preparation. Some influencing factors for viscosity change of COM were studied at normal temperature and atmosphere, which includes the ratio of FCC slurry(recycle oil) to recycle solvent，COM concentration and temperature. Suitable transportation conditions for FCC slurry(recycle oil) mixing systems during liquefaction were achieved under the COM concentration of 45% and 50% respectively. The results show that viscosity of COM increases with solvent viscosity and the COM concentration increasing. Apparent viscosity decreases with temperature increasing，and the relation equation of viscosity-temperature was established by analysis and regression of experimental data.

KEY WORDS：coal liquefaction，coal oil mixture，FCC slurry，FCC recycle oil，rheological properties

脂肪族磺酸盐分散剂对低阶煤制浆性能的影响（52-57）

王玥1)杨东杰2)楼宏铭3)邱学青4)

1) 硕士生；2) 教授；3) 副研究员；4) 教授、博士生导师，华南理工大学化工与能源学院；华南理工大学制浆造纸工程国家重点实验室，510640广州

摘要：以丙酮、甲醛及亚硫酸钠为原料，采用磺化缩聚法通过控制缩合剂和磺化剂的用量，合成一系列具有不同分子量和不同磺化度的脂肪族磺酸盐水煤浆分散剂（SAF）.神华煤作为一种低阶煤，内在水分含量和氧含量过高，成浆性能较差.采用德国Haake流变仪测定SAF作为分散剂对低阶神华煤制浆的流变性能，结果表明，SAF的分子量和磺化度是影响其分散降黏作用的主要因素.SAF对水煤浆的分散降黏能力优于萘磺酸盐甲醛缩合物系分散剂，适宜的分子量（特性黏度为 7.03~10.87）和较高的磺化度（1.64 mmol/g）有利于提高SAF对水煤浆的分散降黏性能.采用Herschel-Bulkley模型对掺SAF的水煤浆浆体的流变曲线进行拟合，研究了SAF的分子量和磺化度对水煤浆流变性的影响.

关键词：磺化丙酮-甲醛缩合物，分子量，磺化度，流变性，水煤浆

INFLUENCE OF SULPHONATED ACETONE-FORMALDEHYDE RESIN APPLIED AS DISPERSANT ON LOW RANK COAL-WATER SLURRY

Wang Yue，Yang Dongjie，Lou Hongming and Qiu Xueqing

(School of Chemical and Energy Engineering; Guangdong Provincial Laboratory of Green Chemical Technology, South China University of Technology, 510640 Guangzhou)

ABSTRACT：A water-soluble aliphatic polymer, sulphonated acetone-formaldehyde resin (SAF) was synthesized by sulfonation and polycondensation reaction. SAF with different molecular and different degree of sulfonation were developed as dispersant for the preparation of highly-loaded coal-water slurry (CWS), which were obtained by controlling the quantity of condensating agent and sulfonating agent. Shenhua coal is a kind of low rank coal, the internal water content and oxygen content is too high, which makes it hard to make coal water slurry. The Haake rheometer was used to measure the rheological property and viscosity of CWS prepared from Shenhua coal. The results show that the molecular weight and the degree of sulfonation of SAF were found to be the key factors affecting its capability for reducing the viscosity of CWS. Comparing with other dispersants of CWS, SAF has much better dispersing effect than nathphalene sulfonate formaldehyde condensate. The suitable molecular weight (inherent viscosity is 7.03-10.87) and the higher degree of sulfonation (1.64 mmol/g) are more effective for reducing the viscosity of CWS, and the shear-stress/shear rate data for each CWS prepared with SAF were fit to three-parameter HerschelBulkley model. Based on the results, the SAF with medium molecular and higher degree of sulfonation is an effective and promising dispersant for highly-loaded CWS.

KEY WORDS：sulphonated acetone-formaldehyde resin,molecular weight,degree of sulfonation,rheological behavior,coal water slurry

离子液体溶剂中煤溶胀性能研究（58-60）

曹敏1)谷小虎2)张爱芸3)马嫚4)

1) 副教授，河南理工大学材料科学与工程学院，454000河南焦作；博士后，义马煤业集团股份有限公司博士后科研工作站，472300河南义马；2) 硕士生，河南理工大学材料科学与工程学院，454000河南焦作；义马煤业集团股份有限公司，472300河南义马；3) 博士、教授；4) 硕士生，河南理工大学材料科学与工程学院，454000河南焦作

摘要：离子液体作为一种新型溶剂，在煤化工领域尚未应用.以离子液体——[Emim]BF4作为煤溶胀的溶剂，在常压常温条件下，从溶胀时间、溶剂性质以及温度等因素来研究煤在离子液体中的溶胀性能.结果表明，煤样在离子液体中的溶胀度是随温度的升高和时间的延长呈现先增大后减小的趋势；溶胀度在反应温度为50 ℃和溶解8 h后达到最大；红外谱图显示经过离子液体处理后，煤样的分子结构发生改变.

关键词煤，离子液体，溶胀，红外光谱

SWELLING CAPACITY OF COAL SAMPLE IN IONIC LIQUID

Cao Min，Gu Xiaohu，Zhang Aiyun and Ma Man1

(1.He’nan Polytechnic University, 454000 Jiaozuo, He’nan; 2.Yima Coal Industry Group, 472300 Yima, He’nan)

ABSTRACT：Ionic liquid is a new kind of solvent, but it has never been applied to coal chemical industry. Ionic liquid was firstly used as coal-direct liquefaction solvent in this paper. The swelling function was studied at ambient pressure and normal temperature. Effects of solvent, confecing time and temperature were discussed. It is found that swelling capacity is the most strong at 50 ℃ and 8 h later, but the swelling capacity along with elevatory temperature and time appeared to firstly increase and subsequently reduced. And the results indicated that molecular structure of coal sample had changed through FTIR analysis.

KEY WORDS：coal,ionic liquids,swelling,FTIR analysis

用镜质组反射率分布控制水钢焦炭质量的研究（61-65+88）

孟庆波1)刘洋2)郭武卫3)张东升4)耿茜5)黄胜林3)

1) 教授级高级工程师、硕士生导师；2) 工程师，中钢集团鞍山热能研究院有限公司，114044辽宁鞍山；3) 工程师；4) 高级工程师；5) 助理工程师，首钢水城钢铁（集团）公司，553028贵州水城

摘要：采用煤镜质组反射率分布并结合常规煤质指标，对稳定和控制水钢焦炭质量进行了实验研究.对水钢的18个煤样进行了反射率及常规指标的检测、煤质分析与评价和炼焦实验；对水钢的生产方案及建议方案进行了40 kg焦炉炼焦实验，并对其进行了分析；使用煤镜质组反射率分布并结合常规煤质指标为水钢制定了三个优化配煤方案，焦炭质量提高，完全满足生产要求.研究结果表明，煤镜质组反射率分布图是指导炼焦配煤的有效手段，对稳定和控制焦炭的热性质效果十分明显，对炼焦配煤煤种多和有混煤情况尤其适用和有效.

关键词：煤镜质组反射率分布，焦炭质量控制，优化配煤，焦炭热性质

CONTROLLING COKE QUALITY OF SHUICHENG STEEL BASED ON REFLECTANCE DISTRIBUTION OF COAL VITRINITE

Meng Qingbo，Liu Yang，Guo Wuwei，Zhang Dongsheng，Geng Qian and Huang Shenglin\*

(Sino Steel Anshan Research Institute of Thermo-energy Company Limited, 114044, Anshan, Liaoning; \* Shougang Shuicheng Iron and Steel Group Corporation Limited, 553028 Shuicheng, Guizhou)

ABSTRACT：For stabilization and control of coke quality of Shuicheng steel the research by application of reflectance distribution of coal vitrinite and traditional coal property parameters has been done. The reflectance determination of coal vitrinite, analysis and evaluation of coal properties and coking test for eighteen coal samples have been carried out. The production coal blend in use and recommended coal blends at Shuicheng steel have been evaluated basesd on the test results obtained from coking tests on 40 kg test coke oven. By application of reflectance distribution of coal vitrinate and traditional coal property parameters three optimum coal blends have been put forward. The coke quality is improved and satisfied with demands of production. The research shows that using the reflectance distribution diagram of coal vitrinite is an efficient means of guiding coal blending and especially effective in controlling and stabilizing coke property at high temperature. It is convenient to guide coal blending by using reflectance distribution diagram of coal vitrinite when charged coal is blended by many kind of coals and/or mixed coals.

KEY WORDS：reflectance distribution of coal vitrinite,coke quality control,optimization of coal blending,coke property at high temperature

炼焦过程中多环芳烃与NO*x*产生的相关性（66-69）

李恩科1)程相利2)苍大强3)石焱4)李茂静5)

1) 博士生、高级工程师，北京科技大学冶金与生态工程学院，100083北京；唐山市环境监测中心站，063000河北唐山；2) 副教授；3) 教授，北京科技大学冶金与生态工程学院，100083北京；4) 教授，河北理工大学冶金与能源学院，063009河北唐山；5) 硕士生，唐山市环境监测中心站，063000河北唐山

摘要：通过对炼焦过程产生的多环芳烃(PAHs)和NO*x*浓度进行监测，得到PAHs和NO*x*的产生规律及其产生的相关性.结果显示，PAHs主要在煤的升温阶段产生，在结焦初期的1 h～3 h 产生的多环芳烃最多，整个炼焦过程中的产生量逐渐减少；随炼焦时间延长，NO*x*浓度先增大后减小，在最初的第4 h～第6 h出现峰值；在炼焦过程前期，PAHs和NO*x*的产生量呈负相关性，通过指数拟合，得到不同煤种和配煤情况下PAHs与NO*x*最大产生量的关系式.

关键词炼焦 ，PAHs，NO*x*，相关性

EMITTING RELATIVITY OF POLYCYLIC AROMATIC HYDROCARBONS AND NOx IN COKING

Li Enke，Cheng Xiangli，Cang Daqiang，Shi Yan and Li Maojing2

(1.School of Metallurgical and Ecological Engineering, Beijing University of Science and Technology, 100083 Beijing; 2.Tangshan Environment Monitoring Center, 063000 Tangshan, Hebei; 3.College of Metallurgy and Energy, Hebei Polytechnic University, 063009 Tangshan, Hebei)

ABSTRACT：The generation chatacteristic and the relativity of polycyclic aromatic hydrocarbons(PAHs) and nitrogen oxide(NO*x*) were obtained by monitoring their generation in coking. The results show that the amount of PAHs mainly generated at the stage of coal temperature increasing is the maximum at the beginning 1 h-3 h of coking and is gradually reduced in the whole coking process. With the time prolonging the amount of NO*x* generated which peak value occurred at the stage from the fourth h to the sixth h is increased firstly and then reduced. The amounts of PAHs and NO*x* generated at the beginning stage have a negtive correlation and the relation of maximum amounts between PAHs and NO*x* for different coals and different blended coals was obtained by fitting an exponential curve.

KEY WORDS：coking, PAHs, NO*x*, relativity

炼焦煤中多环芳烃的分布特性研究（70-73）

何选明1)黄鹂2)韩军3)李振东4)李耀拉2)

1) 教授；2) 硕士生，武汉科技大学湖北省煤转化与新型炭材料重点实验室，430081武汉；3) 副教授，华中科技大学煤燃烧国家重点实验室，430074武汉；4) 助理工程师，攀枝花钢铁有限责任公司煤化工厂，617022四川攀枝花

摘要：选取6种典型炼焦煤用二氯甲烷作萃取剂经索氏提取和K-D浓缩，采用硅胶柱层析纯化，利用高效液相色谱法(HPLC)对其中含有的16种多环芳烃(PAHs) 进行测定，研究了不同煤种中PAHs的分布.结果表明，6种煤中PAHs主要以3环、4环和5环形式存在；此外还发现PAHs总量随煤化度提高而减少，随挥发分含量和氢碳摩尔比增大而增加；且PAHs含量与煤中碳含量和氧碳摩尔比也存在一定关系.

关键词：炼焦煤，多环芳烃，分布特性

DISTRIBUTION CHARACTERISTIC OF POLYCYCLIC AROMATIC HYDROCARBONS IN COKING COAL

He Xuanming，Huang Li，Han Jun，Li Zhendong\*\* and Li Yaola

(Hubei Key Laboratory of Coal Conversion and New Materials, Wuhan University of Science and Technology, 430081 Wuhan;\* State Key Laboratory of Coal Combustion, Huazhong University of Science and Technology, 430074 Wuhan;\*\* Coal and Chemical Works Panzhihua Iron and Steel Corporation Limited, 617022 Panzhihua, Sichuan)

ABSTRACT：The distribution characteristics of 16 polycyclic aromatic hydrocarbons(PAHs) in 6 typical coking coals were investigated. The coal samples were extracted by the Soxhlet extractor with methylene chloride, concentrated by the K-D concentrator, and purified by silica gel technique, then PAHs in the coal samples were analyzed by a high performance liquid chromatographic(HPLC). Experimental results showed that most PAHs were present in the coal with 3-ring to 5-ring structure in the six coals; moreover, the higher coal rank is, the lower the total content of PAHs is. The coal with the high volatile content and H/C mole ratio contained higher PAHs. It was also discovered that there was correlation between PAHs content and carbon content, O/C mole ratio in the six coals.

KEY WORDS：coking coal, PAHs, distribution characterization

煤层气焦炭燃烧除氧实验研究（74-77）

董卫果1)徐春霞2)王鹏3)杨宗仁2)李小亮2)张科达4)邓一英5)

1) 硕士、工程师；2) 助理工程师；3) 工程师；4) 硕士生；5) 高级工程师，煤炭科学研究总院北京煤化工研究分院，100013北京

摘要：低浓度煤层气热值和浓度达不到工业利用的要求，工业利用时需要对其中的甲烷进行浓缩.由于煤层气含有氧，给浓缩工艺的安全性造成危害，因此在浓缩之前必须将氧除去.阐述了现行正在研究的几种除氧方法的特点，并采用管式炉实验装置对低浓度煤层气除氧进行了实验研究.结果发现，除氧温度小于700 ℃时，甲烷损失率小于10%，甲烷的裂解是造成甲烷损失的主要原因.通过焦炭燃烧法除氧，氧气浓度能够降至1%以下.

关键词：煤层气，焦炭燃烧，除氧，损失率

EXPERIMENTAL STUDY ON THE DEOXIDIZATION OF COALBED METHANE BY USING COKE COMBUSTION METHOD

Dong Weiguo，Xu Chunxia，Wang Peng，Yang Zongren， Li Xiaoliang，Zhang Keda and Deng Yiying

(Beijing Research Institute of Coal Chemistry, China Coal Research Institute, 100013 Beijing)

ABSTRACT：The heat value and concentration of low concentration coalbed methane can’t meet the requirement of industry utilization. When it is industrially used, the methane in the gas needs to be concentrated. However, there is danger in the concentrating process because of the oxygen existing in the gas. So it is necessary to remove oxygen from the gas before being concentrated. The characteristics of several deoxidization methods, which are researching currently, are briefly represented; experimental study on the deoxidization of low concentration coalbed methane in a tubular furnace is also carried on in this paper. The results show that the percentage loss of methane is less than 10%, while the deoxidization temperature is less than 700 ℃, the pyrolysis of methane is the main reason of the loss of methane. The concentration of oxygen can be reduced to less than 1% after deoxidization by using coke combustion method.

KEY WORDS：coalbed methane,coke combustion,deoxidization,percentage loss

煤沥青的热分析（78-80）

郑长征1)孙磊2)马丽斯2)王梅芳2)

1) 博士、副教授；2) 硕士生，西安工程大学环境与化学工程学院，710048西安

摘要：采用溶剂分离的方法对煤沥青进行组分分离，并通过TG，DTG以及DSC对煤沥青及α树脂、β树脂和γ树脂进行了分析.结果表明，煤沥青中重组分的热失重开始温度及最大失重速率温度较高，煤沥青与β树脂和γ树脂在400 ℃～500 ℃范围内均出现两个放热峰，α树脂在400 ℃～500 ℃范围内只有一个放热峰.

关键词：煤沥青，溶剂分离，热分析

THERMAL ANALYSIS OF COAL TAR PITCH

Zheng ChangzhengSun LeiMa Lisi and Wang Meifang

(Xi’an Polytechnic University, 710048 Xi’an)

ABSTRACT：Coal tar pitch were separated into α, β and γ resin by the method of solvent extraction. Coal tar pitch, α, β and γ resin were analyzed by TG, DTG and DSC. The results show that the heavy fraction has a higher temperature of initial weight loss and a higher temperature of maximum rate of weight loss than that of light fraction. Coal tar pitch, β and γ resin have two exothermic peaks in the region of 400 ℃-500 ℃, while α resin has only one exothermic peak in the region of 400 ℃-500 ℃.

KEY WORDS：coal tar pitch, solvent extraction, thermal analysis

中低温煤焦油加氢改质工艺研究（81-84）

李冬1）李稳宏2）高新2）杨小彦3）滕家辉3）崔楼伟3）赵鹏1）

1) 博士生、讲师；2) 教授；3) 硕士生，西北大学化工学院，710069西安

摘要：在小型固定床加氢装置上，用加氢精制催化剂和加氢裂化催化剂对陕北的中低温煤焦油进行加氢改质工艺研究.着重考察反应温度、反应压力、氢油体积比和液体体积空速对加氢效果的影响，得到了优化的工艺条件：反应压力14 MPa，反应温度390 ℃，氢油体积比1 600∶1，液体体积空速0.25 h-1.加氢改质产品切割得到汽油、柴油和尾油馏分，分别占产物质量的9.82%，73.12% 和16.43%.汽柴油馏分经过简单处理后可以得到合格的产品，加氢尾油可以作为优质的催化裂化或加氢裂化原料.

关键词：中低温煤焦油，加氢改质，汽油，柴油

HYDRO-UPGRADING PROCESS OF MEDIUM AND LOW TEMPERATURE COAL TAR

Li DongLi WenhongGao XinYang XiaoyanTeng JiahuiCui Louwei and Zhao Peng

(School of Chemical Engineering, Northwest University, 710069 Xi’an)

ABSTRACT：Study on hydrogenation of medium and low temperature coal tar from Shaanxi was carried out in fixed-bed hydrogenation unit using catalysts possessing properties of hydrofining and hydrocracking. It has been emphasized to investigate the effect of reaction temperature, reaction pressure, volume ratio of hydrogen to oil, liquid hourly space velocity (LHSV) on hydrogenation. The optimum process conditions are: reaction pressure 14 MPa, reaction temperature 390 ℃，vo-lume ratio of hyrdogen to oil 1 600∶1 and LHSV 0.25 h-1. Under optimum conditions, mass fraction of gasoline was 9.82％, mass fraction of diesel oil was 73.12％, mass fraction of hydrogenation tail oil was 16.43％. Through a simple treatment,we can get qualified oil products from fraction of gasoline and diesel. The hydrogenation tail oil could be used as superior FCC or hydrocracking feedstock.

KEY WORDS：medium and low temperature coal tar, hydro-upgrading, gasoline, diesel

利用粉煤灰合成Na-X沸石的研究（85-88）

崔杏雨1)陈树伟2)尹辉3)谭建冬3)李瑞丰4)

1) 硕士、高级工程师；3) 硕士生，太原理工大学精细化工研究所；2) 副教授；4) 教授、博士生导师，太原理工大学化学化工学院，030024太原

摘要：以太原某热电厂粉煤灰为原料，采用碱熔融法，考察了碱度、晶化温度和晶化时间对合成Na-X沸石的影响.结果表明，在粉煤灰/NaOH为1∶1.2（摩尔比），熔融温度550 ℃，NaOH浓度为3.75 mol/L（即加水40 mL），晶化温度90 ℃，晶化时间6 h的条件下合成纯度较高的Na-X沸石；粉煤灰通过碱熔融法合成的Na-X沸石质量明显优于传统水热法.

关键词：粉煤灰，Na-X沸石，碱熔融法，水热合成法

SYNTHESIS OF Na-X ZEOLITE FROM COAL FLY ASH

Cui XingyuChen Shuwei\*Yin HuiTan Jiandong and Li Ruifeng\*

(Institute of Special Chemicals, Taiyuan University of Technology；\* College of Chemistry and Chemical Engineering, Taiyuan University of Technology, 030024 Taiyuan)

ABSTRACT：Na-X zeolites were successfully synthesized using the coal fly ash from a thermo-electric plant in Taiyuan by fusion method. The effects of treatment conditions, including NaOH concentration, operating temperature and hydrothermal reaction time, were investigated. The optimal synthetic conditions for Na-X were found to be as follows: ash/NaOH ratio is 1∶1.2, fusion temperature is 550 ℃，NaOH concentration is 3.75 mol/L (addition of 40 mL H2O), reaction temperature is 90 ℃ and reaction time is 6 h. The synthesizing Na-X zeolite by fusion method has higher purity and better crystallinity than that by conventional hydrothermal method.

KEY WORDS：coal fly ash,Na-X zeolite,fusion method,hydrothermal method

新型中间相炭微球的制备及表征（89-91）

柯余良1)林起浪2)郭单余1)张高校3)

1) 硕士生；2) 博士后、副教授；3) 本科生，福州大学材料科学与工程学院，350108福州

摘要：采用甲醛对煤沥青进行聚合改性，然后经热聚合工艺制备中间相炭微球（MCMB），并对MCMB的结构及性能进行了研究.采用偏光显微镜和XRD对MCMB的结构进行分析，采用SEM对所制备的MCMB形貌进行分析，采用TGA对MCMB的热行为进行分析.结果表明，所制备的MCMB收率达35.1%，其平均粒径约为10 μm，MCMB表面聚集了粒径小于0.5 μm的小球；粒径较小的MCMB在偏光显微镜下不呈现各向异性；MCMB的平均微晶层间距d002为0.342 0 nm，平均微晶高度Lc为3.42 nm，平均微晶大小La为2.38 nm；MCMB的5％（质量分数）热分解温度为618 ℃，整个过程的总失重率为15.12%.

关键词：煤沥青，MCMB，制备，结构

PREPARATION AND STRUCTURES OF NOVEL MESOCARBON MICROBEADS

Ke YuliangLin QilangGuo Danyu and Zhang Gaoxiao

(College of Materials Science and Engineering, Fuzhou University, 350108 Fuzhou)

ABSTRACT：Mesocarbon microbeads (MCMB) were prepared from coal-tar pitch by pyrolysis condensation of coal-tar pitch modified with formaldehyde in the presence of oxalic acid. The structures of the MCMB were characterized by polarized light microscopy and XRD. The morphologies of the MCMB were analyzed using SEM, and the thermal behavior of the MCMB was studied by TGA. The results indicate that the yield of MCMB, which have the average size of 10 μm, arrives at 35.1%. Moreover, there are a large number of microspheres with the size below 0.5 μm congregate together on the surfaces of the MCMB. The MCMB with low particle size don’t exhibit optical anisotropy under the polarized light microscopy. Furthermore, the interlayer space (d002) and crystallite height and crystallite size of MCMB are 0.342 0 nm, 3.42 nm, and 2.38 nm respectively. The characteristic degradation temperature at 5% mass loss is 618 ℃, and the total weight loss of the MCMB is 15.12%.

KEY WORDS：coal-tar pitch， mesocarbon microbeads (MCMB)， preparation， structures

生物质焦对甲苯的催化裂解实验研究（92-96）

彭军霞1)赵增立2)王小玲3)李海滨4)

1) 博士生；3) 硕士生，中国科学院研究生院，100039北京；中国科学院广州能源研究所，中国科学院可再生能源与天然气水合物重点实验室，510640广州；2) 研究员；4) 研究员、博士生导师，中国科学院广州能源研究所，中国科学院可再生能源与天然气水合物重点实验室，510640广州

摘要：为降低生物质气化气中焦油含量，在小型固定床反应器上，进行了生物质焦对焦油模型化合物甲苯的催化裂解反应的实验研究，考察了热解焦粒径、裂解温度、气相停留时间和反应气氛对甲苯裂解率的影响.结果表明，高温条件下，热解焦对甲苯的裂解具有明显的催化作用.950 ℃时，所用的两种热解焦对甲苯的转化率分别达到了98%以上，同时发现，较长的气相停留时间更有利于甲苯的裂解.水蒸气或CO2能与甲苯和碳发生反应，提高甲苯的转化率，延长焦的催化活性；另外，动力学计算得出，生物质焦对甲苯催化裂解的活化能约为73 kJ/mol.

关键词：生物质焦，催化裂解，甲苯

CATALYTIC DECOMPOSITION OF TOLUENE OVER BIOMASS CHAR

Peng Junxia1,2Zhao Zengli1Wang Xiaoling1,2 and Li Haibin1

(1.Guangzhou Institute of Energy Conversion, Key Laboratory of Renewable Energy and Gas Hydrate, Chinese Academy of Sciences, 510640 Guangzhou; 2.Graduate School of Chinese Academy of Sciences, 100039 Beijing)

ABSTRACT：In this paper the effects of particle size, temperature, retention time and gas components on tar decomposition using toluene as model tar compounds were investigated. Tests were carried out in a fixed bed tubular reactor under atmospheric pressure using biomass char as catalysts. It was concluded that biomass char showed high catalytic activity. At 950 ℃ toluene conversion achieve to 98% over two kinds of chars. Longer retention time lead to higher toluene conversion. Steam or CO2 can enhance toluene conversion and prolong the activity of char as they can react with toluene and carbon. Calculated by a simple first order kinetic model biomass char had an activation energy of 73 kJ/mol.

KEY WORDS：biomass char, catalytic decomposition, toluene