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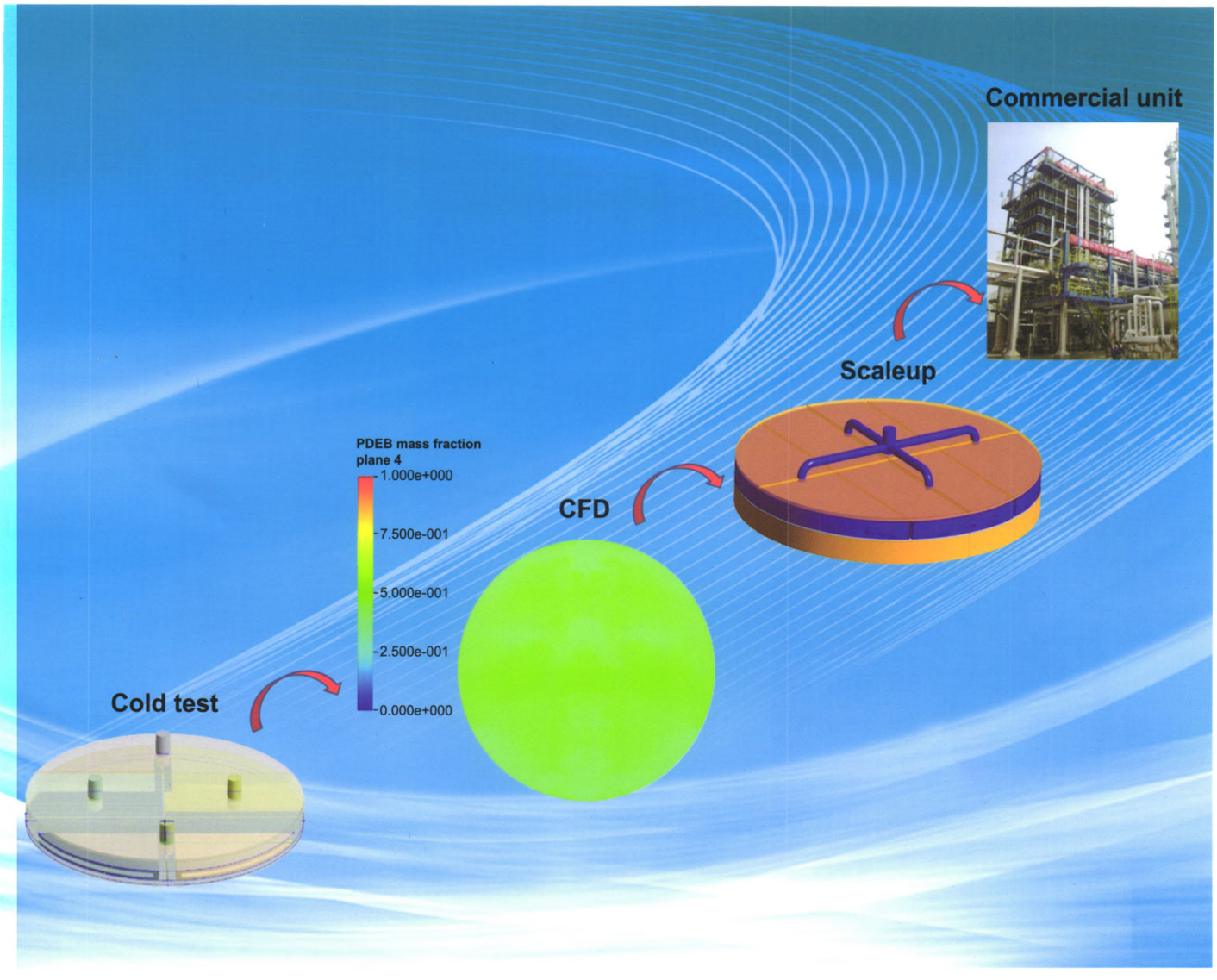
ACTA PETROLEI SINICA
(PETROLEUM PROCESSING SECTION)



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（石油加工）

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ACTA PETROLEI SINICA

(PETROLEUM PROCESSING SECTION)

Vol. 33 No. 5 Sep. 2017

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Research Articles

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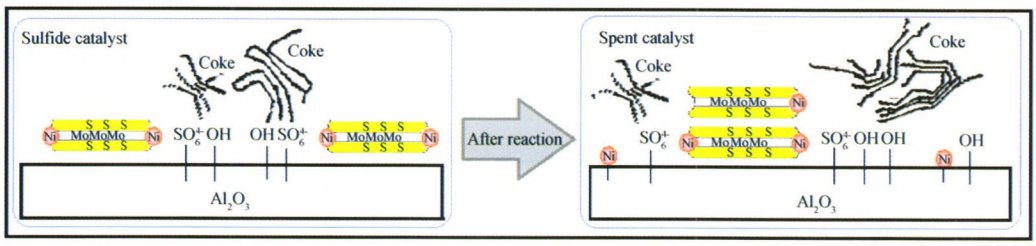
Effect of Feedstock's Properties on NiMoW/Al_2O_3 Catalyst Stability in Ultra-Low Sulfur Diesel Production

ZHANG Le LI Mingfeng DING Shi LI Huifeng

The mechanisms for NiMoW/Al_2O_3 catalyst deactivation in ultra-low sulfur diesel (ULSD) production were studied with different feedstocks. More inferior raw feed could accelerate the deactivation rate of the NiMoW/Al_2O_3 catalyst due to the coke formation, resulting in worse diffusion limitation and lower active center accessibility, and more active phase aggregation.

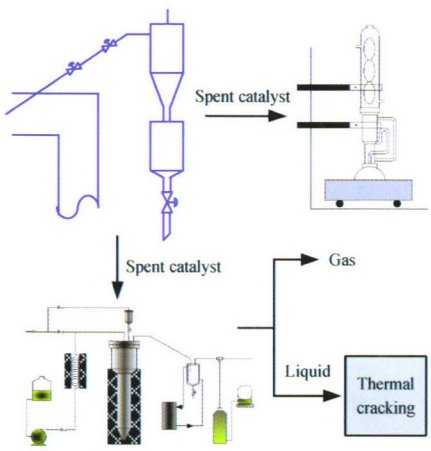


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 842-848 **doi**: 10.3969/j.issn.1001-8719.2017.05.004

Changes of Adsorbed Hydrocarbons on Spent Catalyst in Disengager of a Two-Stage Riser Fluid Catalytic Cracking Unit

LIU Yibin YAN Hao SUN Xiaofang FENG Xiang YANG Chaohe

The spent catalyst from an industrial TSRFCC plant was extracted with toluene as solvent and stripped with steam as a medium. The liquid of stripped hydrocarbons was gathered to carry out thermal cracking.

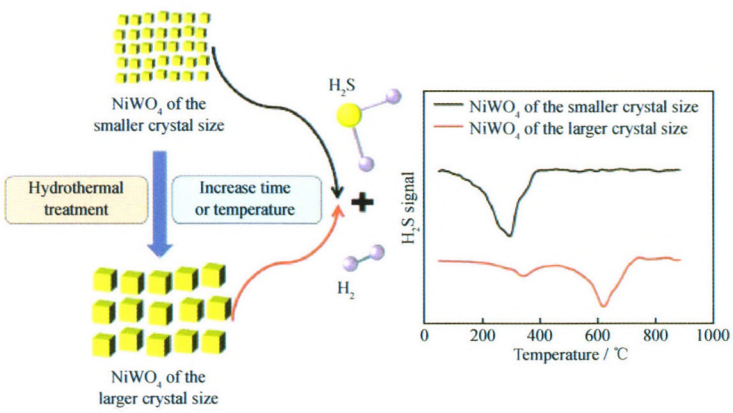


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 849-857 **doi**: 10.3969/j.issn.1001-8719.2017.05.005

Experimental Study on the Sulfidation Behavior of $NiWO_4$ Nanoparticles

ZHAI Weiming LI Huifeng ZHANG Le
LI Mingfeng

$NiWO_4$ nanoparticles were synthesized by the method of solid-state reaction and coprecipitation. The crystal size of $NiWO_4$ nanoparticles was modulated by changing the temperature or the time of hydrothermal treatment. It was found that they had significant effect on sulfidation behaviors in the temperature-programmed sulfidation process.

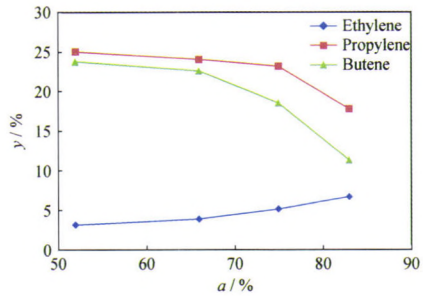


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 858-864 **doi**: 10.3969/j.issn.1001-8719.2017.05.006

Catalytic Cracking Performance of Fischer-Tropsch Synthesis Waxes

YANG Chao

Catalytic cracking performance of Fischer-Tropsch synthesis waxes (F-T waxes) was studied using a ZSP zeolite containing catalyst. The activity of the catalyst had little effect on the conversion of F-T waxes, but large influence on the product distribution. As the activity of the catalyst increased, the yields of dry gas and coke increased significantly, but the yield of LPG changed little. F-T waxes cracked on the catalyst with low activity tended to enhance the yield of light olefins. The yield and selectivity of light olefins could be improved further using coke modified catalyst. More light olefins were generated on the catalyst with 0.6% — 0.8% carbon deposited.

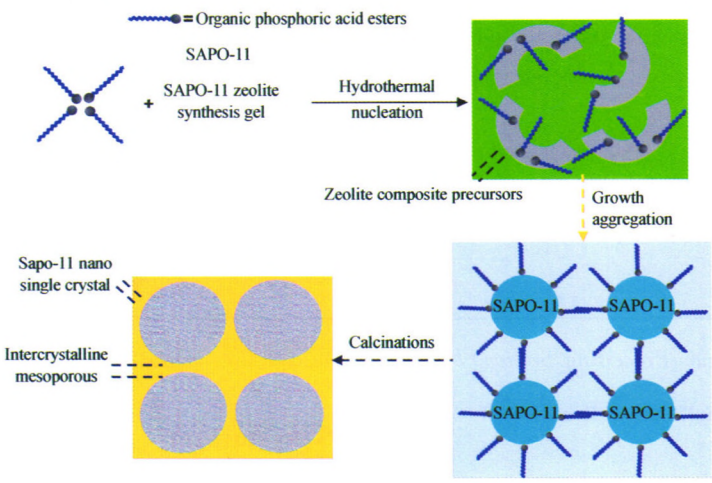


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 865-872 **doi**: 10.3969/j.issn.1001-8719.2017.05.007

Impact of Different Alkyl Chain Lengths on Physicochemical Properties and Hydroisomerization of SAPO-11 Molecular Sieves Synthesized With Organic Phosphoric Acid Esters

XIAO Han ZANG Jiazhong SONG Guoliang WANG Shuai ZHANG Jingcheng NAN Jun YU Haibin

Small-particle-size SAPO-11 molecular sieves with intercrystralline mesoporous were synthesized by adding alkyl organic phosphoric acid esters(APE) into SAPO-11 sol system. The P atoms in APE participate in the formation of microporous SAPO-11 frameworks,and the long alkyl groups prevent the growth of SAPO-11 crystal and thus control the size of SAPO-11 particle.

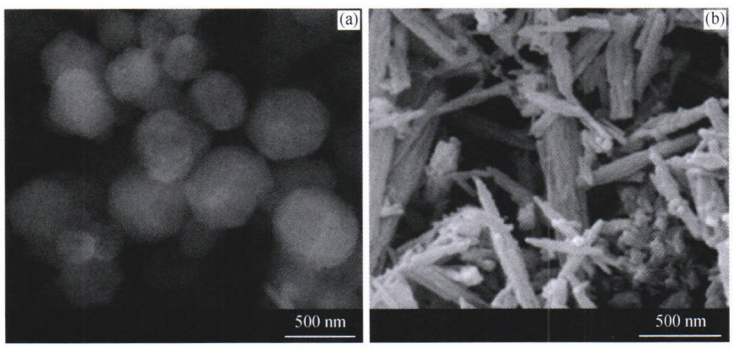


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 873-879 **doi**: 10.3969/j.issn.1001-8719.2017.05.008

Study on Hydroisomerization Catalysts——Effect of Acid Property

BI Yunfei XIA Guofu HUANG Weiguo FANG Wenxiu

ZSM-12 and ZSM-22 with one dimensional and medium size pores were synthesized and used as the acid components of hydroisomerization catalysts. The tests for the transformation of *n*-decane revealed that the sum of acid sites was a key factor determining the activities of the catalysts. When the conversion was less than 85%, the sum of acid sites affects the isomer selectivity in a level stronger than the ratio of strong Brönsted to weak Brönsted. Moreover, the tests also indicated that the acid properties of a zeolite were related by its pore structure.



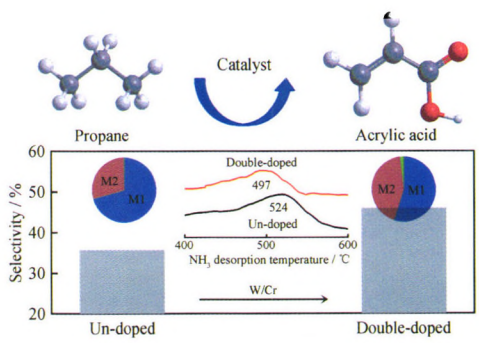
(a) ZSM-12-30; (b) ZSM-22-30

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 880-887 **doi**: 10.3969/j.issn.1001-8719.2017.05.009

Effect of W/Cr Doping on the Catalytic Performance of Propane Oxidation on MoVTeNbO Catalyst

ZHU Ning LIU Xueting CHENG Wenjun YAN Lin LI Shuangming
LI Wenxiu YU Sansan

Doping of W and Cr can decrease the surface acidity and increase M2 phase content of MoVTeNbO catalyst, and W/Cr double-doped catalyst exhibits excellent selectivity of acrylic acid in the selective oxidation of propane, out performing that of un-doped catalyst.

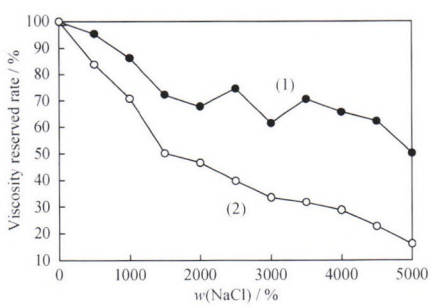


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 888-892 **doi**: 10.3969/j.issn.1001-8719.2017.05.010

Synthesis of T-Like Polyacrylamide and Its Structure and Performance Study

ZHU Rongjiao JIANG Weiwei TIAN Yuqin FANG Qiang
ZHONG Qing LIU Bo CHEN Lei GUO Hongwei JIN Yanxin

The polyacrylamide with T-like structure was synthesized using AA, AM, AMPS and VO as monomers. It was found that the performances of T-like polyacrylamide were better than that of HPAM in terms of temperature tolerance and salt resistance.



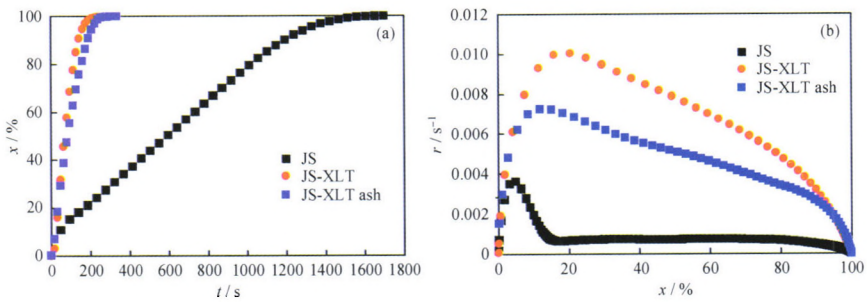
(1) T-like PAM; (2) HPAM

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 893-900 **doi**: 10.3969/j.issn.1001-8719.2017.05.011

Feasibility Study on Catalytic Gasification of Petroleum Coke at High Temperatures

REN Liwei WEI Ruidi GAO Yuhong XIN Jing

The mineral rich in Fe and Ca has an obvious catalytic effect on the gasification of petroleum coke at a high temperature. The unreacted carbon can inhibit the fusion of minerals during gasification which provides the possibility of catalytic gasification of petroleum coke at a high temperature.



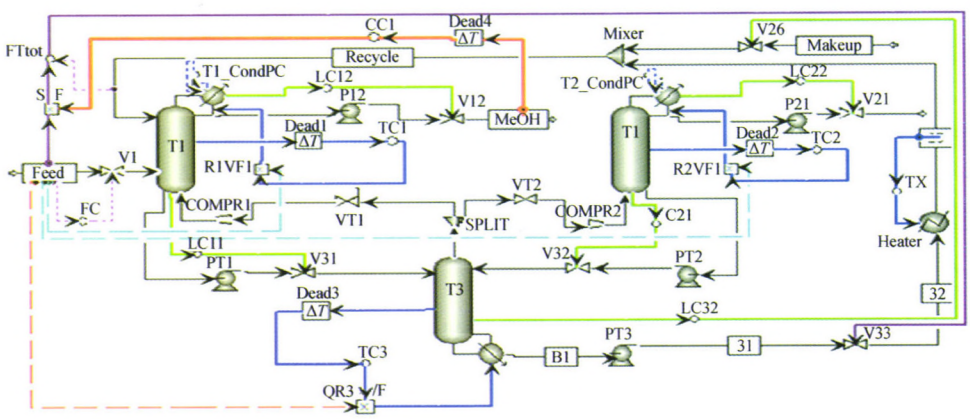
Blending mass ratio of JS and XLT is 1/1, adding amount of XLT ash is 10%;
(a) Conversion (x) vs time (t); (b) Gasification rate (r) vs conversion (x)

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 901-909 **doi**: 10.3969/j.issn.1001-8719.2017.05.012

Design and Control of Dimethyl Carbonate and Methanol Separation by an Extractive Dividing Wall Column

PENG Jiayao ZHANG Qingrui GUO Tong LÜ Minglian

This paper presents a criterion for the selection of the temperature control stage in the main column. In addition, the dynamic simulation results revealed that the improved control structures without vapor split ratio with stage 5 selected as the control stage could act as the control scheme.



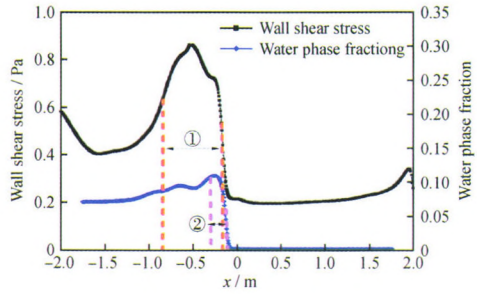
Control structure without vapor split ratio

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 910-918 **doi**: 10.3969/j.issn.1001-8719.2017.05.013

Numerical Simulation of Gas-Liquid Phase Flow Characteristic of Injection T-tube in Hydrogenation Reactor Effluent Air Cooler Systems

JIN Haozhe LIU Wenwen OU Guofu CHEN Xiaoping LI Pengxuan

As shown in Fig. 8, the inter section area of maximum value in wall stress shear and water phase fraction is from $x=0.15$ m to $x=0.26$ m. The generated ammonium salt by chemical reaction in this area will dissolve in the presence of water. In the area of bigger wall stress shear, it will be easy to cause erosion failure on the basis of corrosion.



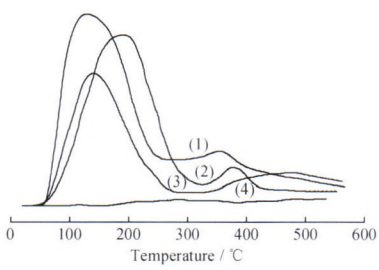
Research Notes

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 919-926 **doi**: 10.3969/j.issn.1001-8719.2017.05.014

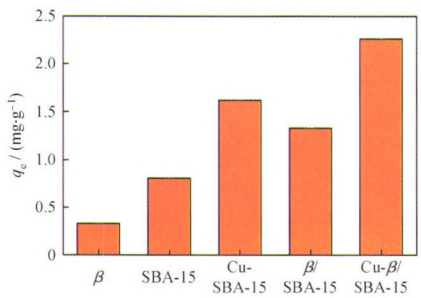
Preparation and Adsorption Desulfurization Performance of Cu-β/SBA-15 Composite Molecular Sieves

YANG Jing MING Yang SUN Yu WANG Junfeng SHI Weiwei SHEN Jian

The adsorbent of Cu-β/SBA-15 was synthesized by the impregnation method and the samples were characterized using a number of analysis methods. The Cu-β/SBA-15 that was adsorbent prepared under the optimum of conditions could retain the micro-mesoporous composite structure of β/SBA-15 well. The acidity of the adsorbent was improved, thus the sulfur capacity was increased.



(1) Cu-β/SBA-15; (2) β/SBA-15; (3) Cu-SBA-15; (4) SBA-15



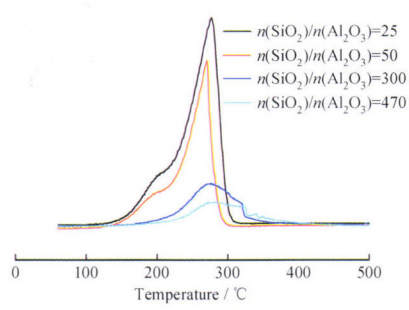
Reaction conditions: $m_{oil}=30$ g; $t=2$ h; $T=120$℃; $m_{ads}=1$ g

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 927-933 **doi**: 10.3969/j.issn.1001-8719.2017.05.015

The Desorption Law and Alkylation of Benzene With Methanol on HZSM-5 Zeolites

SUN Renshan HUANG Xingliang ZHAO Leilei GONG Yan ZHANG Xin ZI Qin CAO Zhongyang

Toluene was found during the temperature-programmed desorption (TPD) after methanol adsorbed on HZSM-5 at 60℃, and with the higher silica to alumina ratio, the less amount of toluene was detected.

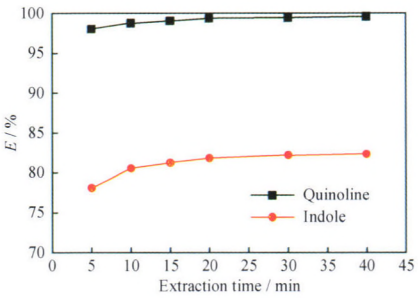


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 934-940 **doi**: 10.3969/j.issn.1001-8719.2017.05.016

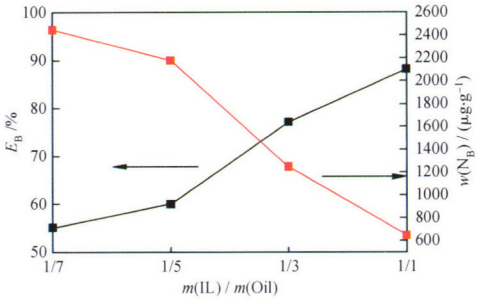
Removal of Nitrogen Compounds From Fuel Oil With [C_4mim]Br/$ZnCl_2$ Ionic Liquid

ZHOU Zhaoqian LI Wenshen LIU Jie

Metal-based ionic liquid [C_4mim]Br/$ZnCl_2$ was synthesized, and its structure was characterized with FT-IR spectroscopy and ^{1}H NMR. The ionic liquid [C_4mim]Br/$ZnCl_2$ exhibited excellent removal performance for basic nitrogen compounds, and under the experiment conditions, basic nitrogen denitrogenation efficiency from model oil and Fushun shale diesel distillate could reach 99% and 88%, respectively.



Extraction temperature 40℃, m(IL)/m(Oil)=1/7, Settling time 2 h



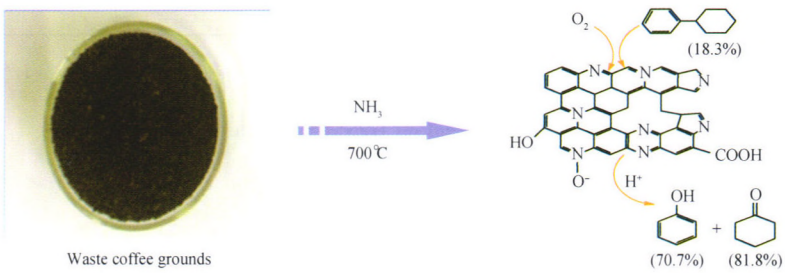
Extraction temperature 40℃, Extraction time 30 min, Settling time 2 h

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 941-949 **doi**: 10.3969/j.issn.1001-8719.2017.05.017

Preparation of Nitrogen-Doped Carbon Material From Waste Coffee Grounds and Its Catalytic Performance in Cyclohexylbenzene Oxidation

FENG Yangyang SHAN Yuhua ZHENG Yitian LI Mingshi LU Mohong

A new *N*-doped carbon material, prepared from waste coffee grounds and NH_3 at 700℃, exhibits good catalytic performance in cyclohexylbenzene(CHB) oxidation to phenol and cyclohexanone. The graphite-type doped nitrogen species on the surface play a significant role for the formation of the catalytic active sites. No obvious catalytic performance change has been observed after it was reused 10 times. The results demonstrated the NC-700 is a stable, reusable and clean catalyst for converting CHB into phenol and cyclohexanone.



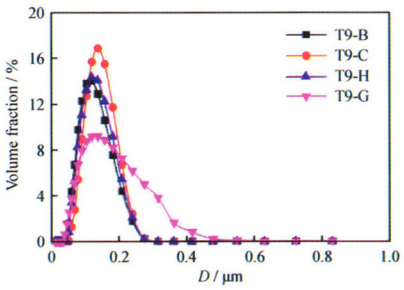
Waste coffee grounds

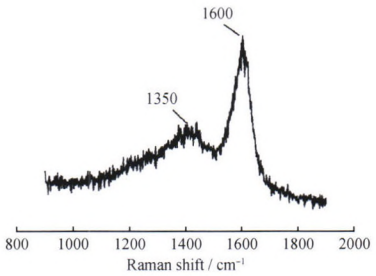
Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 950-958 **doi**: 10.3969/j.issn.1001-8719.2017.05.018

Analysis of the Diesel Engine Oil Soot's Physical and Chemical Properties in the Mack T-9 Bench Test

YANG He ZHENG Aiguo HAO Lichun LU Wentong SONG Haiqing

Soot particles are composed by a dozen of crystallites with the size of 1.789 nm, and form assembling soot particles with the size from 200 nm to 300 nm due to van der Waals forces. Lubricant oils with fewer big soot particles exhibit better anti-wear performance due to better dispersibility.





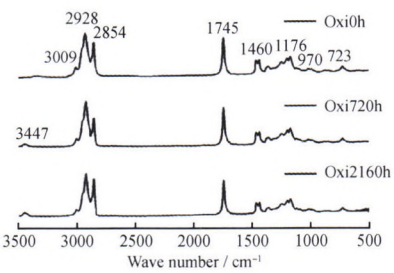
The ordinate of the figure represents the percentage of the volume of particles with specific diameter accounted for the volume of total particles

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 959-965 **doi**: 10.3969/j.issn.1001-8719.2017.05.019

Effect of Biodiesel Oxidation Stability on Diesel Engine Performance and Emission

WANG Zhong YANG Dan FENG Yuan LI Ruina HE Lina

Biodiesel will be oxidized during the storage. The surface functional groups of biodiesel with different oxidation times were measured by FT-IR. With the increase of oxidation time, the double bonds on the biodiesel molecules break, the content of free radicals increases and the oxidation stability deteriorates, which ultimately affects the diesel engine emission.

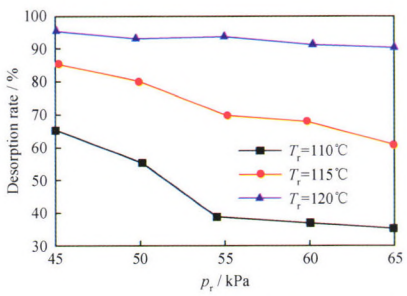


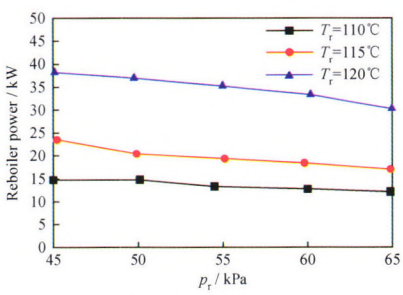
Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 966-974 **doi**: 10.3969/j.issn.1001-8719.2017.05.020

The Pilot Scale Experiment and Optimization Simulation of Decarbonization Process Parameters by Alcohol Amine

CHEN Jie TANG Jianfeng JIN Xinming HUA Yihuai CHU Jie WANG Yue ZHAO Mingyu

The accuracy of the simulation model is verified based on a pilot experiment, which can support the simulation of process parameters optimization; The parameters in the alcohol amine method of decarburization processes are optimized by using the pilot experiment device and HYSYS simulation.





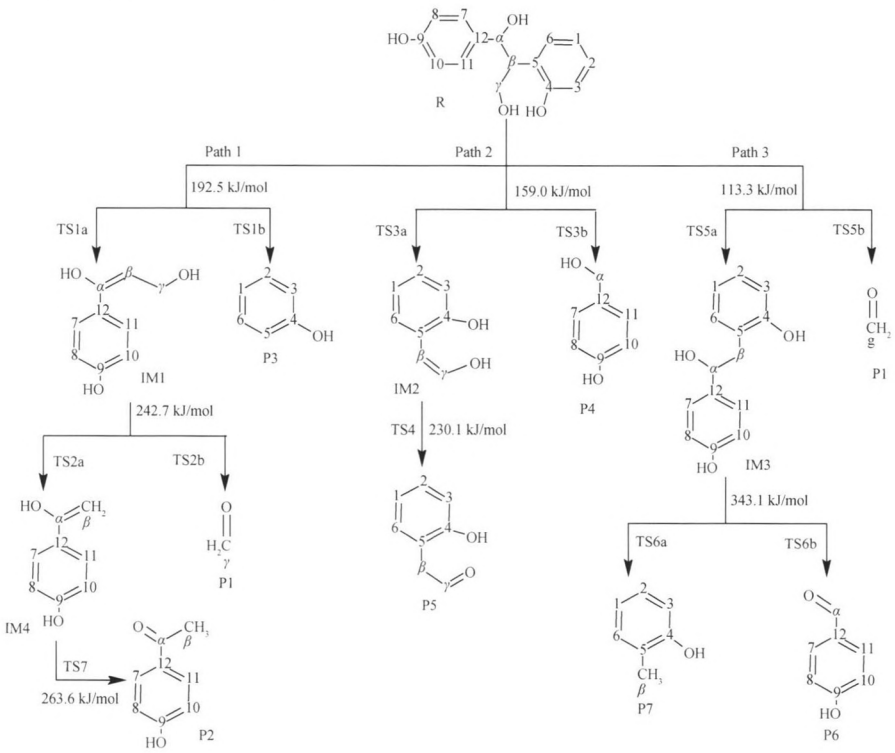
Feed gas flow 50 Nm^3/h; Amine solution circulation 0.20 m^3/h; $\varphi_F(CO_2)$ 4%—6%; T_a=50℃; p_a=3.0 MPa

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 975-984 **doi**: 10.3969/j.issn.1001-8719.2017.05.021

Density Functional Theory of Gasification Reaction of Lignan Model Compound With β-5 Linkage

ZHANG Hang DENG Shengxiang TIAN Hong CAO Xiaoling

On the basis of density functional theory (DFT), B3LYP/6-31 G+(*d*,*p*) method was used to investigate gasification reaction of lignan model compound with β-5 linkage from thermodynamics and kinetic perspective. Three pyrolysis reaction pathways and corresponding subsequent reactions were considered. Results showed that Path 2 was the optimal reaction path, namely C_α—C_β key fractured more easily in the lignan model compound. Path 4 was optimal in the subsequent reaction.

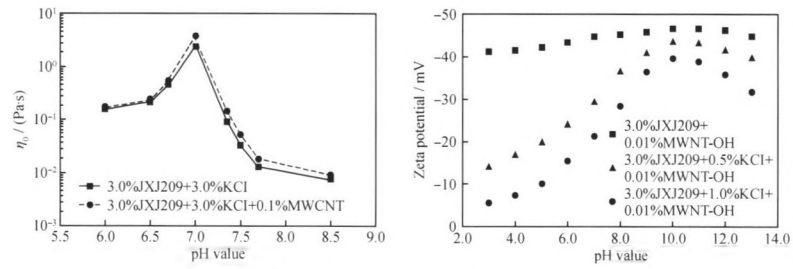


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 985-991 **doi**: 10.3969/j.issn.1001-8719.2017.05.022

Effect of pH Value and Salinity on Rheological Properties of Carbon Nanotubes/Wormlike Micelle Solution

QIN Wenlong JIANG Guanfeng LIANG Guoqi LI Ran YANG Jiang

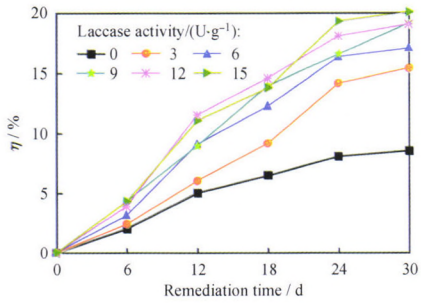
A pH-responsive wormlike micelle system was formed by 3.0% sodium-methyl-*N*-oleoylaminoethylsalfonate (JXJ209) dissolved in 3.0% brine with potassium chloride (KCl). The MWNT-OH can obviously improve the viscosity and elasticity of anionic wormlike micelle solution under the conditions of low salinity or alkaline because the MWNT-OH is more stable under the same condition.



Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 992-997 **doi**: 10.3969/j.issn.1001-8719.2017.05.023

Influence of Laccase Activity on Characteristic and Microbial Activity of Oil-Contaminated Soil

ZHENG Hongting ZHONG Zhesen ZHANG Xiuxia LI Zhenwei SHANG Qiongqiong



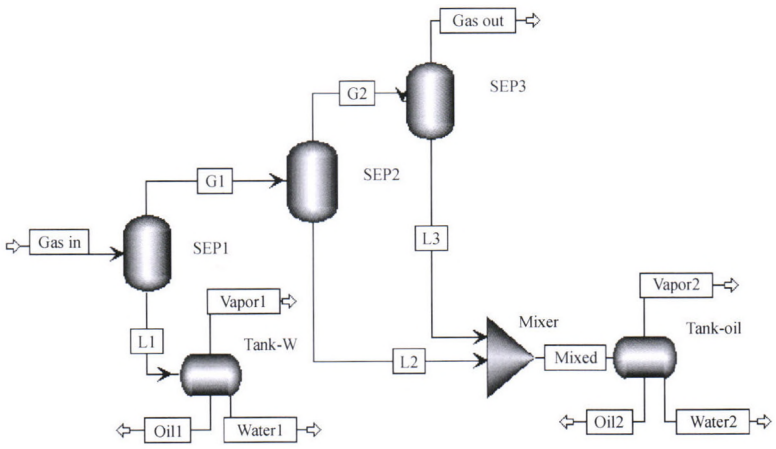
It has been shown that increasing the activity of laccase is helpful to enhance the biodegradable indigenous microbial effect of petroleum hydrocarbon. The result showed that when the activity of laccase was 12 U/g, the effect of oil degradation was the best and after 30 d degradation the degradation rate could reach 19 percent, which advanced about 10 percent as compared to the control group without regulating the activity of laccase in soil.

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 998-1006 **doi**: 10.3969/j.issn.1001-8719.2017.05.024

Identification of State Equation and Process Optimization for the Condensation Simulation of Oil Vapor Recovery With Water Content

QIN Xiuyu HUANG Weiqiu LÜ Aihua ZHOU Ning LIU Peng WANG Hongning HAO Qingfang

There is only one recovery tank with oil-water separation effect but without insulation in the traditional condensing recovery process. The optimized process has two recovery tanks, one tank to recovery the products of the precooling stage and the other to recovery the products of the second and third condensing stage. By analyzing, we find that the two recovery tanks do not need to set the oil-water separation structure, but the one which recovery the products of the second and third condensing stage needs insulation to reduce the re-volatilization of oil.



SEP1—Precooling stage; SEP2—Second condensing stage; SEP3—Third condensing stage; Tank-W—Condensed water recovery tank; Tank-oil—Condensed oil recovery tank

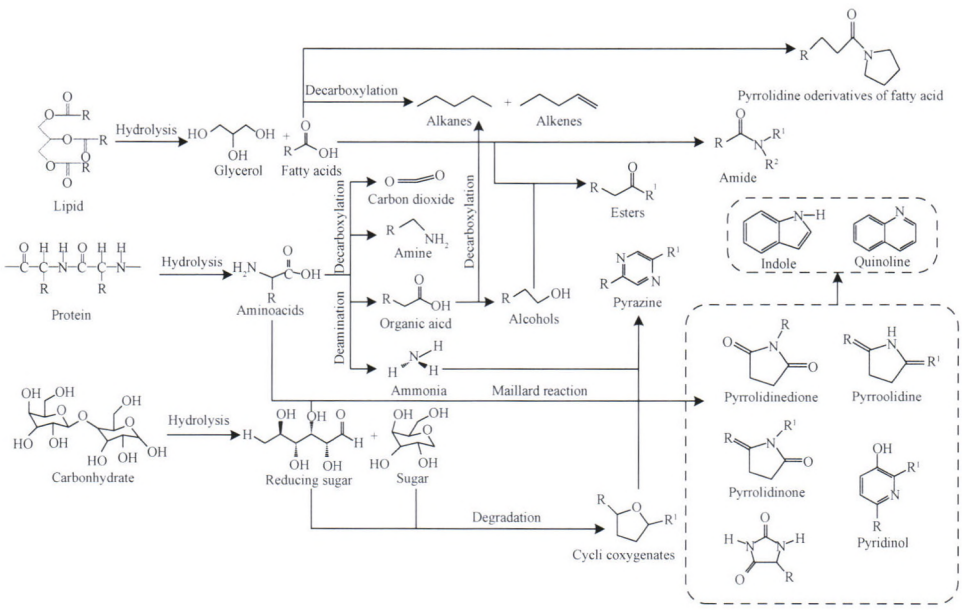
Reviews

Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 1007-1016 **doi**: 10.3969/j.issn.1001-8719.2017.05.025

Research on Bio-Oil Production From High-Protein Algae via Two-Step Hydrothermal Liquefaction

ZHUANG Xiuzheng HUANG Yanqin YIN Xiuli WU Chuangzhi

We reviewed the studies on one-step hydrothermal liquefaction and proposed a two-step hydrothermal liquefaction. In particular, we reported the latest study on bio-oil produced from high-protein algae via two-step hydrothermal liquefaction and the liquefaction pathway of protein, lipid and carbohydrate and suggested several promising research directions.

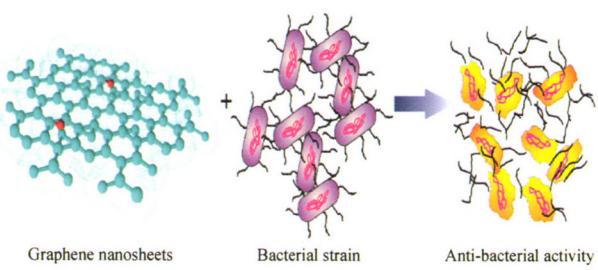


Acta Petrolei Sinica (*Petroleum Processing Section*), 2017, 33(5): 1017-1028 **doi**: 10.3969/j.issn.1001-8719.2017.05.026

Progress in the Application of Graphene and Its Composites in Antibacterial

JIANG Guofei LIU Fang SUI Linlin WANG Hongxi WANG Yongqiang ZHAO Chaocheng

Graphene shows an excellent antibacterial property, which can effectively inhibit the growth of gram-negative and gram-positive bacterium. It can make the antibacterial ability better with the composites of graphene and Ag, ZnO, chitosan. Also, the ultrafiltration membrane and antimicrobial coating prepared by graphene composites can be widely used in water treatment, bio-medical equipment, pharmaceutical and other fields.



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