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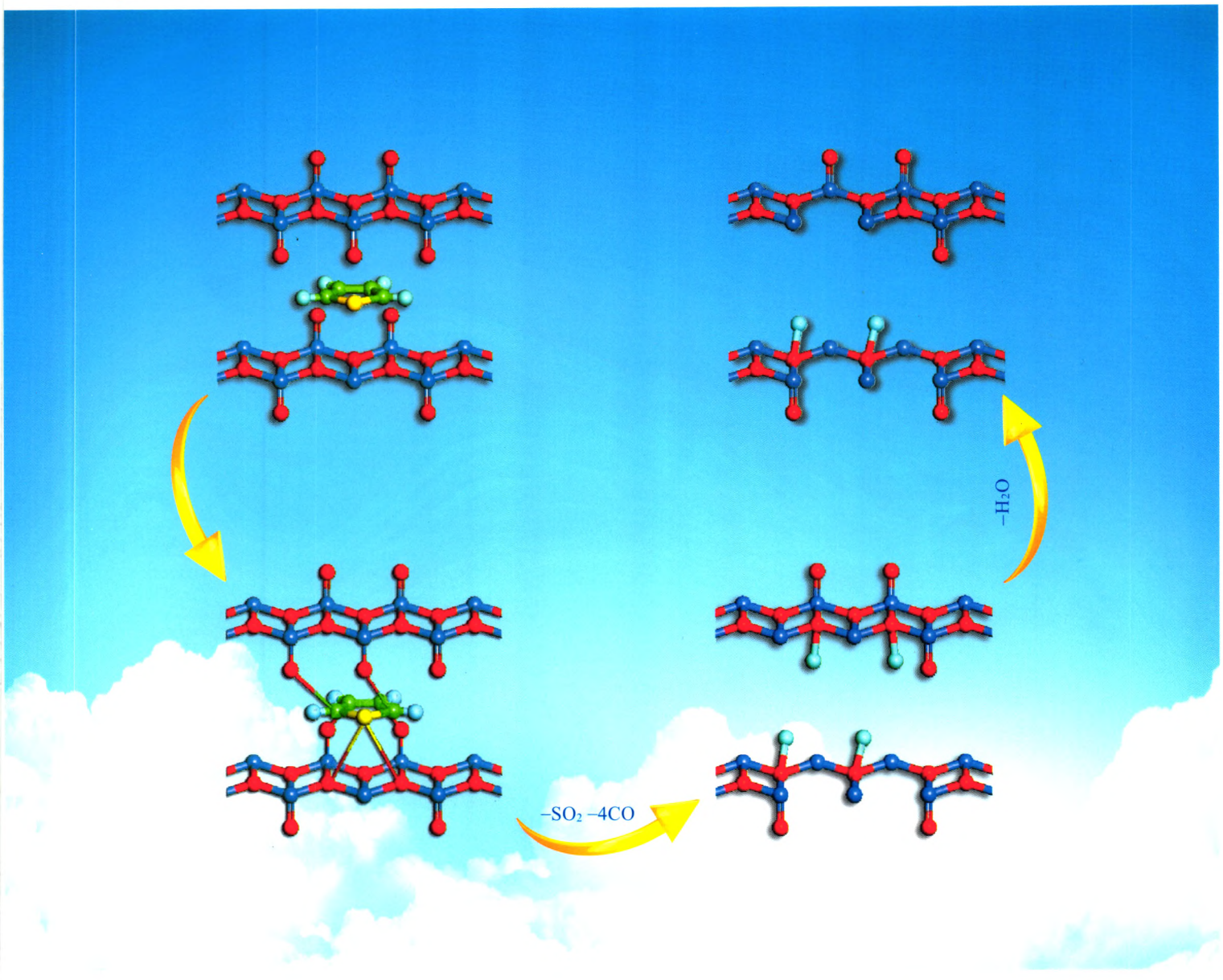
ACTA PETROLEI SINICA
(PETROLEUM PROCESSING SECTION)



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（石油加工）

第 29 卷 第 3 期 2013 年 6 月

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ACTA PETROLEI SINICA

(PETROLEUM PROCESSING SECTION)

Vol. 29 No. 3 Jun. 2013

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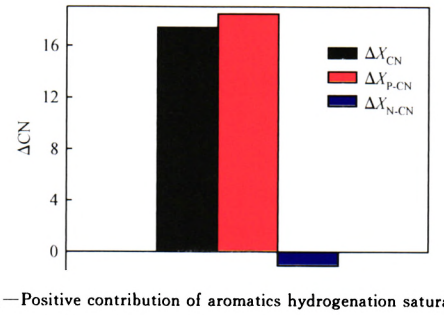
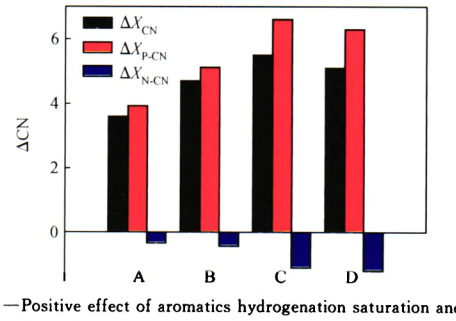


$\Delta X_{P\text{-}CN}$—Positive contribution of aromatics hydrogenation saturation; $\Delta X_{N\text{-}CN}$—Negative contribution of cracking reaction of hydrocarbons with long side-chain; ΔX_{CN}—Actual improvement of CN



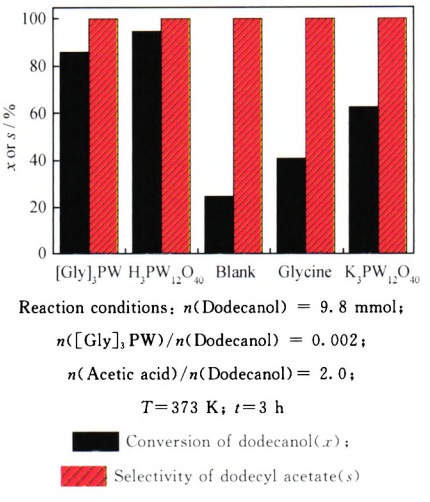
$\Delta X_{P\text{-}CN}$—Positive effect of aromatics hydrogenation saturation and ring opening of cyclic hydrocarbons; $\Delta X_{N\text{-}CN}$—Negative effect in the cracking of side-chain of cyclic hydrocarbons; ΔX_{CN}—Actual improvement of CN

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 383-389 **doi**: 10.3969/j.issn.1001-8719.2013.03.003

Preparation of Amino Acid Functionalized Heteropolyacid Salt and Its Catalytic Performance for Solvent-Free Esterification of Dodecanol With Acetic Acid

LIU Jing HUANG Xiaowen ZHAO Xiaoping LIU Xiumei
YAN Peifang WANG Chang GAO Yan'an

A new amino-acid functionalized heteropoly tungstates $[Gly]_3PW$ was prepared via one-step synthesis method with glycine and phosphotungstic acid as raw materials. Its catalytic performance was investigated through the esterification of dodecanol with acetic acid. The good catalytic activity of $[Gly]_3PW$ demonstrated that it was a very potential organic-inorganic hybrid catalyst.

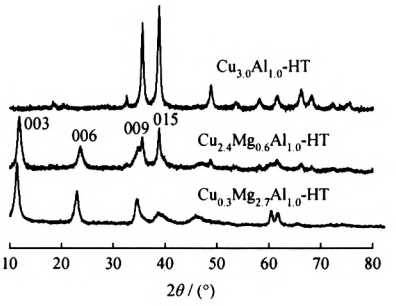


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 390-397 **doi**: 10.3969/j.issn.1001-8719.2013.03.004

Highly Selective Catalytic Oxidation of Glycerol by Cu-Containing Hydrotalcites

LIU Xianfeng ZHANG Fang WANG Xiaoli DING Keqiang
WANG Fang LIU Junhua SONG Xiaobo WU Gongde

Cu-containing hydrotalcite catalysts ($Cu_xMg_yAl_z$-CHT-T) were synthesized and used in catalytic oxidation of glycerol. Among the prepared $Cu_xMg_yAl_z$-CHT-T catalysts the $Cu_{0.3}Mg_{2.7}Al_{1.0}$-CHT-450 possessed the highest catalytic performance for glycerol oxidation with glycerol conversion rate of 57.4% and glycelic acid selectivity of 73.7%.

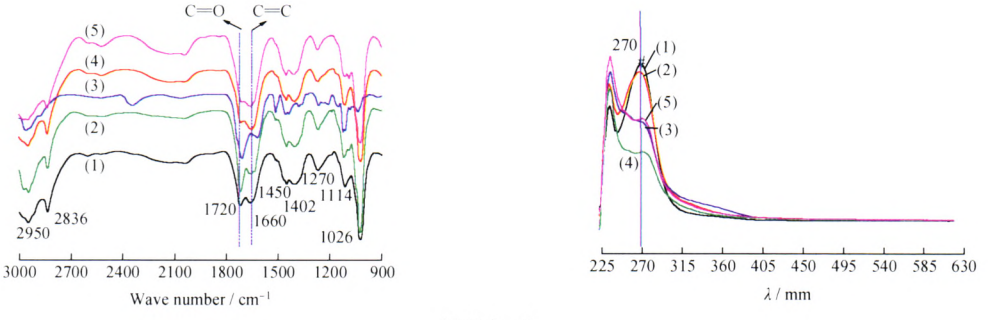


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 398-403 **doi**: 10.3969/j.issn.1001-8719.2013.03.005

Upgradation of Light Fraction of Biomass Oil via Catalytic Hydrogenation

HU Enzhu XU Yufu LI Wendong LIU Tianxia HU Xianguo

The light fraction oil obtained from crude biomass oil could be catalytic hydrodeoxygened over MoS_2 catalyst at 150, 250, 350, 250/350℃ and 2 MPa, respectively. The catalytic hydrodeoxgenation mechanism over MoS_2 could be clarified via the unsaturated functional bonds (C=C and C=O sites) of the components in the light fraction oil that were easily attacked by the hydrogen during the proper temperature and pressure.



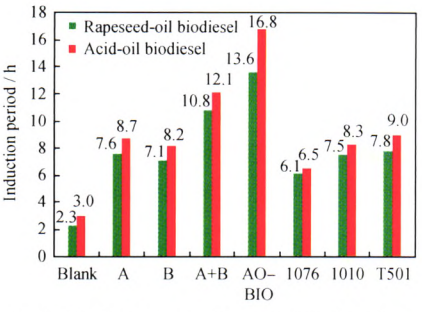
(1)Light oil;
Upgraded oil, T/℃: (2) 150; (3) 250; (4) 350; (5) 150/350

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 404-408 **doi**: 10.3969/j.issn.1001-8719.2013.03.006

Synthesis of Phenol-Amide Antioxidant AO-BIO and Its Application in Biodiesel

LIU Jinsheng LIN Jianmin ZHANG Jianrong ZHANG Yongguang

N-containing groups were introduced into methyl 3-(3,5-di-*tert*-butyl-4-hydroxyphenyl) propionate through the ester-to-amide reaction and antioxidant AO-BIO was obtained. The novel antioxidant AO-BIO showed better performances than other common phoenic antioxidants in the acid oil biodiesel, rapeseed oil biodiesel and biodiesel fuel blends tested by using Rancimat oxidation test method(EN 14112:2003 and EN 15751:2009).



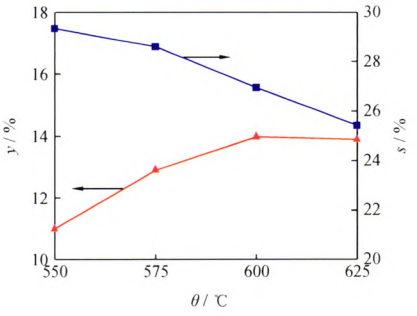
A—3,5-Methyl ester; B—*N*-aminoethyl piperazine; A+B—The complex of 3,5-methyl ester and *N*-aminoethyl piperazine with the mole ratio of 1

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 409-415 **doi**: 10.3969/j.issn.1001-8719.2013.03.007

Kinetic Modeling of Gasoline Catalytic Cracking to Propylene Ⅱ. Model Analysis

LÜ Lufeng LI Bo HE Jinlong HOU Shuandi

The effects of reaction temperature, catalyst/oil mass ratio and mass space velocity on the product distribution of FCC gasoline catalytic cracking performance were investigated by using a fixed-fluidized bed reactor. The kinetic model was analyzed by experimental results, showing that calculated results of cracking product distribution were well consistent with experimental data.

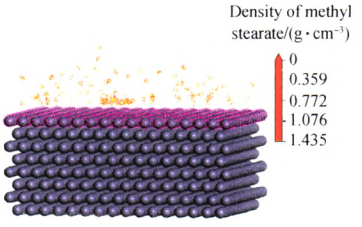


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 416-421 **doi**: 10.3969/j.issn.1001-8719.2013.03.008

Molecular Dynamics Simulation on the Adsorption Behavior of Biodiesel Components on Iron Surface

LUO Hui FAN Weiyu LI Yang NAN Guozhi

The adsorption behaviors of biodiesel components on Fe(110) surface were investigated by using molecular dynamics(MD) simulations. Biodiesel components could be adsorbed on the iron surface to form a hydrodynamic film and improve the lubricity of low-sulfur diesel. Double bonds or hydroxyl group introduced or an increase in the chain length could enhance the stability of the adsorbed films.

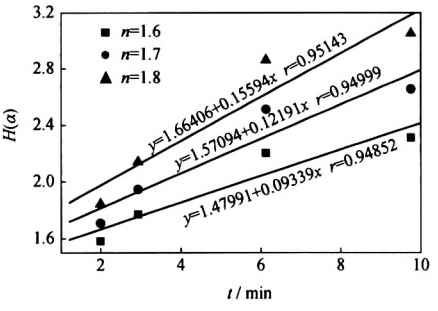


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 422-426 **doi**: 10.3969/j.issn.1001-8719.2013.03.009

Pyrolysis Kinetic Analysis for Water-soluble Fraction of Bio-oil in Fixed Bed Reactor

LIU Shaomin CHEN Mingqiang HU Qingsong
YANG Zhonglian LI Feng WANG Juan WANG Jun

Thermodynamic parameters and the reaction order of water-soluble fraction of bio-oil were investigated. Fig. 1 showed the relation of $H(\alpha)$ and time at different reaction orders in the decomposition stage. The r values illustrated that the reactions were in well conformity with the corresponding reaction order.

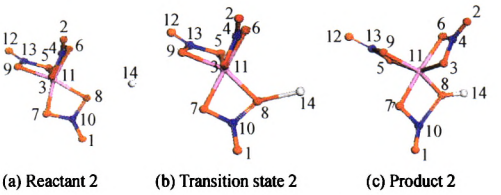


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 427-432 **doi**: 10.3969/j.issn.1001-8719.2013.03.010

Theoretical Study on Hydrogen Reduction of Nitrate

LI Qian GUO Dawei ZHOU Han

The mechanism of H_2 reduction of $Al(NO_3)_3$ was studied with density functional method. The reductions were performed by separated steps, such as formation of hydrogen radical, aluminum nitrite, aluminum hydroxide and nitrogen oxide followed by NO to N_2. The key step was dissociation of H_2 into radicals.



(a) Reactant 2 (b) Transition state 2 (c) Product 2

The reaction paths of reaction step of

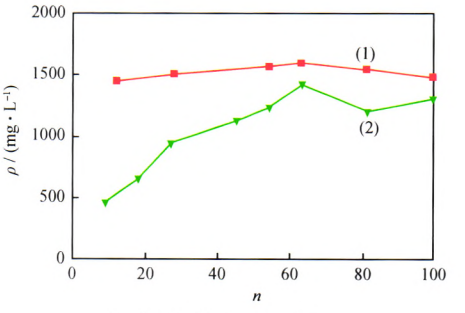
$(NO_3)_2$-Al-NO_3 + H · → $(NO_3)_2$-Al(NO_2)-OH

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 433-437 **doi**: 10.3969/j.issn.1001-8719.2013.03.011

Purification of Lean Sulfolane by Using Clay and Resin Series Program

HAN Dong ZHANG Jimei LI Mingyu WEI Jun

An activated clay and anion-exchange resin program of removing the colloid from lean sulfolane was proposed. The test results showed that the mass concentration of the colloid in lean sulfolane was decreased from 1800 mg/L to 900 mg/L after purification.



(1) Purified by activated clay;

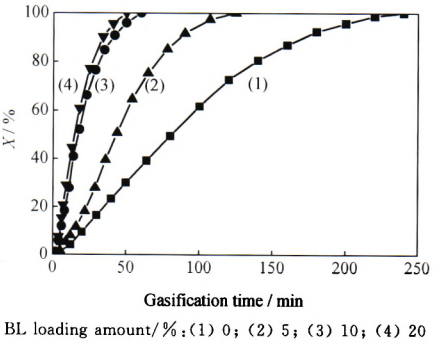
(2) Purified by activated clay and resin

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 438-446 **doi**: 10.3969/j.issn.1001-8719.2013.03.012

Gasification Characteristics of Petroleum Coke Catalyzed by Black Liquor in a Fluidized Bed

YU Deping ZHANG Yuming YANG Yunquan GAO Shiqiu XU Guangwen

Black liquor (BL) could not only effectively improve the gasification reactivity in steam gasification of petroleum coke, but also greatly enhance H_2 volume fraction in the produced syngas, which was an effective catalyst for petroleum coke gasification to produce H_2-rich syngas.



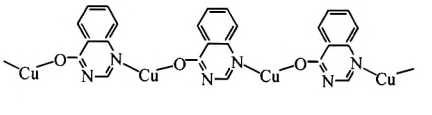
BL loading amount/%: (1) 0; (2) 5; (3) 10; (4) 20

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 447-452 **doi**: 10.3969/j.issn.1001-8719.2013.03.013

Performance of Zero-Sulphur/Phosphorus Quinazolinone Amine as Multifunctional Lubricating Oil Additive

OUYANG Ping CHEN Guoxu ZHANG Xianming

A new zero-sulphur/phosphorus lubricating oil additive of quinazolinone amine was investigated. It had good thermal stability with the extrapolated in cipient decomposing temperature up to 240℃, and the liquid paraffin with 1.0% of quinazolinone amine possessed excellent anti-corrosion and antirust characteristics with the antirust time over 168 h, which exceeded the value of the liquid paraffin with same amount of special antirust additive T746.

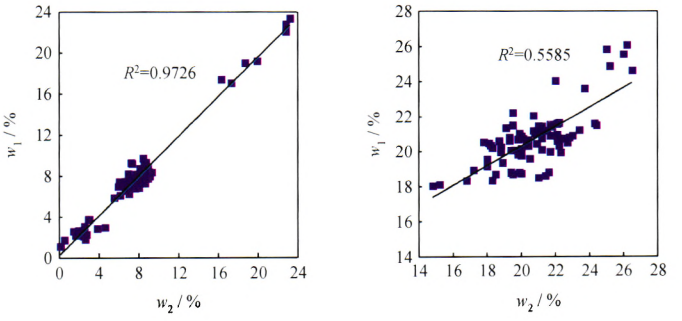


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 453-458 **doi**: 10.3969/j.issn.1001-8719.2013.03.014

Fast Determination of Gahnite Content in S Zorb Regenerated Sorbent by PLS-XRD

FU Ying ZHANG Xin ZOU Kang XU Guangtong

For fast determination of non-activated gahnite(zinc aluminate and Willemite) content in S Zorb regenerated sorbent, quantitative calibration models were first established by partial least square (PLS) regression based on the data of XRD combined with information from Rietveld quantitative phase analysis method.

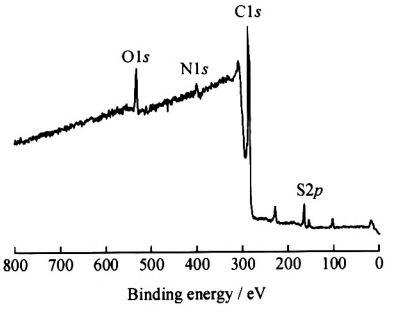


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 459-463 **doi**: 10.3969/j.issn.1001-8719.2013.03.015

Study on XPS of Venezuela Heavy Oil Asphaltene

LI Chuan WANG Jiqian SUI Litao CUI Min DENG Wenan

Functional groups on the surface of Venezuela heavy oil asphaltene were analyzed by XPS. Results showed that among hetero-atomic functional groups, carbonyl content was the most, contents of pyrrolic nitrogen and aliphatic sulfur were less than carbonyl, and contents of hydroxyl, carboxyl, pyridinic nitrogen and thiophenic sulfur were almost the same.

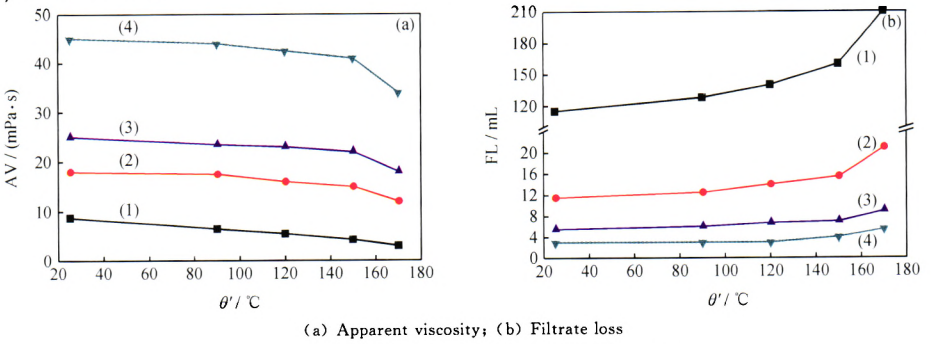


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 464-469 **doi**: 10.3969/j.issn.1001-8719.2013.03.016

Preparation and Properties of Heat- and Salt-Tolerant Viscosity Improver PADA in Water-Based Drilling Fluid

YAN Lili SUN Jinsheng WANG Jianhua WANG Chengbiao XU Bo YANG Zexing

With the increase of PADA concentration, the saturated salt-based mud system displayed a huge increase in apparent viscosity (AV) and a considerable decrease in filtrated loss (FL). The mud properties barely varied before and after aging tests, meaning that the mud formulations had excellent tolerance to salt and temperature.



(a) Apparent viscosity; (b) Filtrate loss

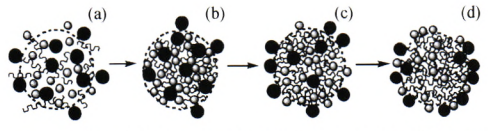
PADA adding amount/%: (1) 0; (2) 0.5; (3) 1.0; (4) 1.5

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 470-474 **doi**: 10.3969/j.issn.1001-8719.2013.03.017

Pore Diameter Adjustment of Sodium Polyacrylate and Balance Control of Selective Adsorption Property for Oil and Water

WU Yun ZHANG Xianming CHEN Bin CHEN Guoxu

In the schematic diagram of selective absorbing oil and water by polymer prepared with different amount crosslinker, it can be seen that when crosslinker amount was 0.09%, water/oil adsorption ratio of the polymer reached its highest value and the capability of selective adsorption was the strongest.



w(Crosslinker)/%: (a)<0.06; (b)0.08; (c)0.09; (d)>0.10

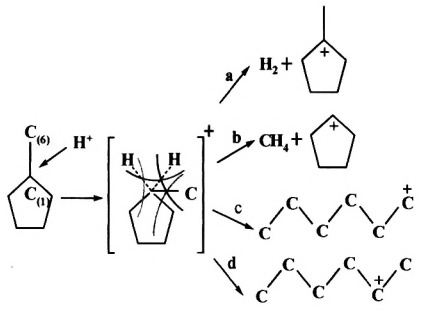
Research Notes

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 475-481 **doi**: 10.3969/j.issn.1001-8719.2013.03.018

Exploration and Analysis on Ethylene and Propylene Formation in Naphthene Catalytic Cracking

YU Shan ZHANG Jiushun WEI Xiaoli

Based on the product distribution in methylcyclopentane catalytic cracking and molecular simulation results, it was supposed that H^+ preferred to attack the carbon atom of methyl-substituent before charge transfer, forming $C_{(1)}$ pentacoordinated carbocation.

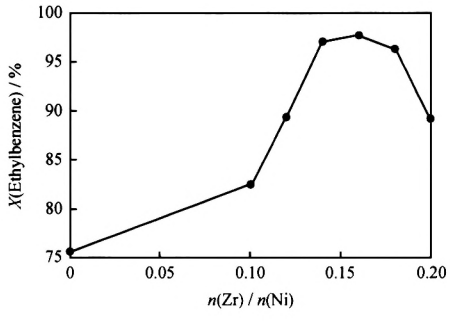


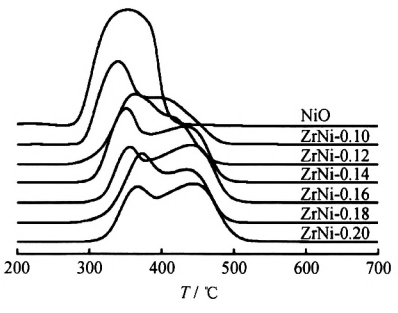
Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 482-486 **doi**: 10.3969/j.issn.1001-8719.2013.03.019

Hydrogenation Performance of Unsupported Ni-Based Catalyst

YUAN Shenghua ZHENG Jinbao TAN Ya'nan YI Xiaodong JIA Lishan FANG Weiping

Unsupported Ni-Zr catalysts, prepared by solid-phase-reaction method, possessed relatively large surface area. The Ni-Zr catalyst with suitable interaction of Ni and Zr exhibited a certain adsorption capacity for H_2 and excellent ethylbenzene hydrogenation activity.



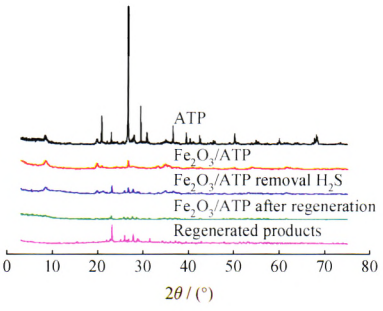


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 487-493 **doi**: 10.3969/j.issn.1001-8719.2013.03.020

Preparation of Iron Oxide Supported Attapulgite Desulfurizer and Its Regeneration Process

LI Lan ZHAO Qiuping CHEN Junyi WEI Guoyu WANG Qingning

Fe_2O_3/ATP desulfurizer was prepared by impregnation method and was regenerated by heat air method. With the Fe_2O_3/ATP desulfurizer prepared under the optimal conditions, the sulfur capacity of 33.08% could be obtained for the removal of high concentration H_2S, and as regenerated under the optimal conditions, the regeneration efficiency of Fe_2O_3/ATP reached 81.22%.

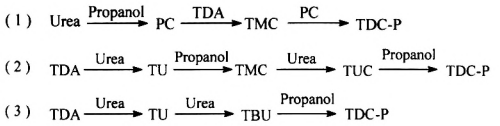


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 494-500 **doi**: 10.3969/j.issn.1001-8719.2013.03.021

Synthesis of Dipropyl Toluene-2,4-dicarbamate via Urea Route

GENG Yanlou FANG Honggang AN Hualiang WANG Guirong ZHAO Xinqiang WANG Yanji

Dipropyl toluene-2, 4-dicarbamate (TDC-P), with lower pyrolysis temperature than dimethyl toluene-2, 4-dicarbamate to synthesize TDI, was synthesized successfully by using 2,4-diamino toluene (TDA), urea and propanol as raw materials in the absence of catalyst. TDA conversion, TDC-P yield and selectivity attained 95.3%, 66.1% and 69.4%, respectively. There existed three possible reaction paths for TDC-P synthesis.

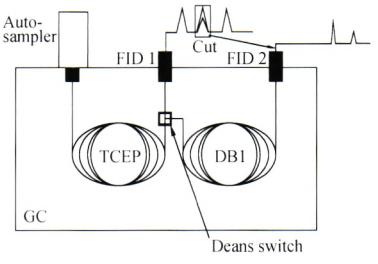


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 501-507 **doi**: 10.3969/j.issn.1001-8719.2013.03.022

Determination of Organic Oxygenates and Benzene in Gasoline by Two-Dimensional Gas Chromatography With a Heart-Cutting System

ZHANG Jidong WEI Yufeng CHEN Junshui WANG Wenqing SHI Lei

The contents of benzene and organic oxygenates in gasoline were determined by two-dimensional gas chromatography with a heart-cutting system. The retention time of common organic oxygenates and benzene in gasoline were confirmed both when column switched and non-switched, and a new dual-column qualitative and quantitative analysis method was established.

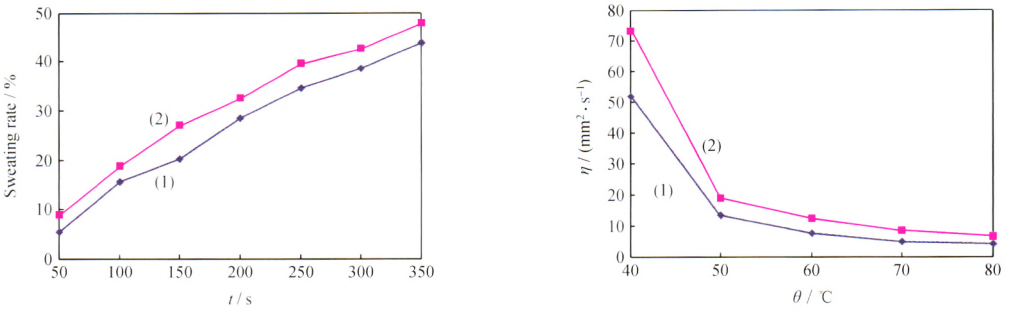


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 508-512 **doi**: 10.3969/j.issn.1001-8719.2013.03.023

Comparison on the Nature of the Crude Oil From CO_2 Flooding and H_2O Flooding

CHEN Ying ZHANG Lei SUN Ruiyan LIANG Hongbao SUN Nannan SUN Lulu

The article showed that the acid number and the content of resin and asphaltene of the crude oil from the CO_2 flooding produced fluid were more and the viscosity and the interfacial tension were lower than that of the one from H_2O flooding.



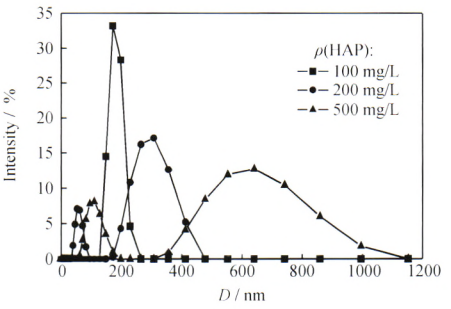
(1) CO_2 flooding; (2) H_2O flooding

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 513-518 **doi**: 10.3969/j.issn.1001-8719.2013.03.024

Association and Structure Characterization of Hydrophobically Associating Polyacrylamide

LI Meirong QU Caixia LIU Kun XU Hui HE Dongyue

The measured CAC of HAP solution was in the range of 150—200 mg/L. When HAP mass concentration was 100 mg/L, there was a single peak in HAP particle size distribution and no network structure. A thin network structure and a double-peak distribution in particle size appeared at 200 mg/L of HAP mass concentration. The two peaks of particle size distribution shifted to right and the network structure was thicker at 500 mg/L of HAP mass concentration.

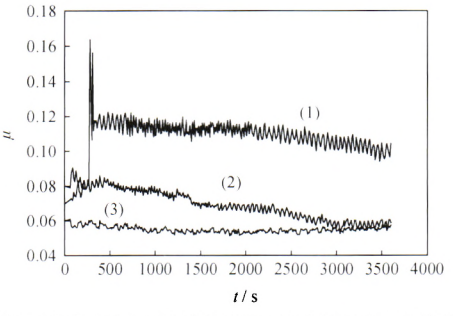


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(3): 519-525 **doi**: 10.3969/j.issn.1001-8719.2013.03.025

Tribological Properties of Ultrafine Copper Particles in Synthetic Lubricant PAO10

ZHANG Zhihong ZUO Xiaoliang LIANG Huijun

The friction coefficient of lubricating oil sample with ultrafine Cu particles was lower than the pure PAO10 in the entire friction process, and the excellent anti-friction function was obtained.



(1)PAO10; (2)PAO10+0.03% Cu-MPs; (3)PAO10+0.05% Cu-NPs

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Characteristics of Three Efficient Lube Oil Biodegrading Bacteria

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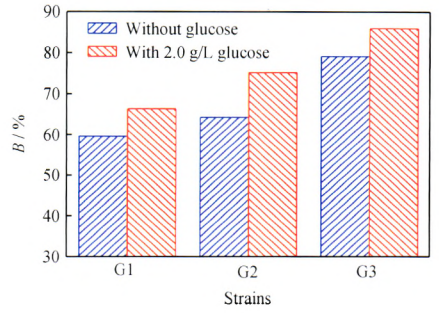
LI Cuiqing

Three lube oil biodegrading strains were screened and identified as *Xanthomonas*, *Azotobacter* and *Pseudomonas*. Biodegradation characteristics such as pH value, temperature, inoculation concentration, initial oil volume, and glucose were studied. Under the appropriate conditions, the biodegradation capability of the three strains within 3 d was 66.4%, 75.3% and 86.1%, respectively.



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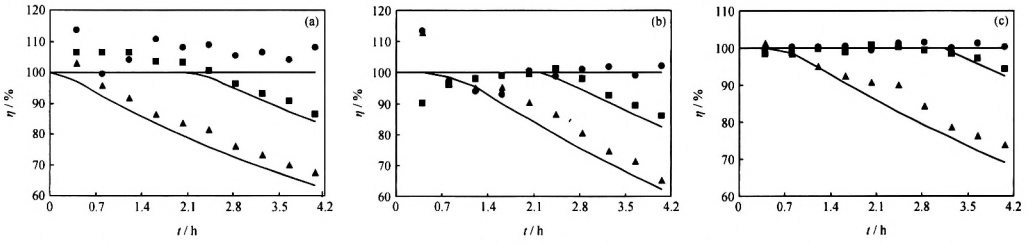
Current Efficiency and Kinetic Model for Degradation of Organic Compounds by Three Dimension Electrode System

QIAO Qicheng ZHAO Yuemin WANG Lizhang GU Weibing YANG Chunhe

According to laws of indestructibility of matter and Farady, the description of current efficiency and kinetic model were evaluated in TDEs. Experimental results were in good agreement with the proposed equation, which could be used for the optimal design and manage of TDEs.



The solid lines represent the theoretical current efficiency. (a) DSD acid; $i/(A \cdot m^{-2})$: ●—5; ■—12; ▲—16; (b) Accelerator M; $i/(A \cdot m^{-2})$: ●—20; ■—45; ▲—60; (c) Polyethylene polymerization initiator; $i/(A \cdot m^{-2})$: ●—80; ■—200; ▲—350

Review

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Review of Methanol to Aromatics

ZOU Hu WU Wei XI Lei ZHU Ning SHI Junjun

Methanol to aromatics (MTA) process is a member of family of methanol to hydrocarbons (MTH) technologies. The review is focused on the industrial MTA drivers, MTA reaction mechanism, catalysts, processes, and further developments, especially the current status of the coal-based MTA technology in China.