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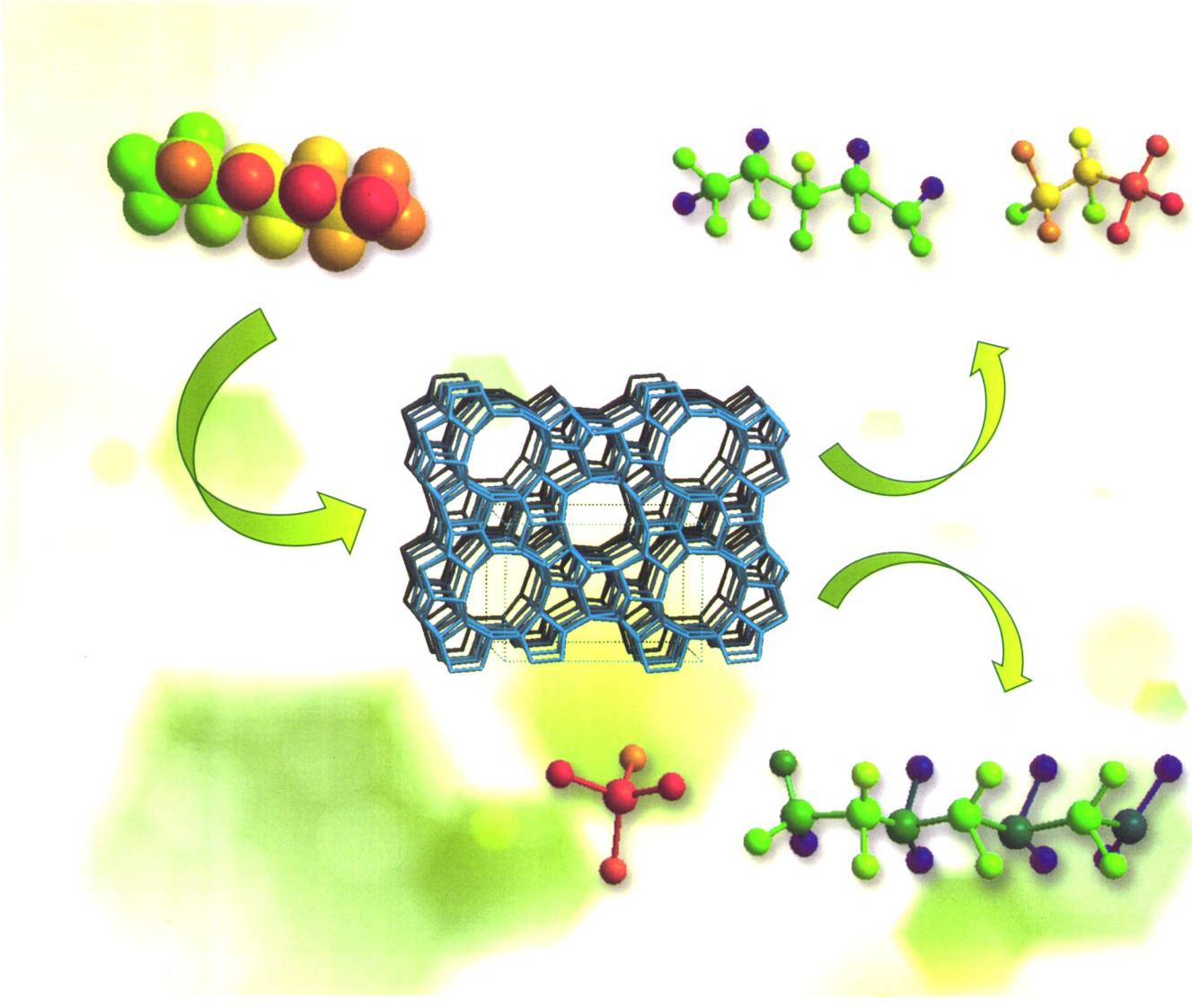
ACTA PETROLEI SINICA
(PETROLEUM PROCESSING SECTION)



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（石油加工）

第 30 卷 第 3 期 2014 年 6 月

目 次

*** 封面文章**

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ACTA PETROLEI SINICA

(PETROLEUM PROCESSING SECTION)

Vol. 30 No. 3 Jun. 2014

CONTENTS

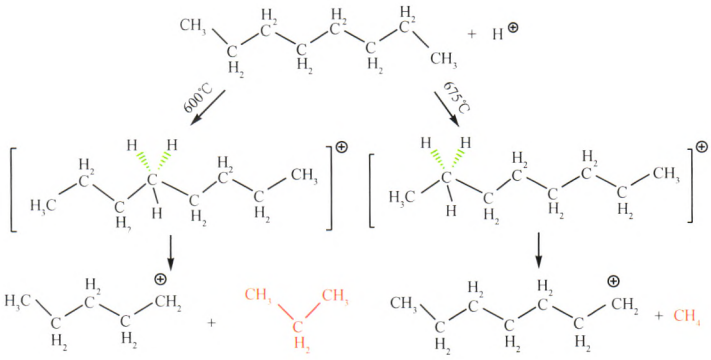
Research Articles

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 379-385 **doi**: 10.3969/j.issn.1001-8719.2014.03.001

Methane Formation in Catalytic Cracking of Straight Run Naphtha

WEI Xiaoli LONG Jun BAI Fengyu YUAN Qimin

The reaction paths of CH_4 formation were explored with *n*-octane as model compound. CH_4 came from heterolytic cleavage occurring at primary C—C bond in *n*-octane thermal cracking, while in catalytic cracking, CH_4 was formed by the protolytic cracking of *n*-octane taking place on C—C bond or C—H bond adjacent to the second carbon atom in carbon chain.

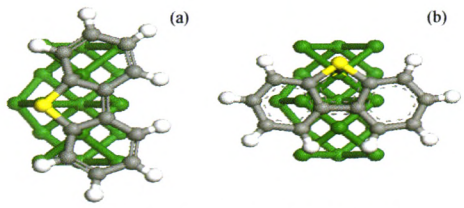


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 386-390 **doi**: 10.3969/j.issn.1001-8719.2014.03.002

Effect of Aromatics on Ultra Deep HDS for Diesel Oil

SHAO Zhicai GAO Xiaodong NIE Hong

During the ultra-deep HDS over either NiW/Al_2O_3 or $CoMo/Al_2O_3$, the inhibition of naphthalene was stronger than that of toluene. Under diesel ultra-deep HDS condition, the effect of toluene and naphthalene on the HDS over NiW/Al_2O_3 was stronger than that over $CoMo/Al_2O_3$ catalyst.



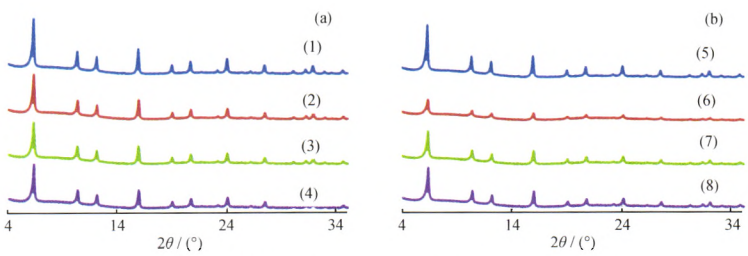
(a) Configuration A; (b) Configuration B

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 391-397 **doi**: 10.3969/j.issn.1001-8719.2014.03.003

Variation of Vanadium Valence State in Vanadium Contaminated FCC Catalyst and Adverse Effects on the Catalyst Structure

TAN Li WANG Xieqing ZHU Yuxia
WANG Zijun REN Fei LI Bengao

The valence state conversion of vanadium (V) on a V contaminated FCC catalyst during reduction and aging treatments was investigated. A part of V converted from V^{+5} to V^{+4} in CO reducing atmosphere at 650℃, and from V^{+5} or V^{+4} to V^{+3} in 0.12% H_2 reducing atmosphere at 780℃. V^{+5} destroyed not only the zeolite structure, but also the substrate structure, while V^{+3} or V^{+4} had little destructive effect during aging procedure.



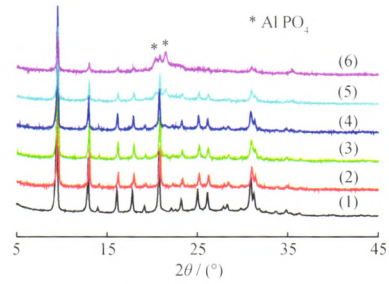
(a) Before aging; (b) After aging
(1) CAT-KB; (2) CAT-0.87V-O; (3) CAT-0.87V-R30; (4) CAT-0.87V-R60; (5) CAT-KB-L; (6) CAT-0.87V-O-L; (7) CAT-0.87V-R30-L; (8) CAT-0.87V-R60-L

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 398-407 **doi**: 10.3969/j.issn.1001-8719.2014.03.004

Effect and Mechanism of Phosphorus Modification on H-SAPO-34 Molecular Sieves

SONG Shouqiang LI Lisheng LI Minggang ZHANG Fengmei SHU Xingtian

In P-modified H-SAPO-34 the loaded phosphorus oxides were distributed uniformly on the surface of H-SAPO-34 crystal and the cleavage fracture of P—O—Al and Si—OH—Al bonds happened. With the increase of $n(P)/n(Si)$, the coordinate number of framework Al with phosphorus oxides increased and the precipitation of $AlPO_4$ tridymite and the formation of $Si(OSi)_4$ amorphous phase were accelerated, along with the decrease of relative crystallinity and acid capacity and decline of pore structure of P-modified H-SAPO-34.



$n(P)/n(Si)$: (1) 0; (2) 0.33; (3) 0.67; (4) 1.00; (5) 1.33; (6) 1.67

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 408-414 **doi**: 10.3969/j.issn.1001-8719.2014.03.005

Characterization, Phosphorus Modification of Small Particle ZSM-5 Zeolite and Its Application in the FCC Catalyst for Propylene Production

LIU Zhaoyong YANG Chaohe ZHANG Zhongdong ZHANG Haitao JI Dong TAN Zhengguo GAO Xionghou

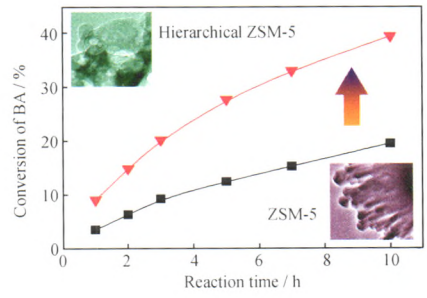
The relative crystallinity of the small particle ZSM-5 was higher, its average particle size was lower and the particles dispersed more evenly, compared with the route ZSM-5. The phosphorous modification could reduce the phosphorous element loss in small particle ZSM-5, further the activity stability of the catalyst containing phosphorous modified small particle ZSM-5 could be enhanced. The results in a commercial RFCC unit showed that the yield of propylene increased by 0.74 percent point.

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 415-420 **doi**: 10.3969/j.issn.1001-8719.2014.03.006

Synthesis of Hierarchical ZSM-5 by Adding 3-Aminopropyltriethoxysilane Coupling Agent and Mesoporous Template in Synthesis System

CHU Linlin YAO Qiongsi XIAO Qiang

Hierarchical ZSM-5 was synthesized by adding 3-aminopropyltriethoxysilane (APTES) and polyacrylic acid combined with cetyltrimethyl ammonium bromide (PAA-CTAB) into a conventional ZSM-5 synthesis system, which possessed a high catalytic activity in alkylation of benzene with benzyl alcohol.

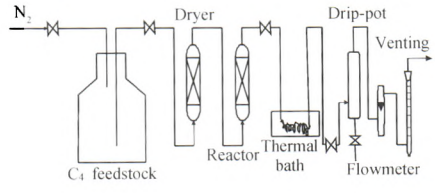


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 421-427 **doi**: 10.3969/j.issn.1001-8719.2014.03.007

Adsorption Removal of Dimethyl Ether From Low Carbon Hydrocarbons by Modified NaY Zeolite

ZHOU Guanglin WANG Xiaosheng SUN Wenyan ZHOU Hongjun

ZnY adsorbent was prepared and used for dimethyl ether removal from low carbon hydrocarbons. The effects of the types of zeolite supports, metal ions and their loading on the dimethyl ether removal were investigated by a fixed-bed reactor. The prepared adsorbents possessed good regenerability, and the activity kept stable after three times of regeneration.

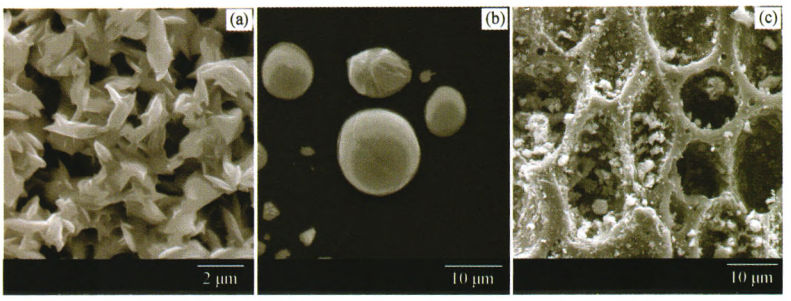


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 428-433 **doi**: 10.3969/j.issn.1001-8719.2014.03.008

Dehydration of 1,4-Butanediol to Tetrahydrofuran Over $La_2P_2W_{18}O_{62}$/C Catalyst

CAO Xiaohua XU Changlong WANG Xueyuan XIE Baohua YAN Ping

A novel type green catalyst of Dawson structure Lanthanum phosphotungstate supported on activated carbon ($La_2P_2W_{18}O_{62}$/C) was successfully prepared, characterized and used as catalyst in the synthesis of tetrahydrofuran from 1,4-butanediol. The results showed this catalyst had high catalytic activity, good chemical stability, good reusability and little waste discharged.



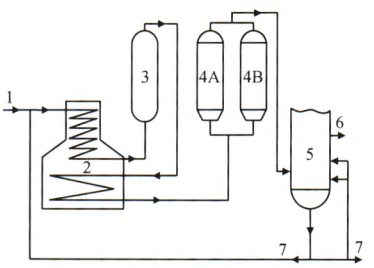
(a) $H_6P_2W_{18}O_{62}\cdot 13H_2O$; (b) $La_2P_2W_{18}O_{62}$; (c) $La_2P_2W_{18}O_{62}$/C

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 434-438 **doi**: 10.3969/j.issn.1001-8719.2014.03.009

Pilot Plant Test for Mild Thermal Cracking of Heavy Oil

HUANG Xinlong LI Jie WANG Shaofeng ZHAO Yangzhi

Advanced delayed coking process (ADCP) was developed by Luoyang Petrochemical Engineering Corporation (LPEC), which integrates a mild thermal cracking stage and a deep thermal cracking stage to improve the properties of feed, prolong the on-stream time of furnace and increase liquid product yield of delayed coking process. The process of viscosity reduction is the main step for ADCP, and the process of viscosity reduction depends on mild thermal cracking reaction. The experiments mentioned here are about mild thermal cracking reaction.



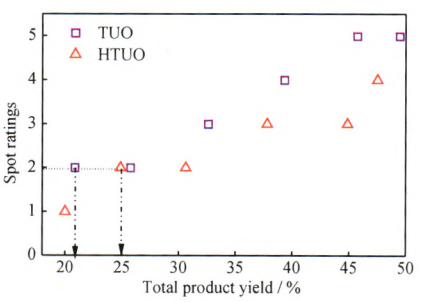
1—Fresh feed; 2—Heating furnace; 3—Visbreaking reactor; 4A—Coke drum A; 4B—Coke drum B; 5—Fractionating tower; 6—Light gas oil; 7—Heavy gas oil

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 439-445 **doi**: 10.3969/j.issn.1001-8719.2014.03.010

Thermal Upgrading of Inferior Residue Without or With Hydrogen Donor

WANG Qi WANG Zongxian ZHUANG Shicheng LI Fengxu GUO Lei GUO Aijun

Thermal upgrading of an inferior residue with a potential industrial hydrogen donor was studied. In the presence of the hydrogen donor, a much higher reaction severity was achieved and total product yield of residue was increased by about 4.0 percentage point at the spot rating of No. 2 in comparison with that of residue without hydrogen donor.

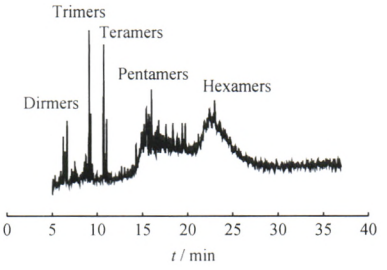


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 446-452 **doi**: 10.3969/j.issn.1001-8719.2014.03.011

The Oligomerization of 1-Dodecene to Synthesize High Performance Lubricating Base Oil

LÜ Chunsheng XU Yunfei YAN Zilong ZHOU Xiaoguang

Oligomerization of 1-dodecene catalyzed by Et_3NHCl-$AlCl_3$ ionic liquid was carried out. The results showed that the product was a mixture, mainly composed of trimers, tetramers and pentamers of 1-dodecene, and possessed high viscosity (ν^{100} range of 32.1—53.2 mm^2/s), high viscosity index (169—189), low pour point (—33℃——42℃), moderate relative molecular mass (645—740), which was a lubricating base oil of high performance.

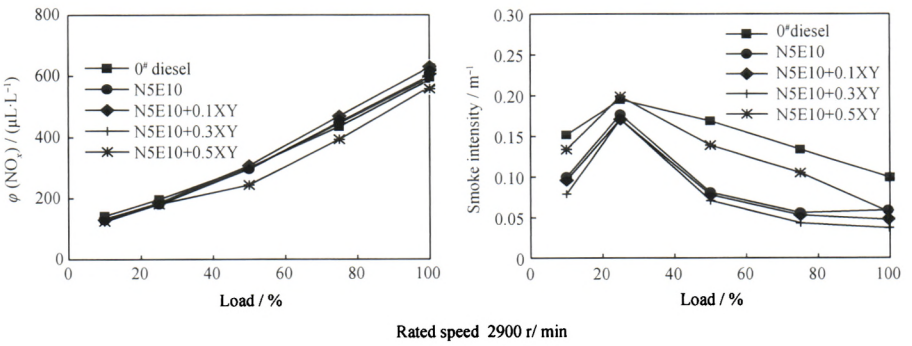


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 453-460 **doi**: 10.3969/j.issn.1001-8719.2014.03.012

Effects of Fuel Additives on Stability of Ethanol-Diesel Blends and Its Emission Characteristics

HU Peng SUN Ping WANG Jiaquan XIANG Liming

Different mass fractions of the smoke suppressor were added to ethanol-diesel (N5E10), and a bench test on the diesel engine was carried out. Compared with pure diesel, smoke and NO_x emissions of the diesel engine fueled with N5E10 or N5E10 containing smoke suppressor were reduced significantly. Addition of smoke suppressor about 0.5% (mass fraction) to N5E10 was suggested.

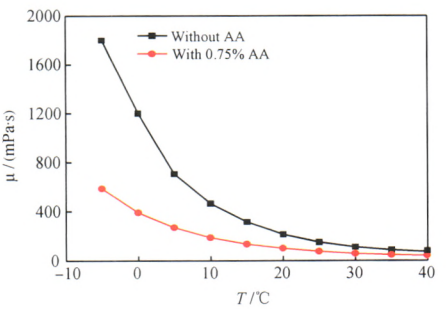


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 461-468 **doi**: 10.3969/j.issn.1001-8719.2014.03.013

Synthesis and Performance Evaluation of Tetradecyl Methacrylate Ester-Acrylamide Polymer on Lubricating Oil

ZHENG Wangang WANG Shujun LIU Hongyan XIONG Wenfeng
LI Yanshan GAO Yun

The polymer AA not only had a good effect on dropping solidifying point for Yanshan lubricating oil, but also had a good effect on dropping viscosity. Moreover, the other physicochemical characteristics of the test samples had little changes with AA added.

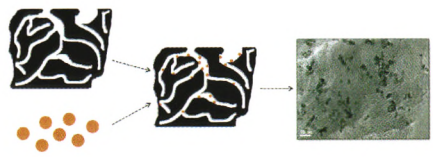


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 469-476 **doi**: 10.3969/j.issn.1001-8719.2014.03.014

Structure and Desulfurization Performance of Desulfurizer of Adsorption Coupled With Catalytic Oxidation

ZHAO Jiangtao LIU Xinmei YAN Zifeng

To improve the low-temperature desulfurization performance of Fe_2O_3 and activated carbon, the adsorption coupled with catalytic oxidation desulfurizers were prepared. Fe_2O_3 nano-particles were highly dispersed on activated carbon via impregnation method. A synergy between adsorption and catalytic oxidation was shown during the H_2S removal process by the coupled desulfurizer.

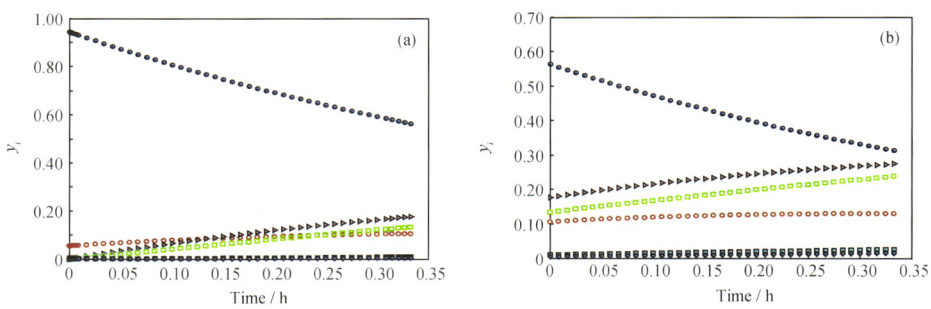


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 477-483 **doi**: 10.3969/j.issn.1001-8719.2014.03.015

Kinetic Model of Vacuum Gas Oil Hydrocracking Catalysts Combination

HAN Longnian PENG Chong FANG Xiangchen ZENG Ronghui

A six-lumped high-pressure hydrocracking kinetic model was proposed to predict the product distribution of hydrocracking catalysts combination, and results of catalyst A bed were used as input for catalyst B bed. Model parameters were regressed from experiment data of two different catalysts by nonlinear least squares algorithm in Matlab 2011b.



At conversion 1: (a) Yield of A bed vs residence time; (b) Yield of B bed vs residence time

y_1—Residue yield; y_2—Diesel yield; y_3—Kerosene yield; y_4—Heavy naphtha yield; y_5—Light naphtha yield; y_6—Gas yield;

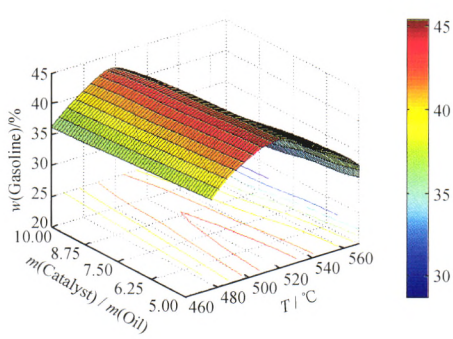
● y_1; ○ y_2; ▶ y_3; □ y_4; ■ y_5; ◆ y_6

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 484-492 **doi**: 10.3969/j.issn.1001-8719.2014.03.016

Effect of Catalytic Cracking of Vacuum Gas Oil Blended With Waste Oil Based on Structure Oriented Lumping Method

ZHU Ran SHEN Benxian LIU Jichang

The simulated results showed that the yield of gasoline was sensitive to reaction temperature. The optimized conditions of catalytic cracking of VGO blending with 5% waste oil were reaction temperature of 500℃, mass ratio for catalyst to oil of 6.5.

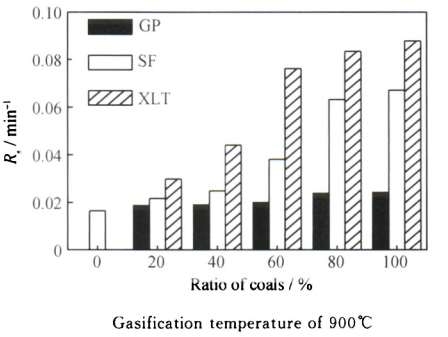


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 493-500 **doi**: 10.3969/j.issn.1001-8719.2014.03.017

Co-Gasification Characteristics of Petroleum Coke and Coal

JI Liyuan HUANG Sheng WU Shiyong WU Youqing GAO Jinsheng

With the increase of the ratio of coal to petroleum coke, the co-gasification reactivity of coal-petroleum coke was enhanced. CO_2 chemisorption mass of coal was related to the presence of active inorganic components in it. The gasification reactivity rate increased linearly with the increase of CO_2 strong chemisorption mass.



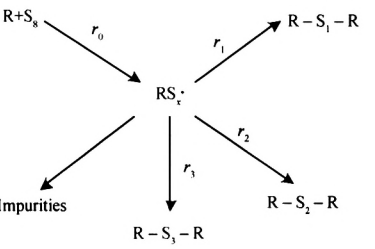
Gasification temperature of 900℃

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 501-508 **doi**: 10.3969/j.issn.1001-8719.2014.03.018

Research on Reaction Kinetics of Sulfurized Isobutylene by One-Step Synthesis

JIANG Binbo CHEN Nan ZHENG Laichang WANG Jindai KE Yunlong FU Xisheng YANG Yongrong

The sulfurized isobutylene was synthesized with sulfur and isobutylene as reactants and ammonia as catalyst in a batch reactor at 160－200℃. A simplified synthesis reaction network of sulfurized isobutylene and three parallel kinetic models were proposed.

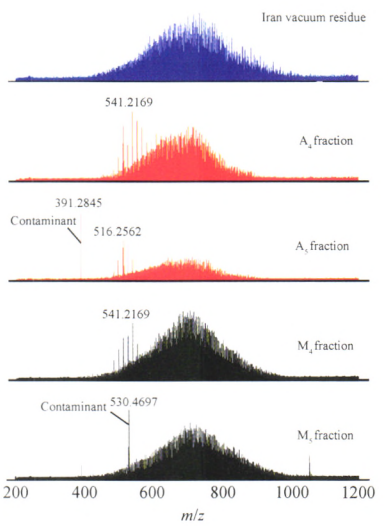


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 509-514 **doi**: 10.3969/j.issn.1001-8719.2014.03.019

Identification of Vanadyl Porphyrins in Iran Vacuum Residue by Fourier Transform Ion Cyclotron Resonance Mass Spectrometry

SHI Yanqiang WANG Wei LIU Zelong

The vanadyl porphyrins in Iran vacuum residue were separated by Soxhlet extraction with solid-phase extraction (SPE), and then were characterized by atmospheric pressure photoionization Fourier transform ion cyclotron resonance mass spectrometry (APPI FT-ICR MS). The results showed that the most plentiful type of vanadyl porphyrins in Iran vacuum residue was deoxophylloerythroetioporphyrins (DPEP), followed by etioporphyrins (ETIO).

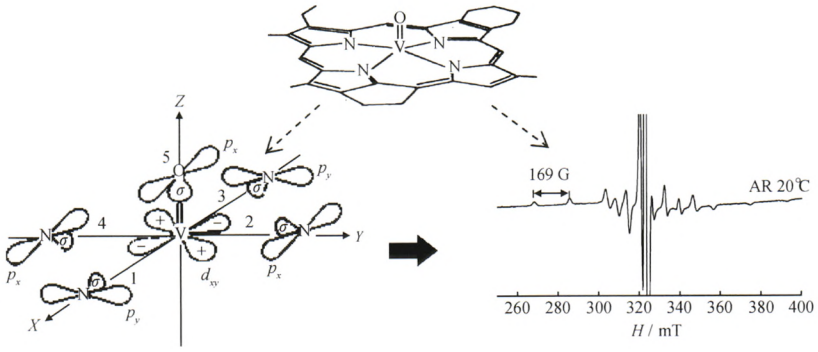


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 515-521 **doi**: 10.3969/j.issn.1001-8719.2014.03.020

Analysis of Vanadyl-Porphyrin in Residue by Electron Spin Resonance

LIU Yongjun LIU Chenguang

Electron spin resonance profile of V-porphyrin in residue was anisotropic. Analysis of ESR parameters indicated that the bond between V atom and its ligands and the interaction among V, pyrrol rings and substituents were effected evidently by micro chemical environment in residue and its fractions.



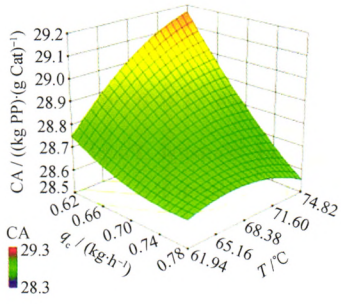
Research Notes

Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 522-526 **doi**: 10.3969/j.issn.1001-8719.2014.03.021

Response Surface Model of Multi-Factors of Conditions Affecting Catalytic Activity of Catalyst in Polypropylene Production

HONG Dongfeng SUI Shuhui WU Wenhui

The effects of polymerization process conditions, including polymerization temperature (T) and polymerization pressure (p), mass flow of propylene (q_P), mass flow of catalyst (q_C), and volume fraction of H_2 (φ_H), on the catalytic activity (CA) of the catalyst during propylene polymerization, based on the response surface method. The built response surface model has great significance in reducing the ash content in polypropylene, improving the quality of product, reducing the consumption of raw materials, saving cost and increasing the economic efficiency.

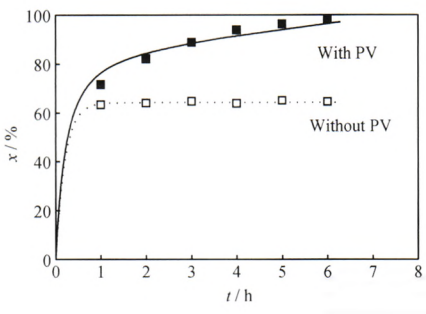


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 527-535 **doi**: 10.3969/j.issn.1001-8719.2014.03.022

Synthesis Optimization and Kinetics for Ketalization of Cyclohexanone with Ethylene Glycol in a Zeolite Membrane Reactor

AN Shunyong ZHANG Fei GUI Tian QIU Lingfang ZHOU Rongfei CHEN Xiangshu

The conversion of cyclohexanone increased from 64.3% to almost completion due to water removal from the system of cyclohexanone ketalization with ethylene glycol by the aid of PV process in a zeolite membrane reactor. The experimental data agreed well with the predictions of the kinetic model. Zeolite T membrane was stable in reaction mixture and showed a good reusability for the reaction.

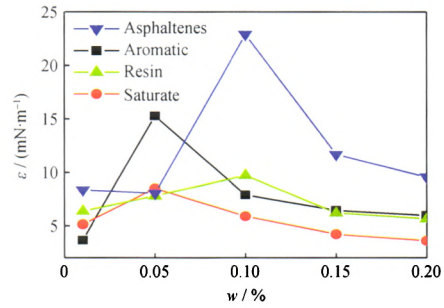


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 536-541 **doi**: 10.3969/j.issn.1001-8719.2014.03.023

Relationship Between Four Fractions of Zhengwang Heavy Oil and Oil-Water Interfacial Viscoelasticity Properties

YIN Zhigang LI Meirong PU Ming CHEN Xinde SUN Kai

The effects of Zhengwang four fractions on the dilational modulus, elastic modulus, viscous modulus and phase angle of the oil-water system were analysed. The results showed that the asphaltene was the main component to affect the interfacial properties of the oil-water system.

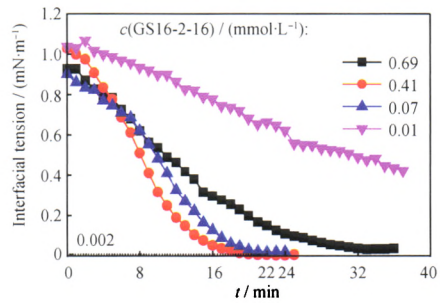


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 542-547 **doi**: 10.3969/j.issn.1001-8719.2014.03.024

Interfacial Activity and Rheological Behavior of *N*,*N*′-Bis (Hexadecyl Dimethyl)-1,2-Dibromide-Ethanediyl Ammonium Salt

HONG Yu SHEN Yiding YANG Xiaowu LIU Guanjun ZHANG Lin

The factors, such as the length of hydrocarbon chain, temperature, shear rate and mass concentration of NaSal, influencing the rheological behavior of GS16-2-16 solution were investigated. The results of interfacial activity showed that GS16-2-16 could reduce the interfacial tension between simulated oil and water to 2.0×10^{-3} mN/m within 22 min.

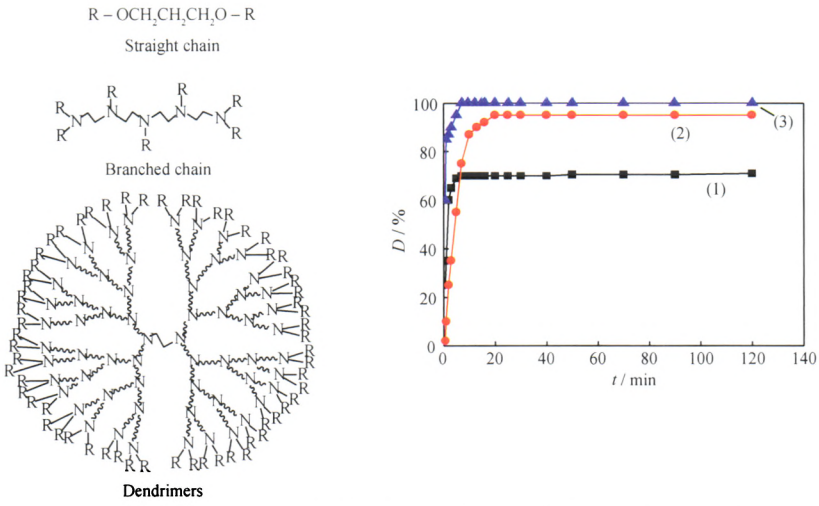


Acta Petrolei Sinica (*Petroleum Processing Section*), 2014, 30(3): 548-554 **doi**: 10.3969/j.issn.1001-8719.2014.03.025

Relationship Between Structure of Polyether and the Demulsification of Fractured Emulsion

ZHANG Jiahua YAN Feng LI Liyuan FANG Zhou SONG Ziwei YANG Maofan LI Jianxin

To the demulsification of simulated fractured emulsion, the branched polyether demulsifier was better than the straight chain one, and with the branched generation increasing, the demulsification performance of demulsifier was improved. The polyether demulsifier prepared with 3 G polyamide-amine as initiator showed the best demulsification, it made the emulsion achieve complete demulsification in 7 min.



c(Demulsifier) =20 mg/L; (1) Straight chain(BP01); (2) Branched chain (TA01); (3) Hyperbranched dendritic (PA08)

R=—(C_3H_6O)$_a$—(C_2H_4O)$_b$—H

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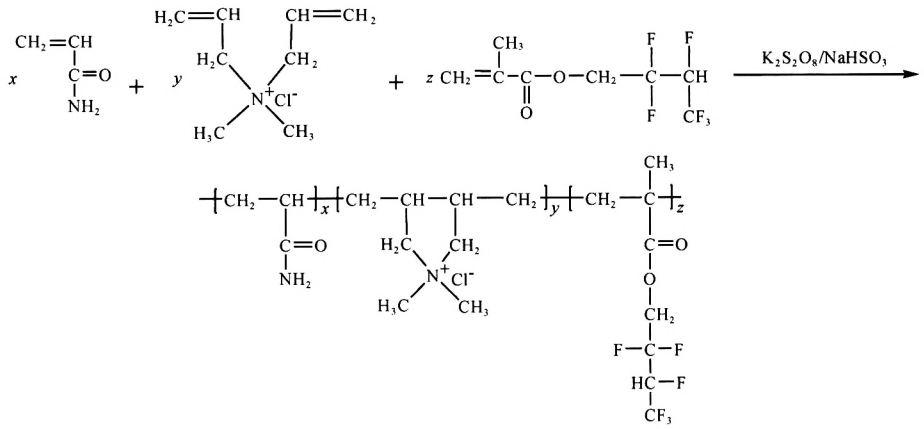
Synthesis and Flocculation Performance of Fluorocarbon-Modified Polyacrylamide Polymer

QIAO Yu GUO Rui LI Caihua

The new type of fluorocarbon copolymer P(AM-DMDAAC-HFMA) was synthesized with hydrophobic monomer hexafluorobutyl methacrylate(HFMA), main monomer acrylic amide(AM) and cationic monomer dimethyl diallyl ammonium chloride(DMDAAC) as raw materials.



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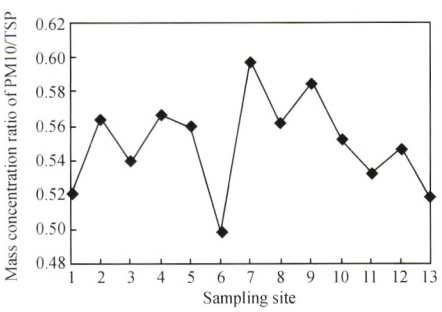
Distribution Characteristics and Source Apportionment of the Atmospheric Pollutants Around Petrochemical Enterprise

ZHAO Dongfeng CHEN Lu XUE Jianliang OUYANG Zhenyu
SHEN Ruihua GAN Weimin LI Shi WU Mingjuan

This research aimed at the distribution characteristics of atmospheric particular pollutants of the petrochemical enterprise, as well as the source apportionment, in order to make a contribution to environment impact assessment and prevention and cure of atmospheric pollution.



Review

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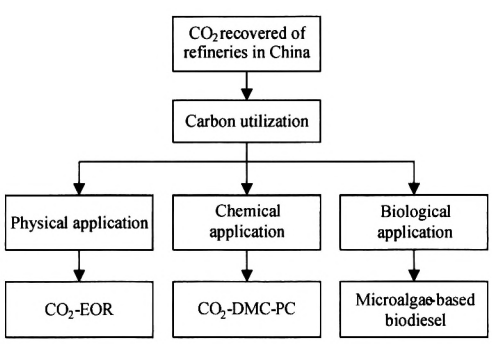
Exploration on New Ideas for Carbon Utilization of Refineries in China

SONG Qianqian JIANG Qingzhe LUO Xiaoli SONG Zhaozheng
YUAN Bo SONG Wenjuan

The route for CO_2 recovered utilization of refineries is explored in China. In the short term, CO_2-EOR should be a focus point, and to meet mid-to-long-term, the development of CO_2-dimethyl carbonate-polycarbonate industry chain be supposed to emphasize. Of course, long-dated goal is to develop the technology of microalgae-based biodiesel.



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