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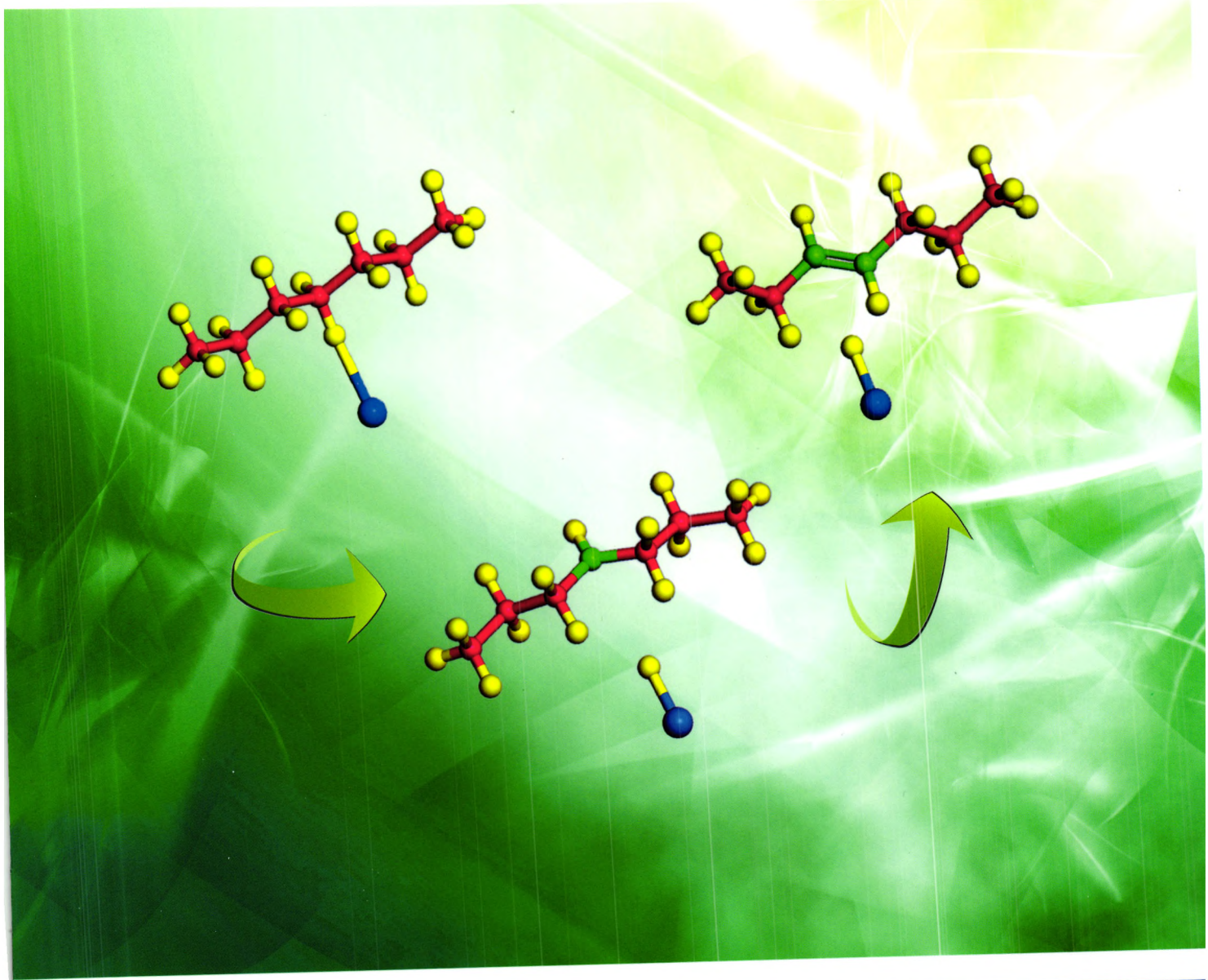
ACTA PETROLEI SINICA
(PETROLEUM PROCESSING SECTION)



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* 封面文章

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ACTA PETROLEI SINICA

(PETROLEUM PROCESSING SECTION)

Vol. 29 No. 2 Apr. 2013

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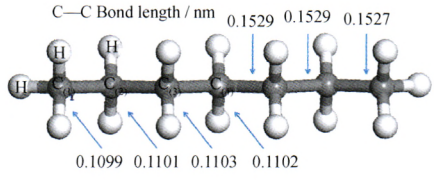
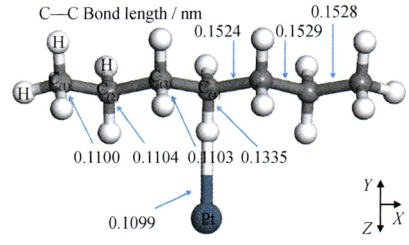
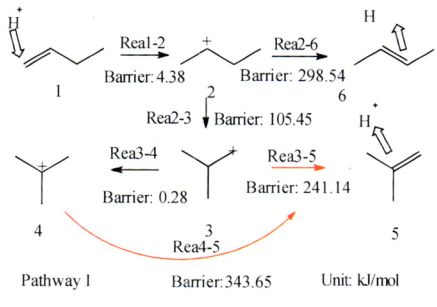
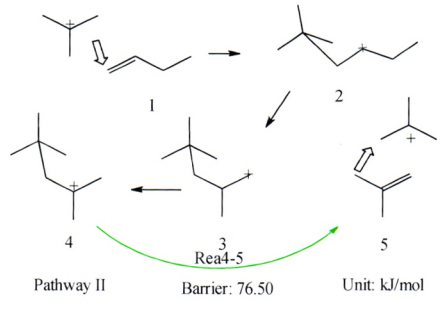






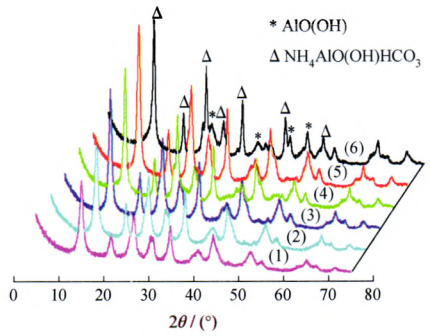


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 191-197 **doi**: 10.3969/j.issn.1001-8719.2013.02.003

Synthesis of γ-Al_2O_3 by Solid-State Reaction and the Hydrodesulfurization Evaluation of Ni-Mo-P/γ-Al_2O_3

HU Xiaofu ZHANG Min LI Guoliang YIN Changlong CUI Ruili ZHAO Ruiyu LIU Chenguang

The crystallinity of ammonium aluminum carbonate hydroxide increased gradually with the increase of aging temperature. When the aging temperature was above 160℃, the pseudo-boehmite could also be obtained. It was recognized that the aging temperature was crucial condition in preparation of ammonium aluminum carbonate hydroxide hydrate. The highest aging temperature of ammonium aluminum carbonate hydroxide should not be more than 160℃.



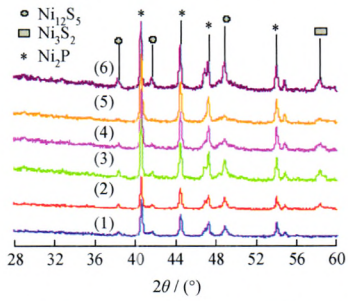
Aging temperature/℃: (1) 60; (2) 80; (3) 100; (4) 120; (5) 140; (6) 160

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 198-204 **doi**: 10.3969/j.issn.1001-8719.2013.02.004

Influence of Sulfurization Behavior on Structure and Hydrodesulfurization Performance of Ni_2P/SBA-15 Catalysts

GAO Lili WU Pingyi LAN Ling GUAN Yueming JI Shengfu

A series of $x$$CS_2$-$Ni_2P$/SBA-15 catalysts were prepared. The phases of Ni_2P, $Ni_{12}P_5$ and Ni_3S_2 existed in the catalysts. Ni existed in the $Ni^{\delta+}$ and Ni^{2+} species and P existed in the $P^{\delta-}$ and P^{5+} species on the catalyst surface. Ni_3S_2 phase played an important role on DBT conversion and direct desulfurization.



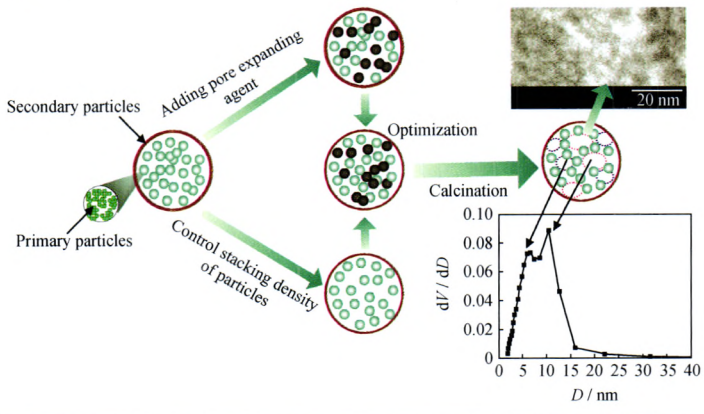
(1)0CS_2-Ni_2P/SBA-15; (2)3CS_2-Ni_2P/SBA-15; (3)4CS_2-Ni_2P/SBA-15; (4)5CS_2-Ni_2P/SBA-15; (5)6CS_2-Ni_2P/SBA-15; (6)7CS_2-Ni_2P/SBA-15

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 205-213 **doi**: 10.3969/j.issn.1001-8719.2013.02.005

Preparation of NiMoP Catalyst Supported on γ-Al_2O_3 of Bimodal Porous Distribution and Its Hydrogenation Performance for VGO + CGO

ZHANG Chengtao CHAI Yongming WANG Xiao LI Guoliang ZHANG Kongyuan ZHAO Ruiyu LIU Chenguang

A γ-Al_2O_3 of bimodal porous distribution could be obtained by adding nano-carbon black and controlling water/*pseudo*-boehmite in extruding process of *pseudo*-boehmite. NiMoP/γ-Al_2O_3 catalyst was synthesized by the wetness impregnation with the γ-Al_2O_3 of bimodal porous distribution. Compared to the catalyst of non-bimodal porous distribution, this catalyst showed higher activity in the hydrogenation for VGO+CGO.

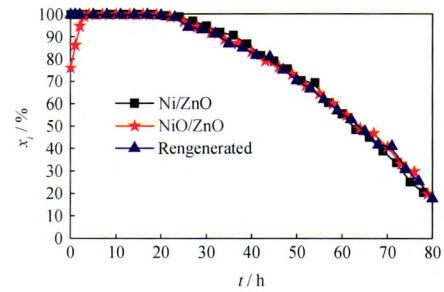


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 214-222 **doi**: 10.3969/j.issn.1001-8719.2013.02.006

Reactive Adsorption Desulfurization for Thiophene on Adsorbent of Ni-Zn Complex Oxides

WEI Yanyu LI Yonghong KONG Aihua

The adsorbents of Ni-Zn complex oxides were prepared by co-precipition of corresponding nitrates with urea and sodium dodecyl sulfate. The results showed that Ni was the main active site of the adsorbent. Under the optimum conditions (673 K, 1.0 MPa), the sulfur capability of adsorbent was 360 mg/g. The adsorbent could be recovered by regeneration.



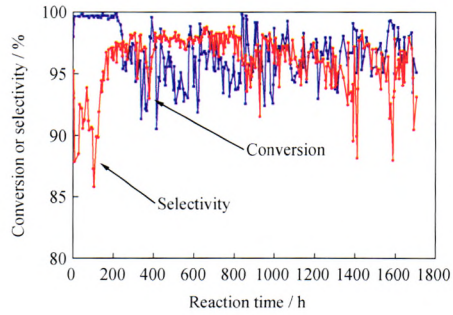
T=573 K; p=1.0 MPa; LHSV=60 h^{-1};
$V(H_2)/V$(Model oil)=200 (volume of H_2 at standard state);
c_0=100 mg/L

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 223-227 **doi**: 10.3969/j.issn.1001-8719.2013.02.007

Study on Catalytic Material Used in HPPO Process

ZHU Bin

Based on the characteristic of propylene oxide preparation reaction from propylene with hydrogen peroxide as oxidant, catalytic material HTS was investigated thoroughly. The results in hydrogen peroxide-propylene oxide process (HPPO) pilot of titanium silicalite prepared under optimized condition were the conversion of H_2O_2 and the selectivity of propylene oxide both above 95%.

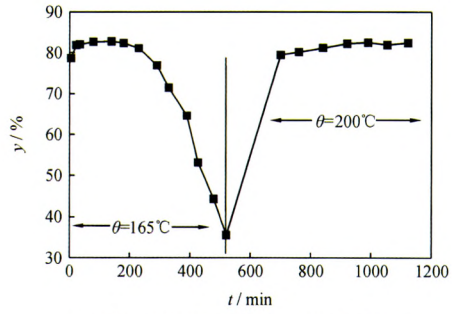


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 228-237 **doi**: 10.3969/j.issn.1001-8719.2013.02.008

Catalytic Behavior of $Pt/SO_4^{2-}/ZrO_2$-Al_2O_3 in *n*-Hexane Isomerization

SONG Yueqin FENG Minchao TIAN Jing XIAO Hang ZHOU Xiaolong XU Longya ZHAO Shenghong HUANG Yi DU Changfei

The catalytic activity of $Pt/SO_4^{2-}/ZrO_2$-Al_2O_3 (PSZA) for *n*-hexane isomerization in the presence of H_2 decreased rapidly at low reaction temperature, but the stability of PSZA was greatly improved at relatively high temperature. Hydrogen spillover which was closely related with the temperature determined the catalytic behavior of PSZA in *n*-hexane isomerization at different reaction temperatures.



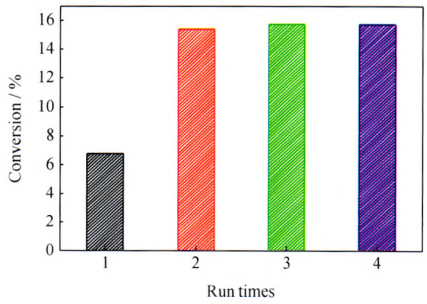
p=2.0 MPa; MHSV=1 h^{-1}; $n(H_2)/n(C_6)$=4

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 238-242 **doi**: 10.3969/j.issn.1001-8719.2013.02.009

Catalytic Performance of MIL-101(Cr) in Oxidation of Cyclohexane With H_2O_2

ZHANG Jiangong HE Min FAN Binbin LI Ruifeng

The crystalline structure of MIL-101 (Cr) was not stable in oxidation of cyclohexane with H_2O_2. The formed amorphous material exhibited much higher catalytic activity than the fresh MIL-101(Cr), and could be reused several times without significant change in its catalytic efficiency.

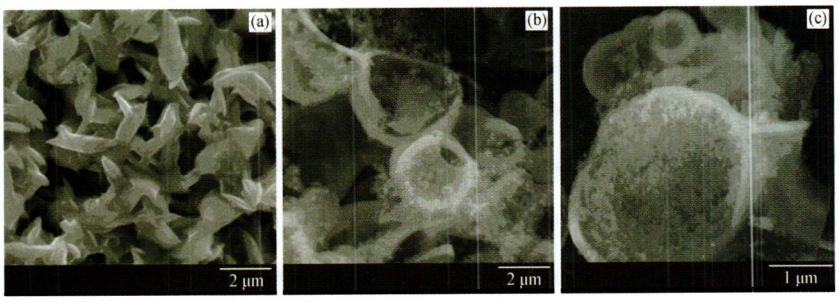


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 243-248 **doi**: 10.3969/j.issn.1001-8719.2013.02.010

Preparation and Characterization of $H_6P_2W_{18}O_{62}$/MCM-48 and Its Application in Catalytic Synthesis of Adipic Acid

CAO Xiaohua REN Jie XU Changlong XIE Baohua YAN Ping

A novel type of supported catalyst $H_6P_2W_{18}O_{62}$/MCM-48 was successfully prepared by impregnation method and characterized by FT-IR, XRD, SEM and EDS. The catalysts acted as an efficient stable catalyst for the synthesis of adipic acid with cyclohexanone and 30% (mass fraction) H_2O_2 under microwave irradiation, and exhibited good reusability.



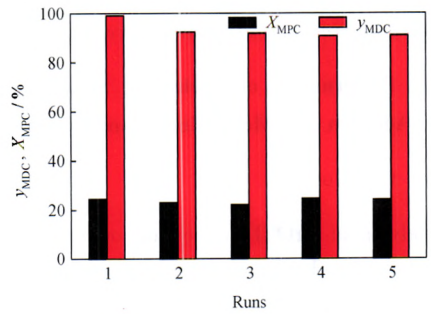
(a) P_2W_{18}; (b) MCM-48; (c) 40%P_2W_{18}/MCM-48

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 249-255 **doi**: 10.3969/j.issn.1001-8719.2013.02.011

Synthesis of Methylene Diphenyl Dimethylcarbamate Catalyzed by Brønsted-Lewis Acidic Ionic Liquid

KANG Lijuan ZHAO Xinqiang AN Hualiang WANG Yanji

$[HO_3S\text{-}(CH_2)_4\text{-mim}]Cl\text{-}0.7ZnCl_2$ showed high catalytic performance for the synthesis of methylene diphenyl dimethylcarbamate (MDC) from methyl *N*-phenyl carbamate (MPC) and formaldehyde (HCHO). Under the suitable reaction conditions, the yield of MDC was 99.1%. Moreover, the ILs could be easily recovered and used more than five times without significant loss in its catalytic performance.



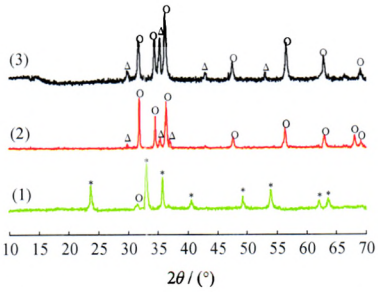
Results of reuse of $[HO_3S\text{-}(CH_2)_4\text{-mim}]Cl\text{-}0.7ZnCl_2$
Reaction conditions: n(MPC)/n(HCHO)=10; Reaction time 1 h; Reaction temperature 70℃; m(ILs)/m(MPC)=2

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 256-260 **doi**: 10.3969/j.issn.1001-8719.2013.02.012

Preparation of Zn-Fe Mixed Oxides for the Synthesis of Dimethyl Carbonate From Methyl Carbamate and Methanol

WANG Dengfeng ZHANG Xuelan BAI Dong CAO Nan WEI Wei SUN Yuhan

The structure of Zn-Fe mixed oxide catalysts for the synthesis of dimethyl carbonate (DMC) from methyl carbamate and methanol was greatly influenced by preparation method and calcination temperature, which could further affect their catalytic performances. Zn-Fe mixed oxide possessed good reusability as a catalyst in DMC synthesis.



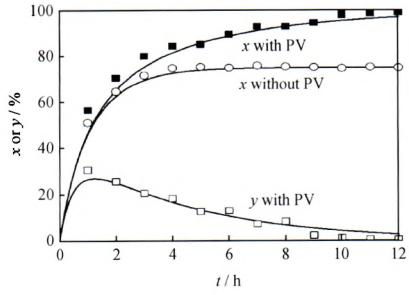
(1) Impregnation method; (2) Co-precipitation method; (3) Sol-gel method
*—Fe_2O_3 (JCPDS 13-0534); ○—ZnO (JCPDS 36-1451); △—$ZnFe_2O_4$ (JCPDS 22-1022)

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 261-268 **doi**: 10.3969/j.issn.1001-8719.2013.02.013

Preparation of High-Flux Mordenite Membranes and the Application to Esterification of Acetic Acid

ZHOU Rongfei ZHANG Peng AN Shunyong ZHANG Youjun NIE Jing CHEN Xiangshu

The convention of acetic acid esterified in mordenite membrane reactor arrived at almost 100% after 12 h by removing water from the reaction. The kinetic model for the esterification of acetic acid was in a good agreement with the experimental data.



Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 269-276 **doi**: 10.3969/j.issn.1001-8719.2013.02.014

Effect of Pd and Formaldehyde on In-Situ Liquid Phase Catalytic Hydrodechlorination of CCl_4 Over Ag/C Catalysts

ZHOU Xiulian LU Mohong ZHU Jie LI Mingshi SHAN Yuhua ZHU Jianjun

The effects of Pd and formaldehyde on the in-situ catalytic hydrodechlorination of CCl_4 in liquid phase over Ag/C catalyst were investigated. Pd-Ag/C catalyst with Pd/Ag molar ratio of 0.03 exhibited high activity in the reaction. Formaldehyde played an important role in promoting the transformation of surface Ag-Cl species to active Ag.

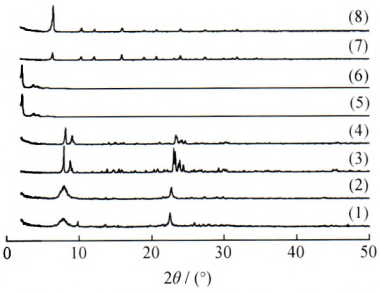
$$CCl_4 \xrightarrow[(Pd\text{-})Ag/C]{CH_3OH(HCHO)} CH_2Cl_2 + CHCl_3$$

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 277-282 **doi**: 10.3969/j.issn.1001-8719.2013.02.015

Catalytic Performance of Molecular Sieve Supported $ZrOCl_2$ Catalyst for Michael Addition of 2-Methyl Indole and Cyclohexenone-2

LIU Jie QIU Jun

The catalysts of $ZrOCl_2$ supporting on molecular sieves were prepared by impregnation method and characterized by XRD, SEM and BET. The catalytic performances of the catalysts for synthesis of 3-(2-methyl-1H-indol-3-yl) cyclohexanone were examined from the catalytic Michael addition with 2-methylindole and cyclohex-2-enone under solvent free condition. The results indicated that the specific surface area of molecular sieve greatly influenced the catalyst activity, and the catalytic synergistic effect of acidity of molecular sieve was not obvious.



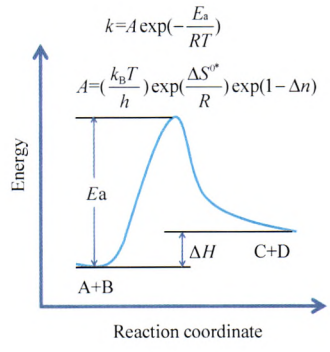
(1) H-BEA; (2) 10% $ZrOCl_2$/H-BEA; (3) H-ZSM-5; (4) 10% $ZrOCl_2$/H-ZSM-5; (5) H-MCM-41; (6) 10% $ZrOCl_2$/H-MCM-41; (7) H-USY; (8) 10% $ZrOCl_2$/H-USY

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 283-288 **doi**: 10.3969/j.issn.1001-8719.2013.02.016

Kinetic Modeling of Catalytic Cracking of Monocyclic Cycloparaffins—Calculation of Pre-Exponential Factors

ZHANG Xu GUO Jinbiao ZHOU Xiang WANG Xinlei YU Bo GE Caixia

The pre-exponential factor calculation was mainly adopted the transition state theory combining the statistical thermodynamics. In the course of hypothesis and introduced correction factor, gas phase molecular translation entropy approximate was used instead of unavailable reaction activation state entropy and reactant entropy difference, which greatly reduced the workload and simplified the complex degree, the data accuracy was improved at the same time.

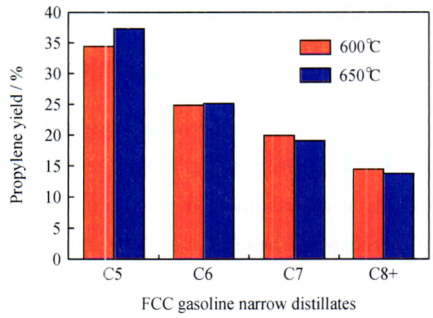


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 289-296 **doi**: 10.3969/j.issn.1001-8719.2013.02.017

A Kinetic Model of Gasoline Catalytic Cracking to Propylene Ⅰ. Model Establishment

HE Jinlong LI Bo LI Zheng HOU Shuandi

The kinetic reaction performances of narrow distillations, which were separated by carbon number in gasoline cut, were studied by using fixed bed. The experimental results showed that the propylene yield was determined by the rate of hydrocarbon cracking reaction and the second conversion reaction of propylene. And then a kinetic model was derived. The said model can not only predict the product yields, but also simulate the chemical composition of the products.

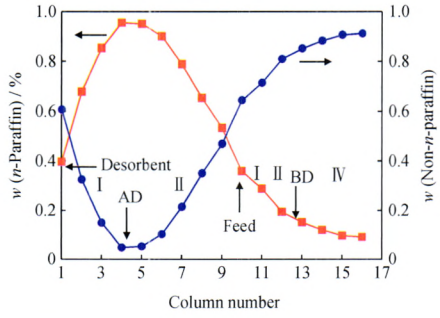


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 297-303 **doi**: 10.3969/j.issn.1001-8719.2013.02.018

Optimization of Liquid-Phase Simulated Moving Bed Technology for Naphtha Separation by 5A Molecular Sieve Based on Molecular Management

CAO Jun SHEN Benxian LIU Jichang CAO Xin LIU Juntao

Optimal utilization of simulated moving bed technology on naphtha resource was studied. The concentration distribution of normal paraffins and non-normal paraffins in the bed was investigated and shown in this figure.

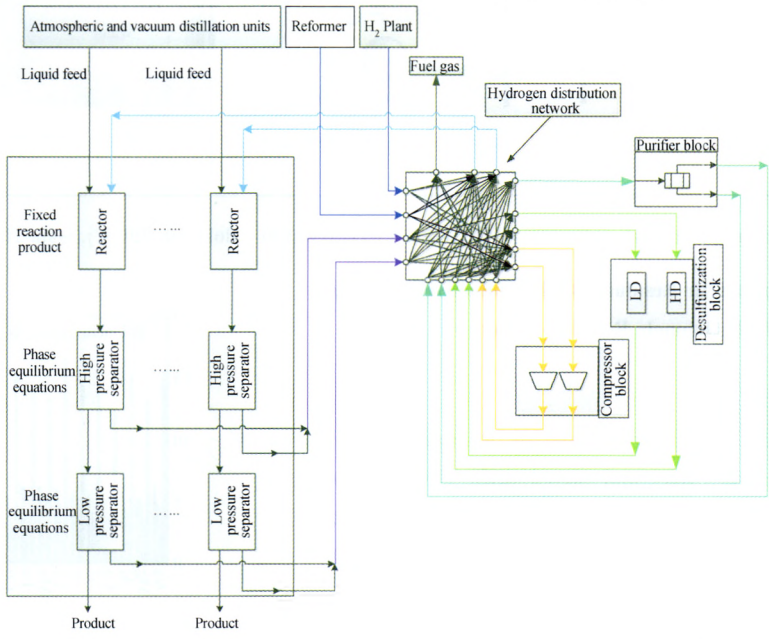


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 304-311 **doi**: 10.3969/j.issn.1001-8719.2013.02.019

Multi-Contaminant H_2 Network Optimization Considering H_2S Remove

ZHOU Li LIAO Zuwei TOKOS Hella WANG Jingdai YANG Yongrong

A mixed integer nonlinear programming model for the design of hydrogen networks was proposed. By introducing a desulfurization block into the state-space superstructure, the H_2S removal unit was incorporated with the H_2 removal unit, such as pressure swing adsorption and membrane. The superstructure was reduced based on engineering experience.

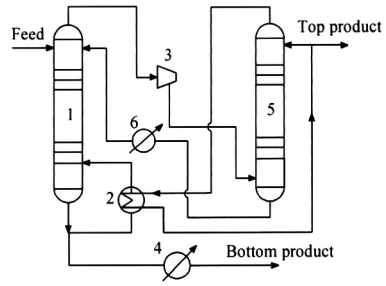


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 312-317 **doi**: 10.3969/j.issn.1001-8719.2013.02.020

An Improved Pressure Swing Thermally Coupled Distillation

ZHANG Lühong LIU Jianbin LI Xingang JIANG Bin LI Hong

An improved pressure swing thermally coupled distillation (PSTCD) process was proposed. Taking methyl-cyclopentane/benzene binary mixture as an example, the characteristics of the improved PSTCD were compared with those of the conventional. Meanwhile, a general PSTCD process was proposed to describe the process systematically. The improved PSTCD had an energy saving efficiency of 3.50%, and had better performance than conventional PSTCD in energy saving.



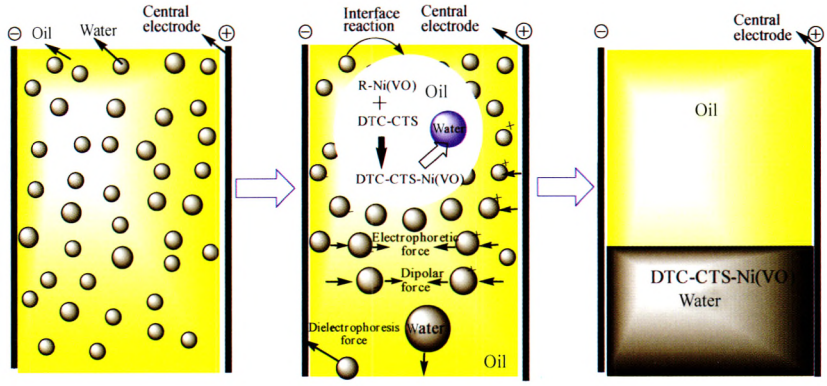
1—Low pressure section; 2—Main heat exchanger; 3—Compressor; 4—Bottom product cooler; 5—High pressure section; 6—Middle cooler

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 318-324 **doi**: 10.3969/j.issn.1001-8719.2013.02.021

Removal of Ni and V From Tahe Crude Oil by Using DTC-CTS

LI Long HAN Linxin REN Mannian XIAO Tiancun CAO Fahai

The demetallization agent (DTC-CTS) reacted with Ni and V on the interface between oil and water. The resultant chelates dissolved in water. Then the water drops coalesced in the alternating electric field. At last, bigger droplets settled down and the process of dehydration and demetallization finished.

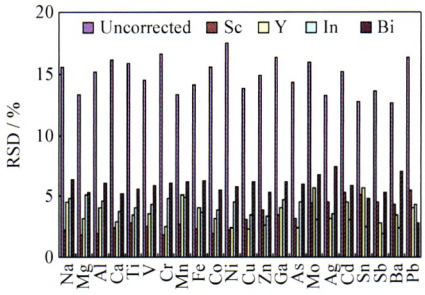


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 325-330 **doi**: 10.3969/j.issn.1001-8719.2013.02.022

Determination of Trace Elements in Residual Oil by Inductively Coupled Plasma Mass Spectroscopy With Octopole Reaction System

NIE Xidu XIE Hualin

In this method, Sc, Y, In and Bi were used as internal standard elements to compensate matrix effect and signal drift. Twenty two elements were determined for 6 times before and after the correction of internal standard elements, and the relative standard deviations (RSD) of the results were calculated and compared.



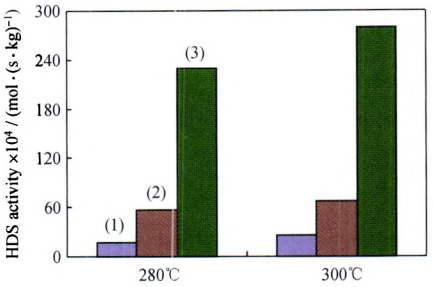
Research Notes

Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 331-335 **doi**: 10.3969/j.issn.1001-8719.2013.02.023

Preparation, Characterization and Hydrodesulfurization Properties of $NiWO_4$ Nanoparticles

WANG Chaofeng

$NiWO_4$ nanoparticles were prepared by a hydrothermal approach and their hydrodesulfurization activity was evaluated on micro device. Compared with bulky $NiWO_4$ and commercial NiW/Al_2O_3, $NiWO_4$ nanoparticles had an extremely high hydrodesulfurization activity for 4,6-dimethyldibenzothiophene.



$p(H_2)=4.2$ MPa; H_2 flow rate of 400 mL/min; Feed flow rate of 0.2 mL/min

(1) Bulky $NiWO_4$; (2) RN-10; (3) $NiWO_4$ nanoparticles

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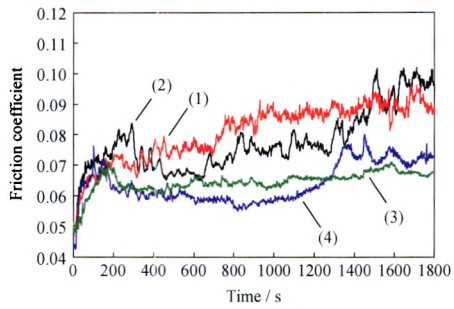
Tribological Properties of Functionalized Ionic Liquid as an Additive in Rapeseed Oil

ZHU Liye CHEN Ligong LIU Hanchen XIONG Xiaolong

The tribological properties of synthesized functionalized ionic liquid, 1-ethoxycarbonylmethyl-3-methylimidazolium bis (trifluoromethylsulfonyl) imide (LF1-4), as an additive in rapeseed oil (RO) were evaluated. Results showed that LF1-4 additive possessed good friction-reducing and anti-wear ability in RO. The optimum addion amount of LF1-4 in RO was 1.0%, when the wear scar diameter could be decreased by 38%.

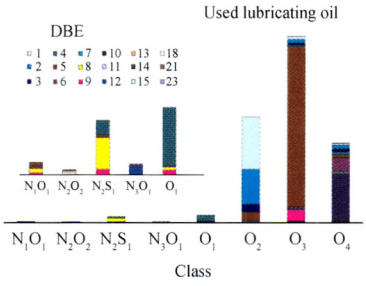


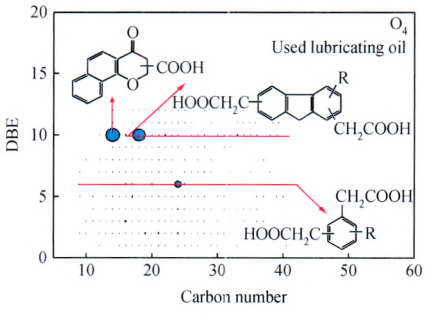
Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 341-347 **doi**: 10.3969/j.issn.1001-8719.2013.02.025

Composition and Distribution of Acidic Components in Used Vehicle Lubricating Oil Identified by Negative Electrospray Ionization Fourier Transform Ion Cyclotron Resonance Mass Spectrometry

LI Xiaohui ZHU Jianhua WU Bencheng ZHOU Yong MAO Xinhua

The difference of occurrence states of acidic compounds between fresh and used vehicle lubricating oil was mainly investigated for revealing the aging mechanism of fresh lubricating oil by negative-ion ESI FT-ICR MS. The remarkable point was that the considerable amount of O_4 class species was found in used vehicle lubricating oil, but it was not found in fresh vehicle lubricating oil.



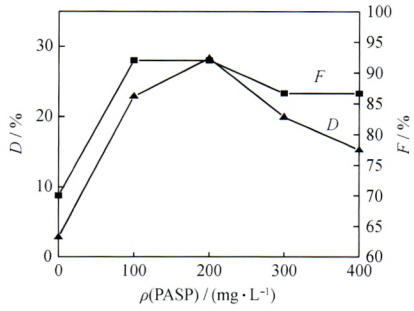


Acta Petrolei Sinica (*Petroleum Processing Section*), 2013, 29(2): 348-352 **doi**: 10.3969/j.issn.1001-8719.2013.02.026

Chelate Effect of Polyaspartic Acid and Iron Component in Crude Oil

LI Meirong LI Ranran PU Ming FANG Hongbo ZONG Hua WANG Yuhui

The iron in crude oil mainly existed as oil-soluble organacid salts and complex. For the aging crude oil emulsion with water mass fraction of 50%, under the conditions that the operating temperature was 60℃, the time was 20 min, demulsifier BSE-238 concentration was 100 mg/L and compound complexing agent concentration was 200 mg/L, the deferrization rate reached its highest value 29.26%.



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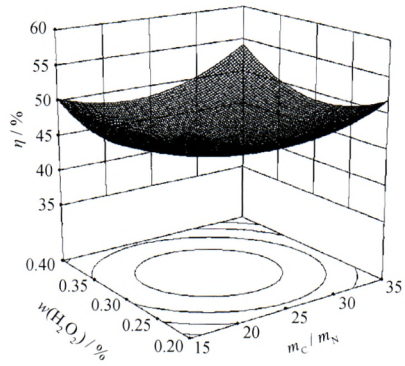
Strengthening Bioremediation of Oil Contaminated Soil by Activation Agent and Optimization of Bioremediation Conditions

ZHANG Xiuxia TENG Zhi WU Jiadong BAI Xuejing

Four kinds of activation agents were added to oil contaminated soil for strengthening bioremediation. According to strengthening bioremediation effects, three significant factors most affecting oil degradation were chosen for the response surface optimization research, then the optimal conditions of strengthening bioremediation were obtained.



Special Review

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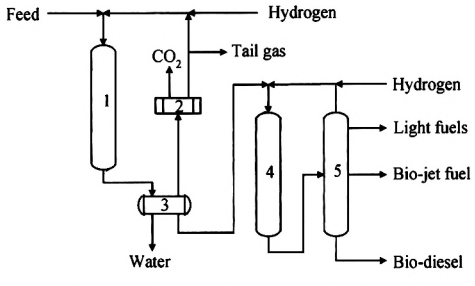
Review on the Progress of Producing Bio-Jet Fuel

LI Yi ZHANG Zhemin QU Hongliang MENG Xiangkun

The processes of producing bio-jet fuel were reviewed. There are four routes to produce bio-jet fuel from vegetable oil, animal fat and biomass.



1—Hydrotreatment; 2—Acid gas removal; 3—Separator; 4—Hydroisomerization; 5—Distillation