

石 油 学 报

(石油加工)

第 34 卷 第 2 期 2018 年 3 月

目 次

特约报告

- 生物基润滑油基础油的结构创新与产业化进展* 陆 交, 张 耀, 段庆华, 刘依农, 鱼 鲲, 王立华, 曾建立(203)
- 催化裂化再生催化剂取热技术研究进展 姚秀颖, 卢春喜(217)
- 柴油抗磨剂的分子结构设计 王 祥, 李 妍, 刘金胜, 蔺建民, 张建荣(229)

研究报告

- 含分子筛 NiMoP/Al₂O₃ 催化剂上邻二甲苯异构化的反应性能 刘诗哲, 李明丰, 张 乐, 杨 平, 李大东(238)
- 环己酮氨肟化工艺中不可逆失活 HTS 分子筛的再生 夏长久, 彭欣欣, 林 民, 朱 斌, 徐广通, 舒兴田(246)
- 纳米二硫化钼的制备及其蒽加氢性能 李 敏, 刘忠杉, 王冬娥, 潘振栋, 马怀军, 姜玉霞, 田志坚(253)
- 汽提条件对两段提升管催化裂化待生剂汽提过程的影响 刘熠斌, 孙晓昉, 陈小博, 杨朝合, 山红红(261)
- 纳米 NaY 分子筛的氟硅酸铵脱铝改性对其性能的影响 郭燕妮, 秦 波, 潘 梦, 杜艳泽, 崔杏雨, 李瑞丰(270)
- Ce/HZSM-5 分子筛催化剂在苯与甲醇制甲苯反应中的催化性能 李贵贤, 杜知松, 季 东, 王东亮, 董 鹏, 边 杰, 郭泳圻(277)
- 胆碱磷钨酸盐的制备及其催化氧化脱硫性能 陈华锴, 秦婉青, 杨嘉鸿, 王寒露(284)
- 高硫石油焦的碱催化煅烧脱硫实验研究 赵普杰, 韩贺祥, 王际童, 龙东辉, 乔文明, 凌立成(292)
- 一种双叶轮动态旋流分离器的分离性能 刘培启, 周运志, 任 帅, 胡大鹏(299)
- 基于金属作用下抗氧化剂对航空润滑油的深色效应 姚 婷, 杨宏伟, 费逸伟, 郭 峰, 郭 力, 卞 森(307)
- 矿物基础油对锂基润滑脂流变性的影响 王伟军, 陈 靖, 何懿峰, 郑 会, 孙洪伟, 姚立丹(316)
- 多烷基环戊烷制备聚脲润滑脂及其摩擦学性能 夏延秋, 席 翔, 邓 颖(326)
- PODE/乙醇双燃料共轨发动机的燃烧特性 刘军恒, 孙 平, 杨 晨, 姚肖华, 梁新华(334)
- 基于多尺度建模的炼油化工过程报警根源分析 胡瑾秋, 蔡 爽, 张来斌(341)

研究报道

- 汽油典型烃分子氧化生胶机理的分子模拟 李 娜, 龙 军, 赵 毅, 陶志平, 代振宇(354)
- 碘掺杂 g-C₃N₄ 光催化剂的制备及催化性能 刘宗梅, 赵朝成, 王帅军, 郭 锐, 王永剑, 韩建鹏(365)
- 石脑油中杂质元素的快速质谱分析 聂西度, 谢华林(373)
- 含油污泥掺混废轮胎燃烧动力学 吕全伟, 林顺洪, 柏继松, 李长江, 李 伟, 莫 榴, 李 玉(380)
- 柴油加氢脱硫三集总动力学 孙国权, 姚春雷, 全 辉(389)

综述

- 纳米碳材料催化乙苯脱氢制苯乙烯的研究进展 吴耿煌, 荣峻峰, 达志坚(398)
- 分子筛催化剂在异丁烷-丁烯烷基化反应中的构效关系研究进展 侯雅聪, 张成喜, 李永祥, 任 奎(410)
- 不同元素改性 ZSM-5 分子筛在轻烃催化裂解中的应用 韩 蕾, 欧阳颖, 罗一斌, 达志坚(419)
- 等离子体技术应用于燃料油加工的研究进展 郭 明, 孙 强, 刘爱贤, 郭绪强(430)

信息

关于《石油学报(石油加工)》网上投稿的特别声明(245); 《石油学报(石油加工)》征订启事(291); Ei 对中英文摘要的要求(340); 《China Petroleum Processing and Petrochemical Technology》征订启事(353); 《石油炼制与化工》征订启事(379)

* 封面文章

期刊基本参数: CN11-2129/TE*1985*b*A4*238*zh+en*P*¥20.00*1200*26*2018-02 本期责任编辑: 白雪

特约英文编审: 孙树瑜教授(沙特阿卜杜拉国王科技大学计算传质现象实验室主任, 博士生导师)

万方数据

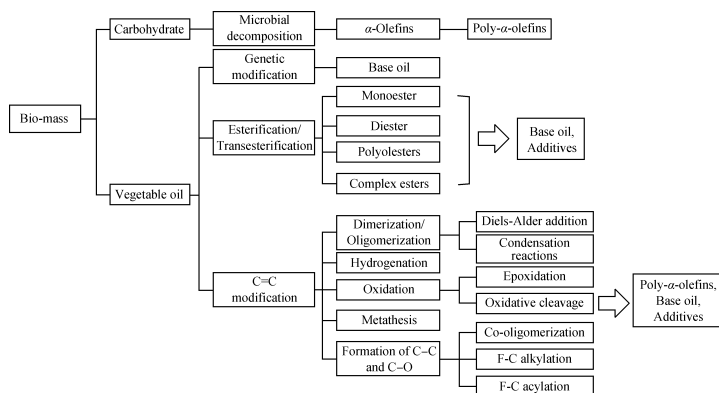
Special Articles

Acta Petrolei Sinica (Petroleum Processing Section), 2018, 34(2): 0203-0216 doi: 10.3969/j.issn.1001-8719.2018.02.001

Structure Innovation and Commercialization Progress of Bio-Based Lube Base Oil

LU Jiao ZHANG Yao DUAN Qinghua
LIU Yinong YU Kun WANG Lihua
ZENG Jianli

The new pathways for preparing high performance base oil from vegetable oil or saccharide are briefly outlined. The relationships between molecular structure and physical properties of estolide esters are emphasized. Moreover, the gaps among technology, environmental and economic benefit of bio-base oil in domestic and overseas are discussed, and the development perspective of bio-base oil in future has been put forward.

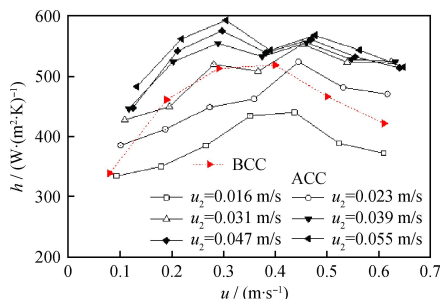
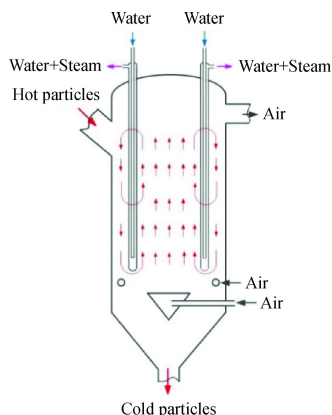


Acta Petrolei Sinica (Petroleum Processing Section), 2018, 34(2): 0217-0228 doi: 10.3969/j.issn.1001-8719.2018.02.002

Advances in Regenerated Catalyst Cooler of FCC

YAO Xiuying LU Chunxi

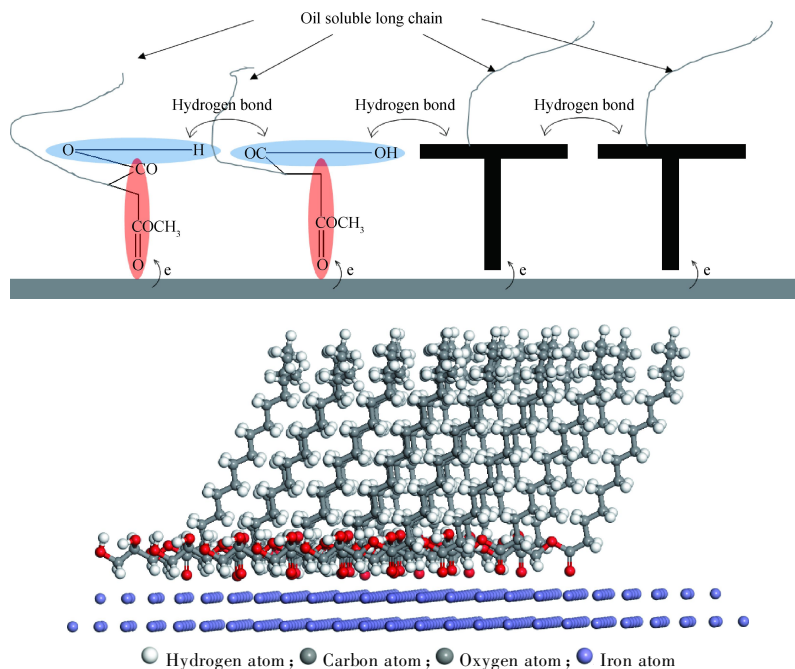
The development and category of external catalyst cooler, the technology adjusting the temperature of regenerated catalysts and the heat transfer intensification technology were described in detail. The cooler performance can be modified by changing the temperature difference, heat transfer area and coefficient. A new annular catalyst cooler and its relative investigation were described.



Molecular Structure Design of Diesel Anti-Wear Agents

WANG Xiang LI Yan LIU Jinsheng LIN Jianmin ZHANG Jianrong

Anti-wear agent molecules that contain the functional groups to form chemical adsorption with the friction surface and hydrogen bonds (called "T" shape molecule), show more superior anti-wear performance.

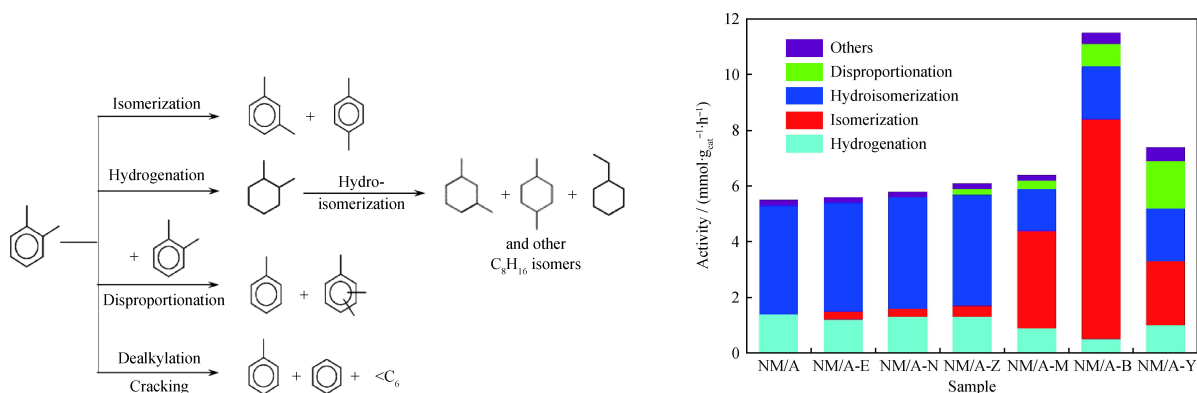


Research Articles

Isomerization of *o*-Xylene Over Zeolite-Containing NiMoP/Al₂O₃ Catalysts

LIU Shizhe LI Mingfeng ZHANG Le YANG Ping LI Dadong

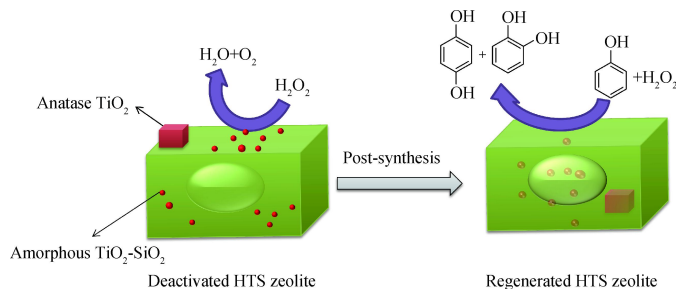
Among sulfided NiMoP/Al₂O₃ (NM/A) and NiMoP/Al₂O₃-zeolite catalysts, NiMoP/Al₂O₃-Beta (NM/A-B) exhibits the highest total activity and isomerization activity of *o*-xylene. With respect to sulfided NiMoP/Al₂O₃-zeolite catalysts, the pore structure and accessibility of acid sites of zeolites are the main factors influencing both the catalytic activity and product distribution.



Regeneration of Irreversible Deactivated Hollow Titanium Silicalite Zeolite From Commercial Cyclohexanone Ammoximation Process

XIA Changjiu LIN Min ZHU Bin PENG Xinxin XU Guangtong SHU Xingtian

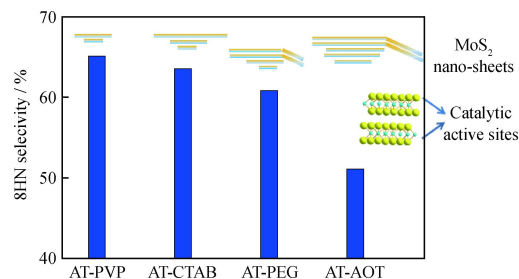
The industrial deactivated HTS zeolite can be completely regenerated via the post synthesis treatment under hydrothermal conditions, owing to the encapsulation of amorphous $\text{TiO}_2\text{-SiO}_2$ binary compounds within zeolite particles. That is because it favors avoiding the inefficient self-decomposition of H_2O_2 during catalytic oxidation reactions. Importantly, we also provide a novel strategy for rationally designing of catalytic materials through post synthesis.



Surfactant-Assisted Synthesis of MoS_2 Nano-Sheets and Their Catalytic Activity in Anthracene Hydrogenation

LI Min LIU Zhongshan WANG Donge PAN Zhendong
MA Huaijun JIANG Yuxia TIAN Zhijian

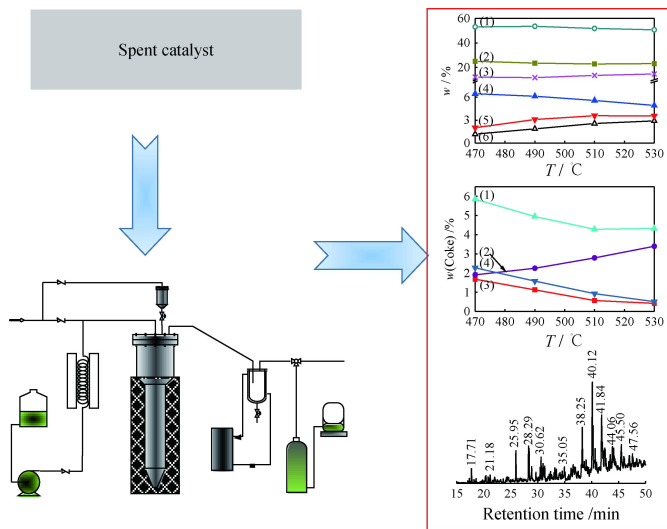
The slab length and stacking layers of MoS_2 nano-sheets and their dispersion can be controlled by adjusting the type of surfactants. Highly dispersed nano-sheet with the smallest size exhibits the highest catalytic activity in anthracene hydrogenation, which can be ascribed to its highly exposed active edges.



Influence of Stripping Conditions on Stripping of Spent Catalysts From Two-Stage Riser Fluid Catalytic Cracking Unit

LIU Yibin SUN Xiaofang CHEN Xiaobo
YANG Chaohe SHAN Honghong

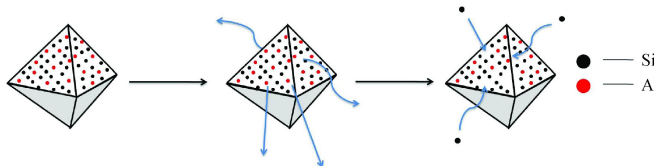
Spent catalysts from a commercial TSRFCC unit were stripped with steam as a medium at various of temperatures and steam flow rates. The coke compositions of stripped spent catalysts were also further analyzed.



Influence of Dealumination of Nano Sized NaY Zeolite by Ammonium Fluosilicate on Its Catalytic Properties

GUO Yanni QIN Bo PAN Meng DU Yanze CUI Xingyu LI Ruifeng

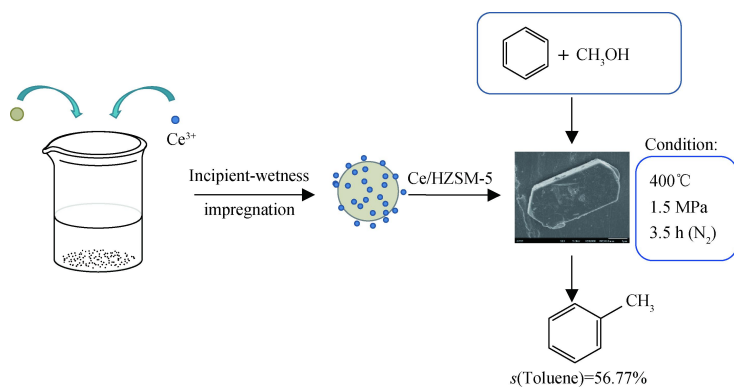
The dealuminated Y zeolite was prepared by the dealumination of parent nano NaY zeolite with $(\text{NH}_4)_2\text{SiF}_6$. And the Si species reinsert into the framework vacancy, which is created during dealumination processing. The dealuminated nano Y zeolite shows good catalytic properties in the cracking reaction of 1,3,5-triisopropylbenzene.



Catalytic Performance of Ce/HZSM-5 Molecular Sieve Catalysts in the Alkylation of Benzene With Methanol to Toluene

LI Guixian DU Zhisong JI Dong WANG Dongliang
DONG Peng BIAN Jie GUO Yongqi

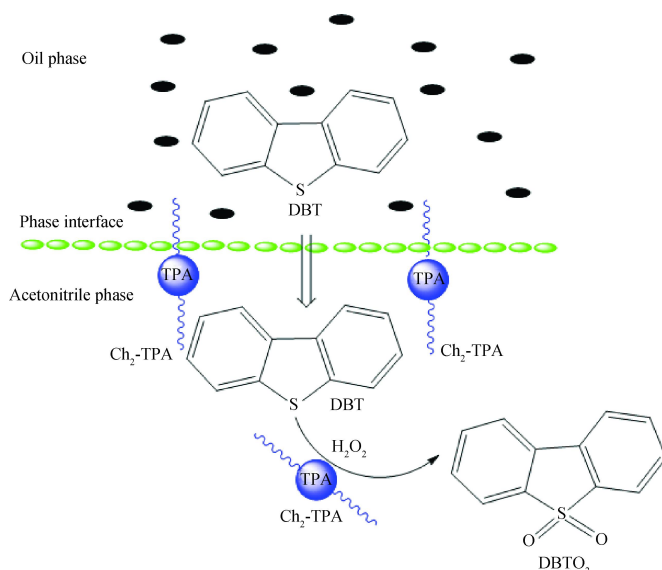
In order to improve the selectivity of toluene in the alkylation of benzene with methanol, Ce/HZSM-5 catalyst has been prepared by impregnation using rare earth as resource. Experimental results show that the selectivity of target toluene product is 56.77%.



Preparation of Choline Phosphotungstic Acid Salt and Its Catalytic Oxidative Desulfurization

CHEN Huakai QIN Wanqing YANG Jiahong
WANG Hanlu

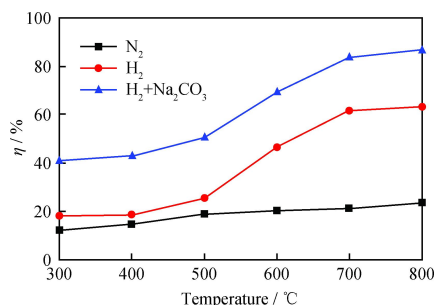
An oxidative desulfurization system for fuel oil was successfully developed, on the basis of the as-prepared choline phosphotungstic-acid catalysts, with H_2O_2 in acetonitrile solvent. The main factors influencing sulfur removal were systematically investigated. The removal of dibenzothiophene reaches 99.7% under the optimal conditions. An excellent recycling performance was also demonstrated in this system.



Experimental Study on the Desulfurization of High-Sulfur Petroleum Coke Through Alkali Catalytic Calcination in Hydrogen Atmosphere

ZHAO Pujie HAN Hexiang WANG Jitong LONG Donghui
QIAO Wenming LING Licheng

The desulfurization rate of high-sulfur petroleum coke is significantly improved through the method of alkali catalyzed calcination in hydrogen atmosphere, and research results show that the physicochemical properties of desulfurized petroleum coke are also improved to some extent.

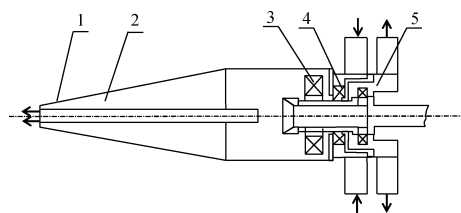


Particle size 80 μm; Reaction time 120 min;
w(Na₂CO₃)=25%; Velocity of temperature 3°C/min

Separating Performance of Double-Impeller Dynamic Hydrocyclone

LIU Peiqi ZHOU Yunzhi REN Shuai HU Dapeng

The double-impeller dynamic hydrocyclone integrated separation and pressurization function. The whirl producer could suck in and pressurize the flow, enhancing the separating efficiency as well as symmetrization of the inlet flow field. The central rod could also stabilize the flow field, while the overflow impeller would pressurize the overflow liquid.

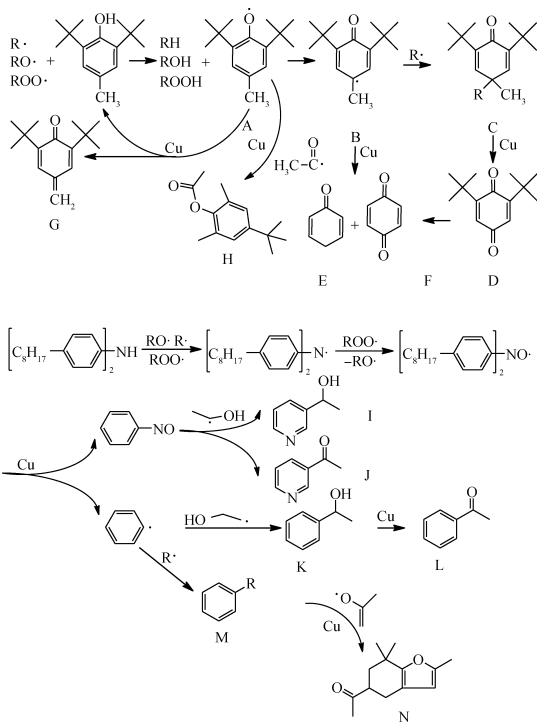


1—Underflow structure; 2—Static cyclone cavity;
3—Whirl producer; 4—Feed structure;
5—Overflow structure

Hyperchromic Effect of Antioxidants on Aero Lubricating Oil Under Metal Action

YAO Ting YANG Hongwei FEI Yiwei GUO Feng
GUO Li BIAN Sen

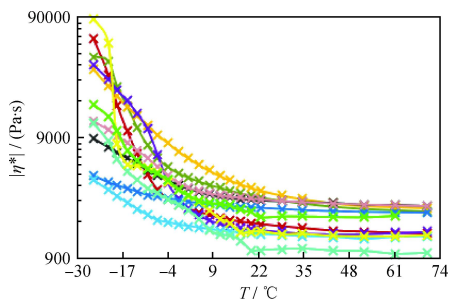
Metal and antioxidants play the key roles in causing color deepening of oil. At high temperature, the antioxidants were easily broken to generate the colored compounds. Along with metal catalysis, these substances were further presented including 4-tertiary-butyl-2,6-dimethyl phenyl acetate (H), 1-(pyridin-3-yl) ethanone (J), 1-(2,7,7-trimethyl-4,7-dihydrobenzofuran-4-yl)ethanone (N), which deepened the oil color.



Influence of Mineral Base Oils on Rheology of Lithium Lubricating Greases

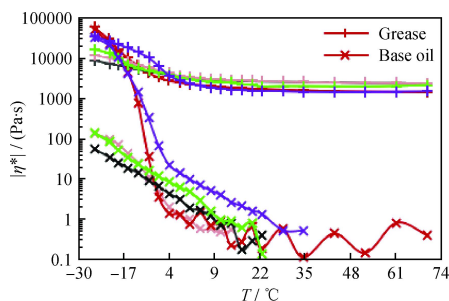
WANG Weijun CHEN Jing HE Yifeng ZHENG Hui SUN Hongwei YAO Lidan

Apparent viscosity of greases, especially at low temperature, in the linear viscoelastic region is mainly decided by physical properties of the base oil. The key determinant is the pour point of the base oil, followed by the viscosity.



—150N; —3⁺ oil; —400SN; —NS100;
—650SN; —500N; —T400; —150BS;
—500N; —10⁺ oil; —S100B

Experiment condition: $\omega=0.1$ r/s; $f=1$ Hz; $\gamma=0.02\%$; $d=1$ mm



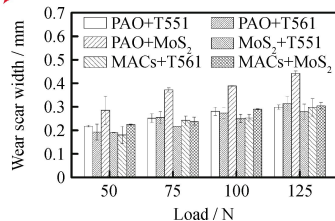
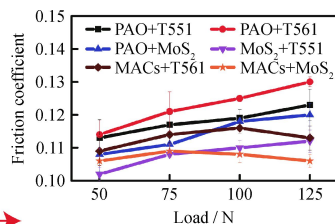
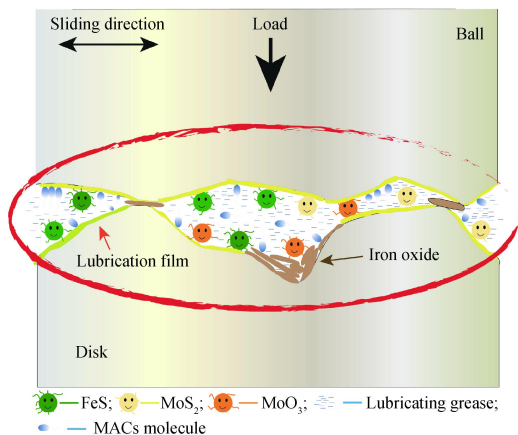
—400SN; —150BS; —500N;
—NS100; —S100B;

Experiment condition: $\omega=0.1$ r/s; $f=1$ Hz; $\gamma=0.02\%$; $d=1$ mm

Preparation and Tribological Performances of Multiply-Alkylated Cyclopentanes Polyurea Grease

XIA Yanqiu XI Xiang DENG Ying

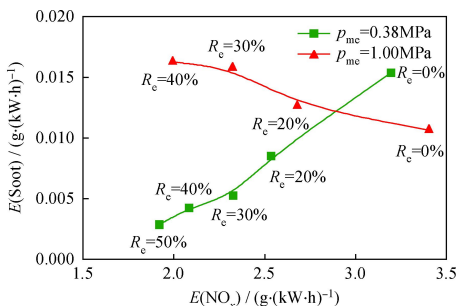
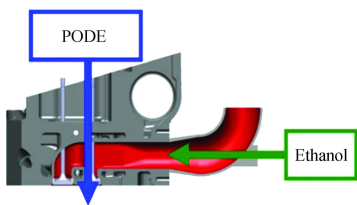
The study reveals that polyurea greases prepared by MACs show better tribological properties because the boundary lubricating film of MACs was formed on the steel worn surface by physical absorption, which can enhance oil film's carry-loading ability and the chemical reacting film containing S, Mo, Fe was produced to reduce the friction and wear.



Combustion Characteristics of Common-Rail Engine Fueled With PODE/Ethanol Dual Fuel

LIU Junheng SUN Ping YANG Chen YAO Xiaohua LIANG Xinhua

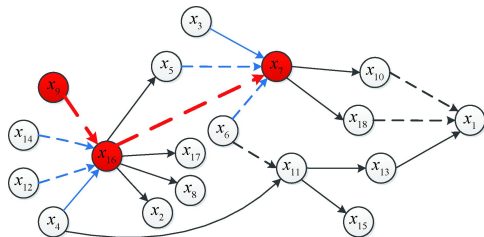
The effects of premixed ethanol ratio on combustion and emission characteristics of PODE/ethanol dual fuel were conducted on a common-rail engine. As a result, the amount of premixed heat release and the peak heat release rate increase with the increase of ethanol ratio. Dual fuel can simultaneously reduce NO_x and soot emissions at low load, and also change the trade-off relationship between them.



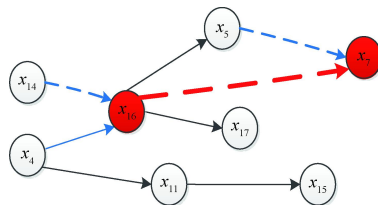
Alarm Root Cause Analysis in Refinery Process Based on Multi-Scale Modeling

HU Jinqiu CAI Shuang ZHANG Laibin

By dividing spatial scale of refinery production system, process risk indicators under different scales were analyzed to establish the risk process alarm root cause analysis model based on cross-correlation function. The comparison and analysis of models in different scales were made so as to choose the appropriate scale for modeling.



The searching map for alarm root cause of the risk process in mesoscale
 x_i ($i=1, 2, \dots, 18$) represents the i th process variable node corresponding to the risk indicators of mesoscale
 The dotted lines indicate a negative correlation between two variables;
 The solid lines indicate a positive correlation between two variables



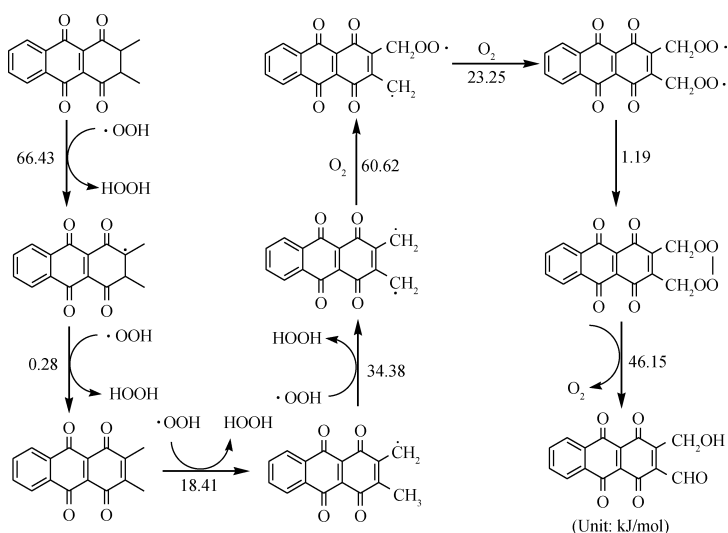
The searching map for alarm root cause of the risk process in small scale
 x_i represents the i th process variable node corresponding to the risk indicators of small scale
 The dotted lines indicate a negative correlation between two variables;
 The solid lines indicate a positive correlation between two variables

Acta Petrolei Sinica (Petroleum Processing Section), 2018, 34(2): 0354-0364 doi: 10.3969/j.issn.1001-8719.2018.02.018

Molecular Simulation of the Mechanism of Oxidation Gum Formation of Typical Gasoline Hydrocarbon

LI Na LONG Jun ZHAO Yi TAO Zhiping
DAI Zhenyu

Using the DFT method, we calculated the chain radical oxidation network that produced deposit. The results showed whether there was C—H in α position of C=C or phenyl, *tert* C—H, or whether it generated electron-withdrawing group, are the factors to determine whether deposit would be produced. Furthermore, ROOH and ROO• were the most critical intermediates, thus it is crucial to remove them.

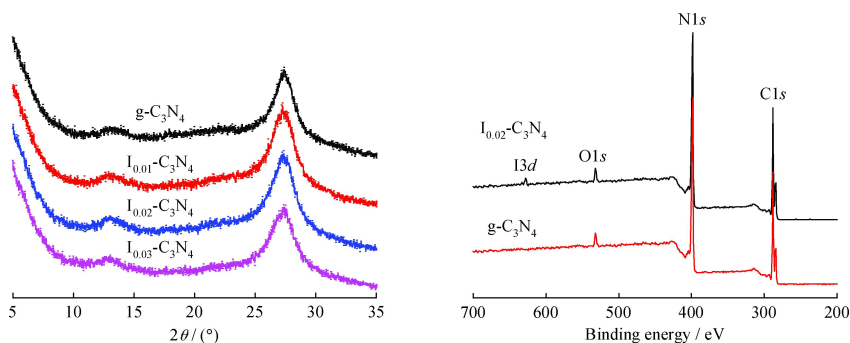


Acta Petrolei Sinica (Petroleum Processing Section), 2018, 34(2): 0365-0372 doi: 10.3969/j.issn.1001-8719.2018.02.019

Preparation and Photoactivity Activity of Iodine Doping g-C₃N₄

LIU Zongmei ZHAO Chaocheng WANG Shuaijun GUO Rui WANG Yongjian HAN Jianpeng

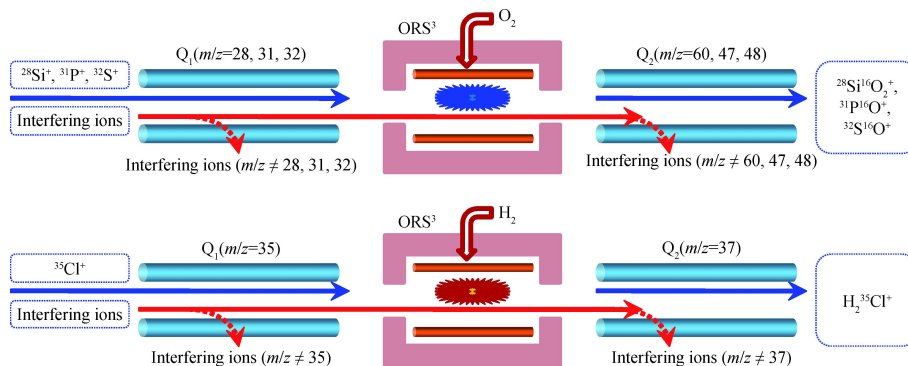
The photocatalysts g-C₃N₄ with iodide doping by thermal polymerization method with urea and ammonium iodide were analyzed by XRD, XPS, and EIS. The photocatalytic *p*-nitrophenol degradation experiment was done. The results show iodide broadens the absorption range of the visible light, and reduces the recombination rate of the photogenerated electron-hole pairs.



Rapid Determination of Impurity Elements in Naphtha by Inductively Coupled Plasma Tandem Mass Spectrometry

NIE Xidu XIE Hualin

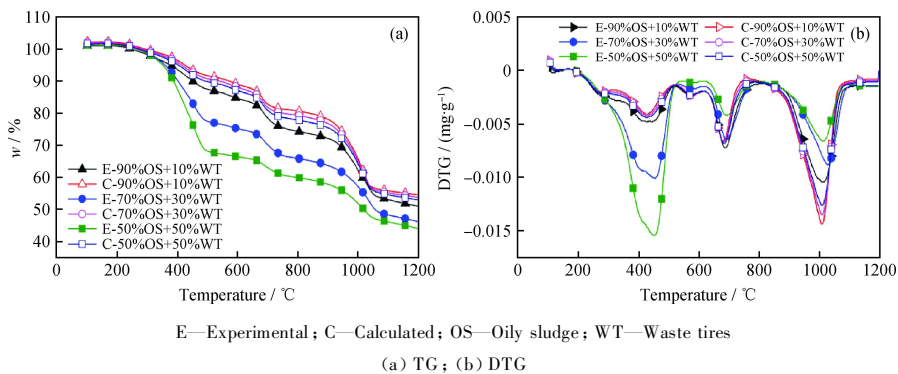
The impurity elements (Si, P, S and Cl) were accurately determined by ICP-MS/MS through diluting naphtha in ethyl alcohol. In MS/MS model, the mass spectral interferences are eliminated using mass shift by the reaction of target ions with reaction gas in ORS³. A simple, rapid and accurate analytic method has been established for the determination of impurity elements in naphtha.



Combustion Kinetics of Oily Sludge Blends Waste Tires

LÜ Quanwei LIN Shunhong BAI Jisong LI Changjiang LI Wei MO Liu LI Yu

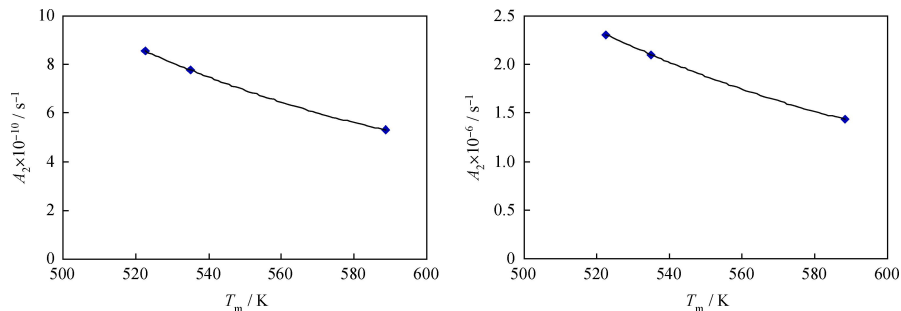
There is a synergistic effect of blended waste tires on combustion process of oily sludge. Co-pyrolysis can promote the combustion of oily sludge, and decrease the mean activation energy, promote the decomposition and combustion of *tert*-butyl at the high temperature stage (800—1200°C).



Three-Lump Kinetics Model of Diesel Hydrodesulfurization

SUN Guoquan YAO Chunlei QUAN Hui

Assuming apparent activation energy of three types of sulfide is unchanging, three-lump kinetics model with first order was established by acquiring the relation curve of pre-exponential factor and mean average boiling point, considering numbers of distillates separated by boiling range.

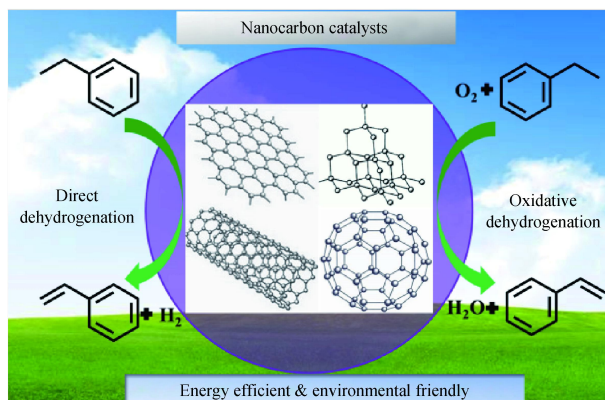


Reviews

Recent Advances in Catalytic Dehydrogenation of Ethylbenzene to Styrene by Nanocarbon Catalysts

WU Genghuang RONG Junfeng DA Zhijian

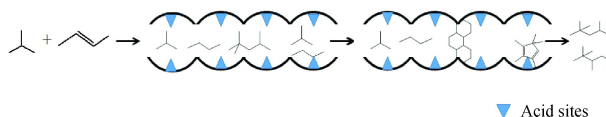
This review highlights the recent development in the catalytic dehydrogenation of ethylbenzene to styrene by nanocarbon catalysts, including the introduction of the structure and surface properties of nanocarbons; the preparation and performance of nanocarbon catalysts; the mechanisms of dehydrogenation reactions; current challenges and future perspectives for the industrial application of nanocarbon catalysts.



Structure-Activity Relationship Review of Zeolite Catalysts in Isobutane-Butene Alkylation

HOU Yacong ZHANG Chengxi LI Yongxiang REN Kui

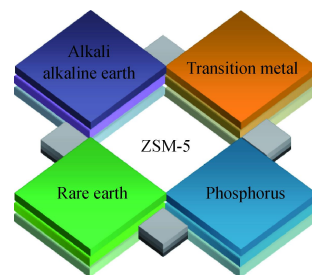
The reaction performance is affected by zeolites in two aspects: one is the acidity property of zeolites, which mainly affects the catalyst lifetime and the selectivity of the products; the other one is the pore structure of zeolites, which has a shape selective effect on alkylation products.



Application of Modified ZSM-5 Zeolite With Different Elements in Catalytic Cracking of Light Hydrocarbon

HAN Lei OUYANG Ying LUO Yibin DA Zhijian

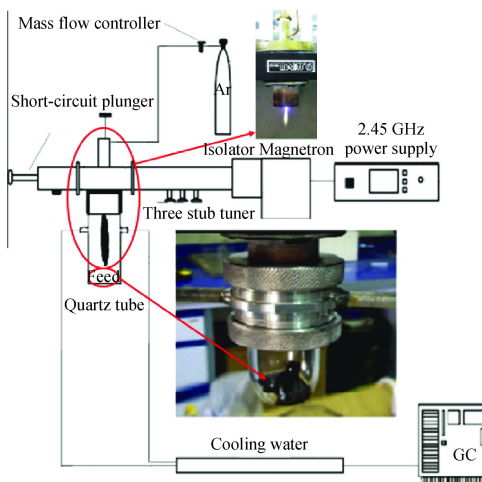
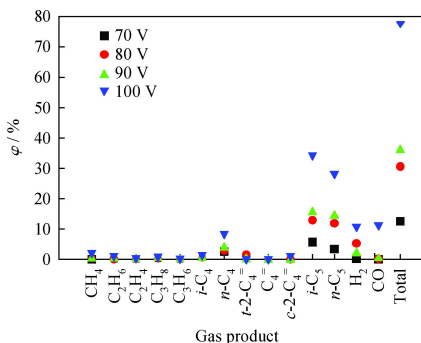
The application of ZSM-5 zeolites modified by alkali and alkaline earth, transition metal, rare earth, and phosphorus in light olefin cracking is summarized. And the effects of the above modification on acid property and catalytic performance of ZSM-5 in light hydrocarbon cracking are discussed in detail.



Review of Plasma Technology on Fuel Oil Processing

GUO Ming SUN Qiang LIU Aixian GUO Xuqiang

This paper mainly summarizes the recent progress on plasma assisted oil processing and various related reactors. Furthermore, a large number of parameters are compared and discussed, including the discharge type, working gas, structure of reactors and voltage and power. Finally, some suggestions are proposed to direct potential research orientations in future work.



GC—Gas chromatography