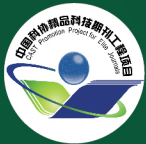


# 9

2018  
第37卷  
EI收录期刊

# 化工进展

Chemical Industry and Engineering Progress



中国化工学会会刊

Journal of Chemical Industry and Engineering Society of China

ISSN 1000-6613 / CN 11-1954/TQ

化工进展

第三十七卷

第九期

二〇一八年九月



精馏技术国家工程研究中心（天津大学）  
北洋国家精馏技术工程发展有限公司



欢迎扫码关注  
化工进展微信公众号

主办 |  中国化工学会  
 化学工业出版社



## 目次

### 特约评述

中国进口乙烷裂解制乙烯项目前景分析.....何盛宝,王红秋,王春娇(3283)

### 化工过程与装备

水冷壁气流床气化炉渣层热应力数值模拟方法的改进  
.....王浩鹏,陈智超,张晓研,曾令艳,李争起,方能,刘晓英(3288)

旋转流化床粉体混合机混合效果数值模拟和实验验证.....陈程,刘雪东,罗召威,崔树旗,谈志超(3294)

双压膨胀有机朗肯循环中低温余热发电系统的热力性能.....黄靖伦,王辉涛,葛众,韩金蓉,赵玲玲(3303)

喷气增焓型单级MVR蒸发结晶系统性能分析.....王汉治,李帅旗,黄冲,何世辉,宋文吉,冯自平(3312)

多孔板压降特性实验与关联式比较.....焦乾峰,马有福,吕俊复,蔡振琦,彭杰伟,孙选举(3320)

### 能源加工与技术

天然气水合物储运技术中水合物反应器的研究进展  
.....施政灼,李玉星,王武昌,宋光春,姜凯,姚淑鹏,张玉乾(3326)

油砂沥青分离技术研究进展.....郝俊辉,田原宇,张金弘,乔英云,车远军(3337)

直接利用生物质的化学燃料电池研究进展.....刘跃岭,景琦,徐帆,李欢(3346)

中低温煤焦油蒸馏过程中金属元素的迁移规律  
.....马明明,苏小平,闵小建,郑化安,樊英杰,万冲,孙鸣,马晓迅(3355)

O<sub>2</sub>/CO<sub>2</sub>气氛下基于反应面积的Char-N转化模型的建立.....曲践,史小四,王照国,武文斐(3362)

基于颗粒堆积理论的管壁水合物沉积层力学特性研究  
.....宋光春,李玉星,王武昌,姜凯,施政灼,姚淑鹏,魏丁,史培玉(3370)

HZSM-5催化条件下反应温度对热解油品质量影响规律.....李萍,王丽红,司慧,王一青(3379)

水和游离脂肪酸对DBU催化制备生物柴油的影响.....袁川,鲁厚芳,刘长军,蒋炜,刘颖颖,梁斌(3386)

### 工业催化

草酸二甲酯加氢反应中铜催化剂稳定性的研究进展  
.....赵鹤,王世栋,负宏飞,高懂儒,李贵贤,沈俭一(3393)

黏土负载型类Fenton催化剂的研究进展.....廖丰,龙明策(3401)

煅烧温度对磁性铁钛复合氧化物微观结构及脱硝活性的影响  
.....周飞,熊志波,金晶,武超,陆威,丁旭春(3410)

低温等离子体协同铜铈催化剂脱除甲苯.....甘蓉丽,罗光前,许洋,梅瑞冬,朱海露,周梦丽(3416)

氯的脱除对丙烷脱氢PtSnNa/Al<sub>2</sub>O<sub>3</sub>催化剂结构的影响.....张海娟,赵悦,万海,高杰,高文艺,赵珍珍(3424)

金属离子改性分子筛吸附水的Monte Carlo模拟.....肖永厚,周梦雪,赵颖,王传明,贺高红(3430)

### 材料科学与技术

一类新型镁材料——镁基金属有机骨架材料.....韩森建,王海增(3437)

用于高温质子交换膜燃料电池的聚合物电解质膜研究进展.....李英,张香平(3446)

纳米纤维素及其聚合物纳米复合材料的研究进展.....林凤采,卢麒麟,卢贝丽,黄彪,唐丽荣(3454)

UiO-66的制备、功能化及膜分离研究进展.....贾明民,冯艺,邱健豪,姚建峰(3471)

马来酸酐接枝纤维素超细纤维制备高容量可再生吸附剂.....李智雄,李如燕,董祥,姜跃平,张松(3484)

生物炭负载纳米羟基磷灰石复合材料的制备及对铅离子的吸附特性  
.....张连科,王洋,王维大,李玉梅,孙鹏,韩剑宏,姜庆宏(3492)

SPTES-b-PI质子交换膜的制备及表征.....刘闪闪,侯敬贺,肖振雨,孙翔,丁会利(3502)

磷酸缓冲液快速洗涤纳米羟基磷灰石.....黄金会,李玉宝,左奕,李吉东(3508)

海藻酸钠/二氧化硅杂化微球结构与吸附性能.....曹仕文,张鸿,孟驰涵,邹新全,周炜东,于跃,郭静(3512)

改性活性碳纤维对CO<sub>2</sub>的吸附性能.....李灿灿,朱佳媚,任婷,郭斌,严红芳(3520)

制备方法对钙钛矿薄膜结构及形貌的影响.....韦慧,汤洋,尤晖(3528)

超高分子量聚丙烯的制备.....王帆,刘小燕,赵文康,朱博超,张平生(3534)

孔隙分布对分形泡沫金属基相变材料传热特性的影响.....王晟琪,郑佳宜,余延顺(3540)

SiO<sub>2</sub>/聚丙烯酰胺核壳结构复合材料的分子动力学模拟.....戴姗姗,寇子敏,刘艳,赵晓文(3547)

硅烷改性环氧树脂自修复微胶囊的制备及应用.....童晓梅,郝芹芹,闫子英,郑博学(3555)

EVA-g-MAH的制备及在聚合物共混相容中的应用.....金世龙,崔崑,毛国梁,历娜,吴韦,马志(3562)

### 生物与医药化工

联合生物加工产纤维素乙醇中真菌的开发与应用.....刘东国,吴云青,段学辉(3568)

## 精细化工

- 乙醇酸和聚乙醇酸的制备与分离研究进展..... 王晓静, 魏琦峰, 任秀莲(3577)  
非稳态体系合成聚丙烯酰胺..... 魏哲, 王旭, 王传兴(3585)  
缩醛交换反应制备双二乙二醇丁醚缩甲醛..... 邵冲, 王大卫, 沈雯雯, 刘洋, 张小祥, 朱新宝(3592)

## 资源与环境化工

- 赤泥中铁的提取与回收利用研究进展..... 顾汉念, 郭腾飞, 马时成, 代杨, 王宁(3599)  
燃煤电厂镁法脱除烟气中 SO<sub>2</sub> 的研究现状与展望..... 马双忱, 别璇, 孙尧, 陈奎续, 朱召平(3609)  
典型氧化铜铅锌矿物浮选的表面硫化研究进展  
..... 宋凯伟, 李佳磊, 蔡锦鹏, 刘思言, 曹阳, 苏超, 刘殿文(3618)  
Cl<sup>-</sup> 含量对钙基吸收剂微观结构以及动力学性能的影响..... 孙荣岳, 叶江明, 陈凌海, 毕小龙, 李尚(3629)  
二价铁活化过碳酸钠对磺胺甲噁唑的去除..... 颜平平, 隋倩, 吕树光, 邱兆富(3635)  
双杆介质阻挡放电降解酸性红 73 废水..... 刘丹, 张连成, 黄逸凡, 朱安娜, 刘振, 闫克平(3640)  
光催化膜对水中腐植酸的去除及积垢机理..... 饶瑞晔, 毛竹筒, 林靖靖, 廖夏露, 胡家朋, 林皓(3649)  
市政污泥中低温气化及重金属迁移转化特性  
..... 张伟, 陈晓平, 杨叙军, 宋联, 朱葛, 马吉亮, 刘道银, 梁财(3657)  
聚酯醇解废液的脱色动力学..... 李梦娟, 李艳艳, 鲁静, 李晓强(3666)  
Ca<sup>2+</sup> 对序批式生物反应器活性污泥性能的影响  
..... 张兰河, 王佳平, 陈子成, 郭静波, 贾艳萍, 张海丰, 李正(3675)

## 应用技术

- 复分解电渗析清洁生产谷氨酸钠新工艺..... 李帅, 王建友, 冯云华(3682)

## 化工园区

- 工业污水处理厂生化出水氨氮周年变化及原因分析..... 何尚卫, 张雷, 张超, 刘斌, 邵娟, 李鹏章(3691)

## 行业动态

- 征订启事(3311, 3319)

## 广告索引

- 封面: 精馏技术国家工程研究中心(天津大学)  
封二: 北京三聚环保新材料股份有限公司  
封三: 北京世纪森朗实验仪器有限公司  
封四: 中山大学惠州研究院  
彩插 1: 精馏技术国家工程研究中心(天津大学)  
彩插 2: 北京泽华化学工程有限公司  
彩插 3: 北京泽华化学工程有限公司  
彩插 4: 沈阳奥吉娜化工有限公司  
彩插 5: 沈阳奥吉娜化工有限公司  
彩插 6: 上海弗鲁克科技发展有限公司  
彩插 7: 石家庄波特无机膜分离设备有限公司  
彩插 8: 山东省淄博三剂化工设备有限公司  
彩插 9: 天津市创举科技有限公司  
彩插 10: 四川天一科技股份有限公司  
彩插 11: 天津市新天进科技开发有限公司  
彩插 12: 苏州顶裕节能设备有限公司  
彩插 13: 烟台信亚精馏设备高新技术有限公司  
彩插 14: 北京北化工程技术有限公司  
彩插 15: 合众高科(北京)环保技术股份有限公司  
彩插 16: 常州大学石油化工学院  
彩插 17: 青岛科大隆腾科技发展有限公司  
彩插 18: 中国石油化工股份有限公司大连石油  
化工研究院  
内插 1: 广西碳酸钙产业化工程院  
内插 2: 南通富莱克流体装备有限公司  
内插 3: 浙江东瓯过滤机制造有限公司  
内插 4: 上海申银机械(集团)有限公司

责任编辑 史来娣  
英文顾问 蔡家琦, 李保庆, 龙秉文, 王运东

主 管	中国科学技术协会	主 编	谭天伟	国际标准刊号	ISSN 1000-6613
主 办	中国化工学会 化学工业出版社	编辑部主任	黄丽娟	国内统一刊号	CN 11-1954/TQ
编 辑	《化工进展》编辑部	副主任兼广告负责人	胡晓丹	广告发布登记号	京东工商广登字 20170106 号
出 版	化学工业出版社	编辑部电话	010-64519500/9501/9502	订 阅 处	全国各地邮局
通讯地址	北京市东城区青年湖 南街 13 号	广告部电话	010-64519466/9499	邮 发 代 号	82-311
邮 编	100011	印 刷	北京科信印刷有限公司	海外总发行	中国国际图书贸易集团有限公司
E - m a i l	hgjz@263.net	开 户 银 行	中国工商银行北京和平里支行	国外发行代码	M3231
网 址	www.hgjz.com.cn	账 户 名 称	北京进展期刊社	定 价	95 元(国内) 20 美元(国外)
		银 行 账 号	0200004219200176319		



## Contents

### Invited review

Prospect analysis of import ethane cracking projects in China.....HE Shengbao, WANG Hongqiu, WANG Chunjiao (3283)

### Chemical processes and equipment

An improvement on numerical modeling for thermal stress analysis of slag layer in a membrane wall entrained-flow gasifier  
.....WANG Haopeng, CHEN Zhichao, ZHANG Xiaoyan, ZENG Lingyan, LI Zhengqi, FANG Neng, LIU Xiaoying (3288)

Numerical simulation and experimental verification of mixing effect in rotating fluidized bed powder mixer  
.....CHEN Cheng, LIU Xuedong, LUO Zhaowei, CUI Shuqi, TAN Zhichao (3294)

Thermodynamic performance of dual-pressure expansion organic Rankine cycle power generation system driven by  
low-middle temperature waste heat..... HUANG Jinglun, WANG Huitao, GE Zhong, HAN Jingrong, ZHAO Lingling (3303)

Performance analysis of single-effect MVR evaporative crystallization system using vapor injected compressor  
.....WANG Hanzhi, LI Shuaiqi, HUANG Chong, HE Shihui, SONG Wenji, FENG Ziping (3312)

Comparison of experiment with correlation on pressure drop of multi-orifice plates  
.....JIAO Qianfeng, MA Youfu, LÜ Junfu, CAI Zhenqi, PENG Jiewei, SUN Xuanju (3320)

### Energy processes and technology

Review of hydrate reactor in natural gas hydrate storage and transportation  
..... SHI Zhengzhuo, LI Yuxing, WANG Wuchang, SONG Guangchun, JIANG Kai, YAO Shupeng, ZHANG Yuqian (3326)

Research Progress on separation technologies of oil sand bitumen  
.....HAO Junhui, TIAN Yuanyu, ZHANG Jinhong, QIAO Yingyun, CHE Yuanjun (3337)

Research progress of chemical fuel cells by direct use of biomass.....LIU Yueling, JING Qi, XU Fan, LI Huan (3346)

Migration law of metal elements during distillation of low temperature coal tar  
..... MA Mingming, SU Xiaoping, MIN Xiaojian, ZHENG Huaan, FAN Yingjie, WAN Chong, SUN Ming, MA Xiaoxun (3355)

Establishment of Char-N conversion model based on reaction area in O<sub>2</sub>/CO<sub>2</sub> atmosphere  
.....QU Jian, SHI Xiaosi, WANG Zhaoguo, WU Wenfei (3362)

Investigation on the mechanical properties of pipe wall hydrate deposits based on particle packing theory  
..... SONG Guangchun, LI Yuxing, WANG Wuchang, JIANG Kai, SHI Zhengzhuo, YAO Shupeng, WEI Ding, SHI Peiyu (3370)

Effect of reaction temperature on pyrolysis oil quality over HZSM-5 catalyst...LI Ping, WANG Lihong, SI Hui, WANG Yiqing (3379)

Effects of water and free fatty acids on biodiesel production using DBU as catalyst  
.....YUAN Chuan, LU Houfang, LIU Changjun, JIANG Wei, LIU Yingying, LIANG Bin (3386)

### Industrial catalysis

Recent progress on the stabilization of copper catalysts for the hydrogenation of dimethyl oxalate  
..... ZHAO Yu, WANG Shidong, YUAN Hongfei, GAO Dongru, LI Guixian, SHEN Jianyi (3393)

Recent progress on the clay supported Fenton-like catalyst.....LIAO Feng, LONG Mingce (3401)

Influence of calcination temperature on the micro-structure and the NH<sub>3</sub>-SCR activity of magnetic iron-titanium mixed  
oxide catalyst.....ZHOU Fei, XIONG Zhibo, JIN Jing, WU Chao, LU Wei, DING Xuchun (3410)

Removal of toluene by non-thermal plasma coupled with Cu-Ce catalysts  
.....GAN Rongli, LUO Guangqian, XU Yang, MEI Ruidong, ZHU Hailu, ZHOU Mengli (3416)

The effect of chlorine elimination on the structure of PtSnNa/Al<sub>2</sub>O<sub>3</sub> catalyst for propane dehydrogenation  
.....ZHANG Haijuan, ZHAO Yue, WAN Hai, GAO Jie, GAO Wenyi, ZHAO Zhenzhen (3424)

Monte Carlo simulation of water adsorption on metal ions modified molecular sieves  
.....XIAO Yonghou, ZHOU Mengxue, ZHAO Ying, WANG Chuanming, HE Gaohong (3430)

### Materials science and technology

A new material of magnesium complexes—magnesium based metal organic frameworks  
..... HAN Senjian, WANG Haizeng (3437)

Research progress of polymer electrolyte membrane for high temperature proton exchange membrane fuel cell  
..... LI Ying, ZHANG Xiangping (3446)

Research progress of nanocellulose and its polymer nanocomposites  
..... LIN Fengcai, LU Qilin, LU Beili, HUANG Biao, TANG Lirong (3454)

Advances in the synthesis and functionalization of UiO-66 and its applications in membrane separation  
..... JIA Mingmin, FENG Yi, QIU Jianhao, YAO Jianfeng (3471)

Preparation of high capacity and renewable adsorbent from cellulose superfine fiber grafted with maleic anhydride  
.....LI Zhixiong, LI Ruyan, DONG Xiang, JIANG Yueping, ZHANG Song (3484)

- The preparation of biochar-supported nano-hydroxyapatite and its adsorption of Pb<sup>2+</sup>**  
 .....ZHANG Lianke, WANG Yang, WANG Weida, LI Yumei, SUN Peng, HAN Jianhong, JIANG Qinghong (3492)
- Preparation and properties of sulfonated poly(arylene thioether sulfone)-b-polyimide block copolymers as proton exchange membrane**  
 .....LIU Shanshan, HOU Jinghe, XIAO Zhenyu, SUN Xiang, DING Huili (3502)
- Rapid wash of nano-hydroxyapatite with phosphate buffer solution**  
 .....HUANG Jinhui, LI Yubao, ZUO Yi, LI Jidong (3508)
- Structure and properties of sodium alginate / silica hybrid microspheres**  
 .....CAO Shuwen, ZHANG Hong, MENG Chihan, ZOU Xinquan, ZHOU Weidong, YU Yue, GUO Jing (3512)
- CO<sub>2</sub> adsorption performance of modified activated carbon fibers**  
 .....LI Cancan, ZHU Jiamei, REN Ting, GUO Bin, YAN Hongfang (3520)
- Morphologies of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite and performance of perovskite solar cells by using different fabrication process**  
 .....WEI Hui, TANG Yang, YOU Hui (3528)
- Preparation of ultra-high molecular weight polypropylene**  
 .....WANG Fan, LIU Xiaoyan, ZHAO Wenkang, ZHU Bochao, ZHANG Pingsheng (3534)
- Influence of pore structure on the heat transfer characteristics of fractal metal foam filled with phase change material**  
 .....WANG Shengqi, ZHENG Jiayi, YU Yanshun (3540)
- Molecular dynamics simulation of SiO<sub>2</sub>/PAM composites with a core-shell structure**  
 .....DAI Shanshan, KOU Zimin, LIU Yan, ZHAO Xiaowen (3547)
- Preparation and application of epoxy resin self-healing microcapsules modified by silicone**  
 .....TONG Xiaomei, HAO Qinqin, YAN Ziyang, ZHENG Boxue (3555)
- The preparation of EVA-g-MAH and its application in the compatible blending of polymers**  
 .....JIN Shilong, CUI Kun, MAO Guoliang, LI Na, WU Wei, MA Zhi (3562)

## Biochemical and pharmaceutical engineering

- Development and application of fungi in cellulosic ethanol production via consolidated bioprocessing**  
 .....LIU Dongguo, WU Yunqing, DUAN Xuehui (3568)

## Fine chemicals

- Preparation and isolation of glycolic acid and polyglycolic acid**  
 .....WANG Xiaojing, WEI Qifeng, REN Xiulian (3577)
- Synthesis of polyacrylamide in unsteady system**  
 .....WEI Zhe, WANG Xu, WANG Chuanxing (3585)
- Preparation of bis(diethylene glycol butyl ether) formal by acetal exchange reactions**  
 .....SHAO Chong, WANG Dawei, SHEN Wenwen, LIU Yang, ZHANG Xiaoxiang, ZHU Xinbao (3592)

## Resources and environmental engineering

- Review on separation, recovery, extraction and comprehensive utilization of iron from red mud**  
 .....GU Hannian, GUO Tengfei, MA Shicheng, DAI Yang, WANG Ning (3599)
- Present research situation and prospect of magnesium desulfurization in coal-fired power plant**  
 .....MA Shuangchen, BIE Xuan, SUN Yao, CHEN Kuixu, ZHU Zhaoping (3609)
- A review on surface sulfidization of typical copper/lead/zinc oxide minerals flotation**  
 .....SONG Kaiwei, LI Jialei, CAI Jinpeng, LIU Siyan, CAO Yang, SU Chao, LIU Dianwen (3618)
- Effect of Cl content on the microstructure and dynamic performance of calcium-based sorbent**  
 .....SUN Rongyue, YE Jiangming, CHEN Linghai, BI Xiaolong, LI Shang (3629)
- Removal of sulfamethoxazole by ferrous-activated sodium percarbonate in the aqueous phase**  
 .....YAN Pingping, SUI Qian, LÜ Shuguang, QIU Zhaofu (3635)
- Degradation of Brilliant Crocein wastewater by double-rod dielectric barrier discharge**  
 .....LIU Dan, ZHANG Liancheng, HUANG Yifan, ZHU Anna, LIU Zhen, YAN Keping (3640)
- Removal of humic acid from water and fouling mechanism by photocatalytic membrane**  
 .....RAU Juiyeh, MAO Zhuojian, LIN Jingjing, LIAO Xialu, HU Jiapeng, LIN Hao (3649)
- Characteristics of medium-low temperature gasification of sewage sludge and migration and transformation of heavy metals**  
 .....ZHANG Wei, CHEN Xiaoping, YANG Xujun, SONG Lian, ZHU Ge, MA Jiliang, LIU Daoyin, LIANG Cai (3657)
- Dynamics study on decolorization of PET alcoholysis waste liquid**  
 .....LI Mengjuan, LI Yanyan, LU Jing, LI Xiaoqiang (3666)
- Effect of Ca<sup>2+</sup> on the properties of activated sludge in the SBR**  
 .....ZHANG Lanhe, WANG Jiaping, CHEN Zicheng, GUO Jingbo, JIA Yanping, ZHANG Haifeng, LI Zheng (3675)

## Applied technology

- A new technology for cleaner production of sodium glutamate by electrodialysis metathesis**  
 .....LI Shuai, WANG Jianyou, FENG Yunhua (3682)

## Chemical Industry Park

- Annual variations and the cause of the ammonia nitrogen concentration in effluent of a chemical industrial wastewater treatment**  
 .....HE Shangwei, ZHANG Lei, ZHANG Chao, LIU Bin, SHAO Juan, LI Pengzhang (3691)

<b>Superintend:</b> China Association for Science and Technology	<b>Address:</b> No.13 Qingnianhu South Street, Dongcheng District, Beijing, China	<b>E-mail:</b> hgjz@263.net huagongjz@126.com
<b>Sponsor:</b> The Chemical Industry and Engineering Society of China; Chemical Industry Press	<b>Post Code:</b> 100011	<b>http:</b> //www.hgjz.com.cn
<b>Editor:</b> Editorial Department of Chemical Industry and Engineering Progre	<b>Editor in Chief:</b> TAN Tianwei	<b>Price:</b> \$ 20
<b>Publisher:</b> Chemical Industry Press	<b>Managing Editor:</b> HUANG Lijuan	<b>ISSN</b> 1000-6613
	<b>Executive Editor:</b> SHI Laidi	<b>CN</b> 11-1954/TQ
	<b>Tel:</b> (010) 64519466/9499/9500/9501/9502	<b>CODEN</b> HUJIEK