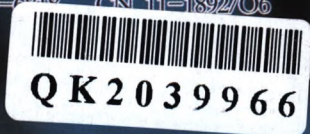


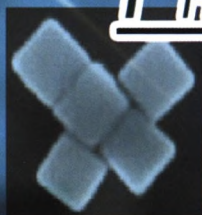
ISSN 1000-2748 CN 11-1892/O6



QK2039966

# 物理化学学报

## ACTA PHYSICO-CHEMICA SINICA

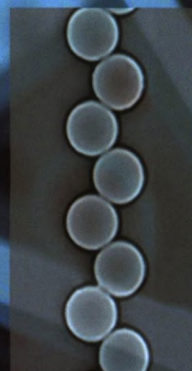


第36卷 第9期 Vol. 36 No. 9 2020

精准纳米合成特刊

Precise Nanosynthesis

Guest Editor: Zhiyong Tang (唐智勇)



COVER



The cover image presents the precise assembly process of nano building blocks from random distribution in solution to ordered accumulations. In article No. 1911057, based on the specific relationship between function and structure at nano-scale, Song and Li *et al.* summarize the research progress of preparing nanoparticle assemblies accurately with the “bottom-up” methods, and investigating their special properties originated from the ordered structures.

CONTENTS

专访 SPOTLIGHT

功能纳米材料研究进展—唐智勇研究员及其团队专访(Interview with Professor Zhiyong Tang and His Research Group: Recent Progress in the Field of Functional Nanomaterials)  
..... 《物理化学学报》编辑部(Editorial Office of Acta Physico-Chimica Sinica) (2003059)

前言 PREFACE

精准纳米合成(Precise Synthesis of Nanomaterials)..... 唐智勇(Zhiyong Tang) (2004050)

亮点 HIGHLIGHT

液滴的动态行为控制(Manipulation of Droplet Dynamic Behaviors)..... 刘鸣华(Minghua Liu) (2003072)

水滑石基材料在长波长光催化CO<sub>2</sub>还原中的应用(Layered Double Hydroxide Based Materials for the Photocatalytic CO<sub>2</sub> Reduction under Long Wavelength Irradiation)..... 吴骊珠(Li-Zhu Wu) (2004005)

稀土Er单原子促进光催化CO<sub>2</sub>还原反应(Photocatalytic CO<sub>2</sub> Reduction Reaction Boosted by Rare-Earth Er Single Atoms)..... 俞书宏(Shu-Hong Yu) (2004010)

用于膜科学技术创新的液体门控的动态界面设计(Dynamic Interface Design of Liquid

Gating for Innovation of Membrane Science and Technology) ..... 褚良银(Liang-Yin Chu) (2004012)

以  $\epsilon$ -Keggin- $\text{Fe}_{13}$  离子为中心的高核稀土-铁氧簇合物(Lanthanide-Iron-Oxo Clusters

Centering the  $\epsilon$ -Keggin- $\text{Fe}_{13}$  Ion) ..... 陈小明(Xiao-Ming Chen) (2004030)

单分散无机超粒子在生物成像分析中的应用(Monodisperse Inorganic Supraparticles for Bioimaging

Analysis) ..... 田阳(Yang Tian) (2004047)

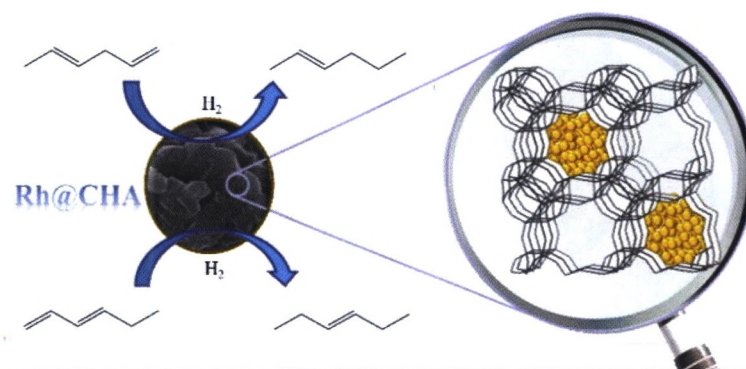
## 通讯 COMMUNICATION

理性设计核-壳 Rh@沸石催化材料用于二烯烃  
选择加氢反应

张建, 王亮, 伍芷毅, 王成涛, 苏泽瑞, 肖丰收

**Rational Design of a Core-Shell Rh@Zeolite  
Catalyst for Selective Diene Hydrogenation**

Jian Zhang, Liang Wang, Zhiyi Wu,  
Chengtao Wang, Zerui Su, Feng-Shou Xiao



*Acta Phys.-Chim. Sin.* **2020**, 36 (9), 1912001

doi: 10.3866/PKU.WHXB201912001

The core-shell Rh@CHA zeolite efficiently catalyzed the selective hydrogenation of the terminal C=C bond of dienes.

## 展望 PERSPECTIVE

钯基纳米材料电化学还原二氧化碳研究进展

周远, 韩娜, 李彦光

**Recent Progress on Pd-based Nanomaterials for  
Electrochemical CO<sub>2</sub> Reduction**

Yuan Zhou, Na Han, Yanguang Li



*Acta Phys.-Chim. Sin.* **2020**, 36 (9), 2001041

doi: 10.3866/PKU.WHXB202001041

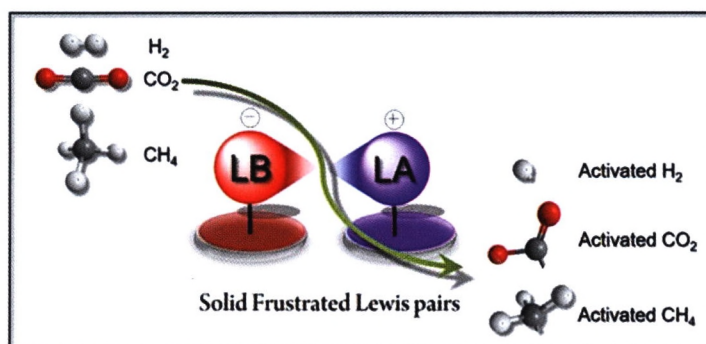
This perspective summarizes recent progress on the development of Pd-based nanomaterials for electrocatalytic CO<sub>2</sub> reduction.

二氧化铈表面构建固体“受阻”Lewis酸碱对  
用于小分子活化

张赛, 张铭凯, 瞿永泉

Solid Frustrated Lewis Pairs Constructed on  
CeO<sub>2</sub> for Small-Molecule Activation

Sai Zhang, Mingkai Zhang, Yongquan Qu



*Acta Phys. -Chim. Sin.* **2020**, 36 (9), 1911050

doi: 10.3866/PKU.WHXB201911050

Solid frustrated Lewis pairs can be successfully constructed on CeO<sub>2</sub> via surface defect regulation, and exhibited strong capacities for small-molecule activation.

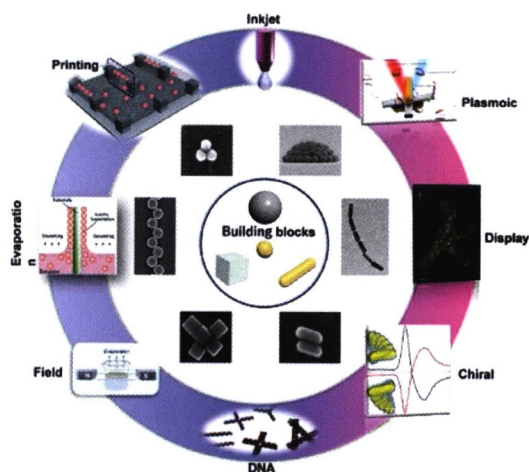
综述 REVIEW

纳米粒子的精准组装

李凯旋, 张泰隆, 李会增, 李明珠, 宋延林

The Precise Assembly of Nanoparticles

Kaixuan Li, Tailong Zhang, Huizeng Li,  
Mingzhu Li, Yanlin Song



*Acta Phys. -Chim. Sin.* **2020**, 36 (9), 1911057

doi: 10.3866/PKU.WHXB201911057

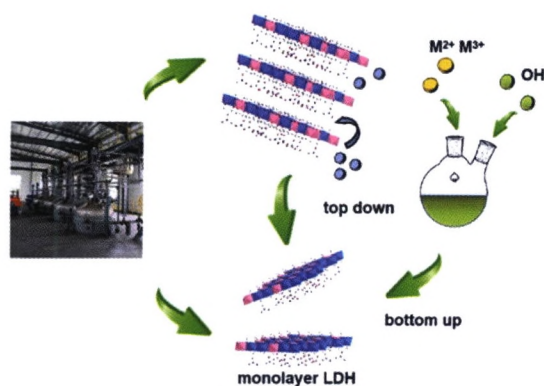
The precise assembly and patterning of nanoparticles provide an ideal platform for exploring the special optical, electronic, magnetic, and mechanical properties of NPs, which is also essential to construct high-resolution functional materials and devices.

单层类水滑石纳米片的可控合成及规模生产展望

李天, 郝晓杰, 白莎, 赵宇飞, 宋宇飞

Controllable Synthesis and Scale-up Production Prospect of Monolayer Layered Double Hydroxide Nanosheets

Tian Li, Xiaojie Hao, Sha Bai, Yufei Zhao, Yu-Fei Song



Acta Phys. -Chim. Sin. 2020, 36 (9), 1912005

doi: 10.3866/PKU.WHXB201912005

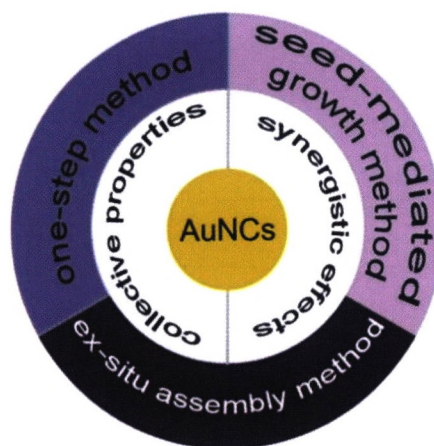
This review overviews the recent progress on the lab-synthesis and scale-up production of monolayer LDHs.

金纳米复合材料：制备、性质及其癌症诊疗应用

凌云云, 夏云生

Gold Based Nanocomposites: Fabrication Strategies, Properties, and Tumor Theranostic Applications

Yunyun Ling, Yunsheng Xia



Acta Phys. -Chim. Sin. 2020, 36 (9), 1912006

doi: 10.3866/PKU.WHXB201912006

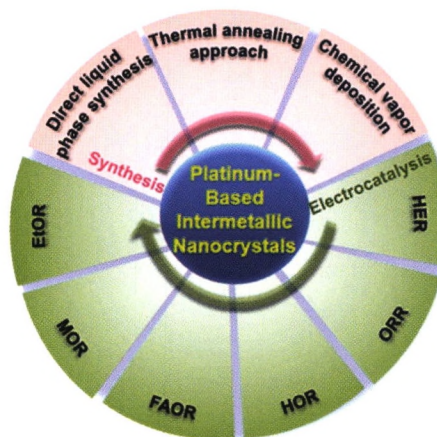
By combining AuNPs with other inorganic nanoparticles, gold-based nanocomposites (AuNCs) that possess special collective properties and synergetic effects can provide the basis for the construction of multifunctional AuNCs.

铂基金属间化合物纳米晶的最新进展：可控合成与电催化应用

杨天怡, 崔铖, 戎宏盼, 张加涛, 王定胜

Recent Advances in Platinum-based Intermetallic Nanocrystals: Controlled Synthesis and Electrocatalytic Applications

Tianyi Yang, Cheng Cui, Hongpan Rong, Jiatao Zhang, Dingsheng Wang



Acta Phys. -Chim. Sin. 2020, 36 (9), 2003047

doi: 10.3866/PKU.WHXB202003047

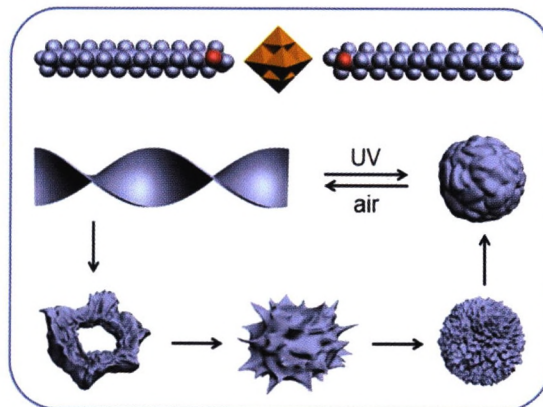
The controlled synthesis strategies, electrocatalytic performances, and future perspectives of Pt-based intermetallic nanocrystals have been summarized in this review.

氧化还原对 Lindqvist 型多金属氧簇复合物自组装的动态调控

张静, 王丽娜, 陈晓飞, 王玉峰, 牛成艳, 吴立新, 唐智勇

Redox-Regulated Dynamic Self-Assembly of a Lindqvist-Type Polyoxometalate Complex

Jing Zhang, Lina Wang, Xiaofei Chen, Yufeng Wang, Chengyan Niu, Lixin Wu, Zhiyong Tang



*Acta Phys. -Chim. Sin.* **2020**, *36* (9), 1912002  
doi: 10.3866/PKU.WHXB201912002

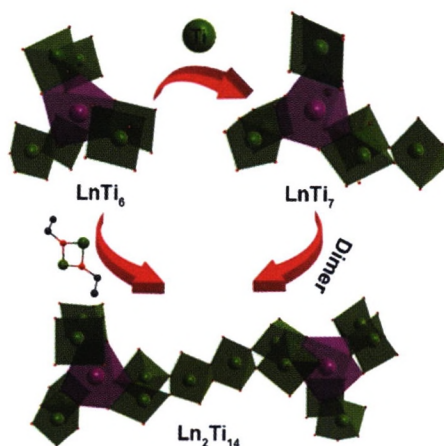
Dynamic self-assemblies of a Lindqvist-type polyoxometalate complex between helical and spherical aggregates were achieved upon UV reduction and air oxidation.

稀土-钛氧簇合物  $\text{EuTi}_6$ ,  $\text{EuTi}_7$  和  $\text{La}_2\text{Ti}_{14}$  的可控合成

杨亚梅, 伦会洁, 龙腊生, 孔祥建, 郑兰荪

Controlled Synthesis of Lanthanide-titanium Oxo Clusters  $\text{EuTi}_6$ ,  $\text{EuTi}_7$  and  $\text{La}_2\text{Ti}_{14}$

Yamei Yang, Huijie Lun, Lasheng Long, Xiangjian Kong, Lansun Zheng



*Acta Phys. -Chim. Sin.* **2020**, *36* (9), 1912007  
doi: 10.3866/PKU.WHXB201912007

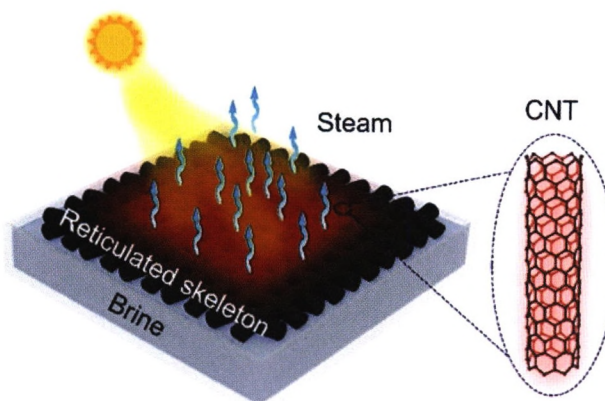
Four lanthanide-titanium oxo clusters containing the basic  $\text{LnTi}_6$  unit have been prepared using chelated organic ligands.

网状骨架 CVD 生长碳纳米管用于重盐水脱盐

熊辉, 谢歆雯, 王苗, 侯雅琦, 侯旭

CVD Grown Carbon Nanotubes on Reticulated Skeleton for Brine Desalination

Hui Xiong, Xinwen Xie, Miao Wang, Yaqi Hou, Xu Hou



*Acta Phys. -Chim. Sin.* **2020**, *36* (9), 1912008  
doi: 10.3866/PKU.WHXB201912008

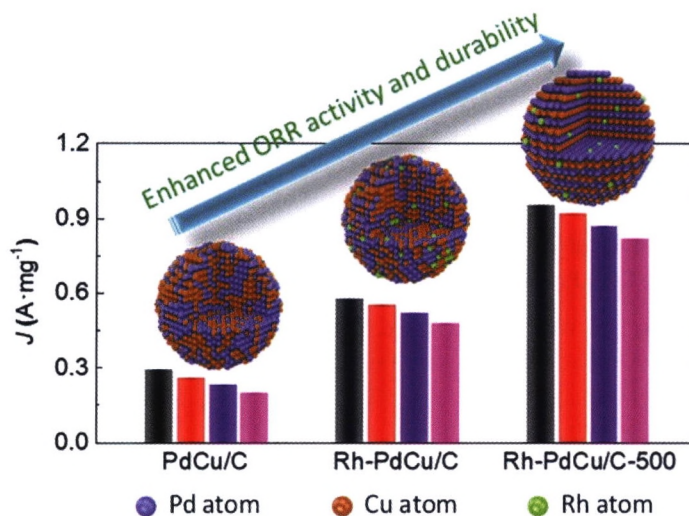
The CVD grown CNTs reticulated membrane achieved efficient photo-thermal conversion and continuous desalination for brine.

具有优异甲醇耐受性的 Rh 掺杂 PdCu 有序金属间化合物纳米粒子增强氧还原电催化

李蒙刚, 夏仲泓, 黄雅荣, 陶璐, 晁玉广, 尹坤, 杨文秀, 杨微微, 于永生, 郭少军

Rh-Doped PdCu Ordered Intermetallics for Enhanced Oxygen Reduction Electrocatalysis with Superior Methanol Tolerance

Menggang Li, Zhonghong Xia, Yarong Huang, Lu Tao, Yuguang Chao, Kun Yin, Wenxiu Yang, Weiwei Yang, Yongsheng Yu, Shaojun Guo



*Acta Phys. -Chim. Sin.* **2020**, 36 (9), 1912049

doi: 10.3866/PKU.WHXB201912049

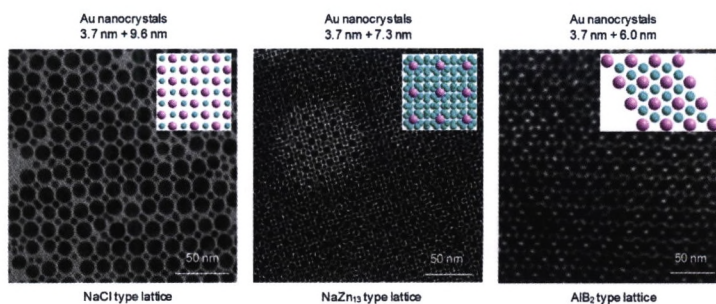
Rh-doped PdCu nanoparticles with ordered intermetallic structures are successfully prepared to enhance the catalytic activity and durability toward oxygen reduction reaction and achieve superior methanol tolerance.

金二元纳米晶超晶格的自组装和结构表征

赵亚楠, 何敏, 刘晓芳, 刘斌, 杨建辉

Self-Assembly and Structural Characterization of Au Binary Nanocrystal Superlattices

Yanan Zhao, Min He, Xiaofang Liu, Bin Liu, Jianhui Yang



*Acta Phys. -Chim. Sin.* **2020**, 36 (9), 1908041

doi: 10.3866/PKU.WHXB201908041

Au binary nanocrystal superlattices with NaCl, NaZn<sub>13</sub>, and AlB<sub>2</sub> structures were obtained via a convenient solvent evaporation method.

**《物理化学学报》编辑委员会**  
**The Editorial Committee of Acta Physico-Chimica Sinica**

**名誉主编(Honorary Editor-in-Chief)**

唐有祺 Youqi Tang

**顾问编委(Advisory Board Member)**

包信和 Xinhe Bao	黄维 Wei Huang	孙世刚 Shigang Sun	杨学明 Xuemin Yang	张锦 Jin Zhang
陈军 Jun Chen	李朝军 Chaojun Li	田中群 Zhongqun Tian	张东辉 Donghui Zhang	赵东元 Dongyuan Zhao
付贤智 Xianzhi Fu				

**主编(Editor-in-Chief)**

刘忠范 Zhongfan Liu

**副主编(Associate Editor-in-Chief)**

陈立桅 Liwei Chen	刘鸣华 Minghua Liu	徐冰君 Bingjun Xu
韩布兴 Buxing Han	吴凯 Kai Wu	杨金龙 Jinlong Yang

**编委(Editorial Board Member)**

陈晨 Chen Chen	黄伟新 Weixin Huang	彭海琳 Hailin Peng	王树涛 Shutao Wang	肖海 Hai Xiao
程方益 Fangyi Cheng	黄云辉 Yunhui Huang	彭章泉 Zhangquan Peng	王帅 Shuai Wang	徐昕 Xin Xu
邓风 Feng Deng	江颖 Ying Jiang	齐利民 Limin Qi	王双印 Shuangyin Wang	杨俊林 Junlin Yang
董金凤 Jinfeng Dong	李广涛 Guangtao Li	乔波涛 Botao Qiao	王拓 Tuo Wang	余家国 Jiaguo Yu
范峰滔 Fengtao Fan	李国辉 Guohui Li	任斌 Bin Ren	王心晨 Xincheng Wang	余彦 Yan Yu
范壮军 Zhuangjun Fan	李剑锋 Jianfeng Li	邵翔 Xiang Shao	王训 Xun Wang	尉志武 Zhiwu Yu
房喻 Yu Fang	李韦伟 Weiwei Li	苏东 Dong Su	王永锋 Yongfeng Wang	占肖卫 Xiaowei Zhan
巩金龙 Jinlong Gong	李象远 Xiangyuan Li	唐智勇 Zhiyong Tang	魏迪 Di Wei	张华 Hua Zhang
郭少军 Shaojun Guo	刘述斌 Shubin Liu	王峰 Feng Wang	魏子栋 Zidong Wei	张铁锐 Tierui Zhang
韩东麟 Donglin Han	刘义 Yi Liu	王键吉 Jianji Wang	吴立新 Lixin Wu	章俊良 Junliang Zhang
郝京诚 Jingcheng Hao	刘志敏 Zhimin Liu	王强斌 Qiangbin Wang	夏永姚 Yongyao Xia	庄林 Lin Zhuang
侯文华 Wenhua Hou	马晶 Jing Ma			

**青年编委(Young Scientist Committee)**

常春然 Chunran Chang	胡晟 Sheng Hu	龙闰 Run Long	徐宝华 Baohua Xu	张涛 Tao Zhang
陈棋 Qi Chen	蒋昆 Kun Jiang	马建民 Jianmin Ma	严凯 Kai Yan	张晓亮 Xiaoliang Zhang
陈重学 Zhongxue Chen	蒋妍彦 Yanyan Jiang	马杰 Jie Ma	杨帆 Fan Yang	张颖 Ying Zhang
董帆 Fan Dong	焦淑红 Shuhong Jiao	牛志强 Zhiqiang Niu	杨建平 Jianping Yang	张莹莹 Yingying Zhang
段鹏飞 Pengfei Duan	康毅进 Yijin Kang	王伟俊 Weejun Ong	杨金虎 Jinhua Yang	张育新 Yuxin Zhang
范修林 Xiulin Fan	赖跃坤 Yuekun Lai	钱江锋 Jiangfeng Qian	杨振宇 Zhenyu Yang	张志成 Zhicheng Zhang
高旺 Wang Gao	蓝宇 Yu Lan	伽龙 Long Qie	伊廷锋 Tingfeng Yi	赵晨 Chen Zhao
宫勇吉 Yongji Gong	雷永鹏 Yongpeng Lei	邵明飞 Mingfei Shao	尹振 Zhen Yin	赵宇飞 Yufei Zhao
顾栋 Dong Gu	李昌治 Changzhi Li	沈炎宾 Yanbin Shen	于乐 Le Yu	钟澄 Cheng Zhong
郭洪 Hong Guo	李皋 Gao Li	施兴华 Xinghua Shi	于永生 Yongsheng Yu	周惠琼 Huiqiong Zhou
郭少华 Shaohua Guo	李能 Neng Li	孙振宇 Zhenyu Sun	虞锦洪 Jinhong Yu	周健 Jian Zhou
韩杰 Jie Han	李伟 Wei Li	田景华 Jinghua Tian	翟月明 Yueming Zhai	周江 Jiang Zhou
韩晓鹏 Xiaopeng Han	李鑫 Xin Li	王锋 Feng Wang	张炳森 Bingsen Zhang	周思 Si Zhou
郝锋 Feng Hao	李祯 Zhen Li	王洪 Hong Wang	张好斌 Haobin Zhang	周小四 Xiaosi Zhou
何宏艳 Hongyan He	刘磊 Lei Liu	王欢 Huan Wang	张金水 Jinsui Zhang	周莹 Ying Zhou
何林 Lin He	刘楠 Nan Liu	王明涌 Mingyong Wang	张立学 Lixue Zhang	朱昌宝 Changbao Zhu
侯广进 Guangjin Hou	刘文 Wen Liu	吴飞翔 Feixiang Wu	张留洋 Liuyang Zhang	朱成周 Chengzhou Zhu
侯旭 Xu Hou	刘雅玲 Yaling Liu	谢微 Wei Xie	张桥保 Qiaobao Zhang	朱禹洁 Yujie Zhu
胡鹏 Peng Hu	刘永畅 Yongchang Liu	熊训辉 Xunhui Xiong		

**物理化学学报(WULI HUAXUE XUEBAO)第 36 卷第 9 期(2020. 09. 15)**  
**ACTA PHYSICO-CHIMICA SINICA, Vol. 36, No. 9 (September 15, 2020)**

月刊(1985 年创刊)

Monthly (First volume appeared in 1985)

编辑出版者	北京大学化学与分子工程学院 《物理化学学报》编辑部	Editor and Publisher:	Editorial Office of Acta Physico-Chimica (Wuli Huaxue Xuebao)
地址	北京大学化学楼(邮政编码 100871)	Address:	Chemistry Building Peking University Beijing 100871, P. R. China
电话	+86-10-62751724, +86-10-62756388		+86-10-62751724, +86-10-62756388
主任	张小娟	Tel.:	
主管单位	中国科学技术协会	Editorial Director:	Xiaojuan Zhang
印刷者	北京科信印刷有限公司	Printer:	Beijing Kexin Printing CO., LTD
国内总发行	北京报刊发行局	Distributor:	China International Book Trading Corporation (Code No 1443-MO)
国内订购	全国各邮局		
国外发行	中国国际图书贸易总公司(Code No 1443-MO)		
Email:	whxb@pku.edu.cn	Website:	http://www.whxb.pku.edu.cn



定价: 50.00 元  
万方数据

2020 年 9 月 15 日出版

广告经营许可证: 京海市监广登字 20170232 号

国内邮发代号: 82-163