



**INSTITUTE OF CHEMISTRY  
CHINESE ACADEMY OF SCIENCES**

# WAY FORWARD 2024

**29 June 2024**

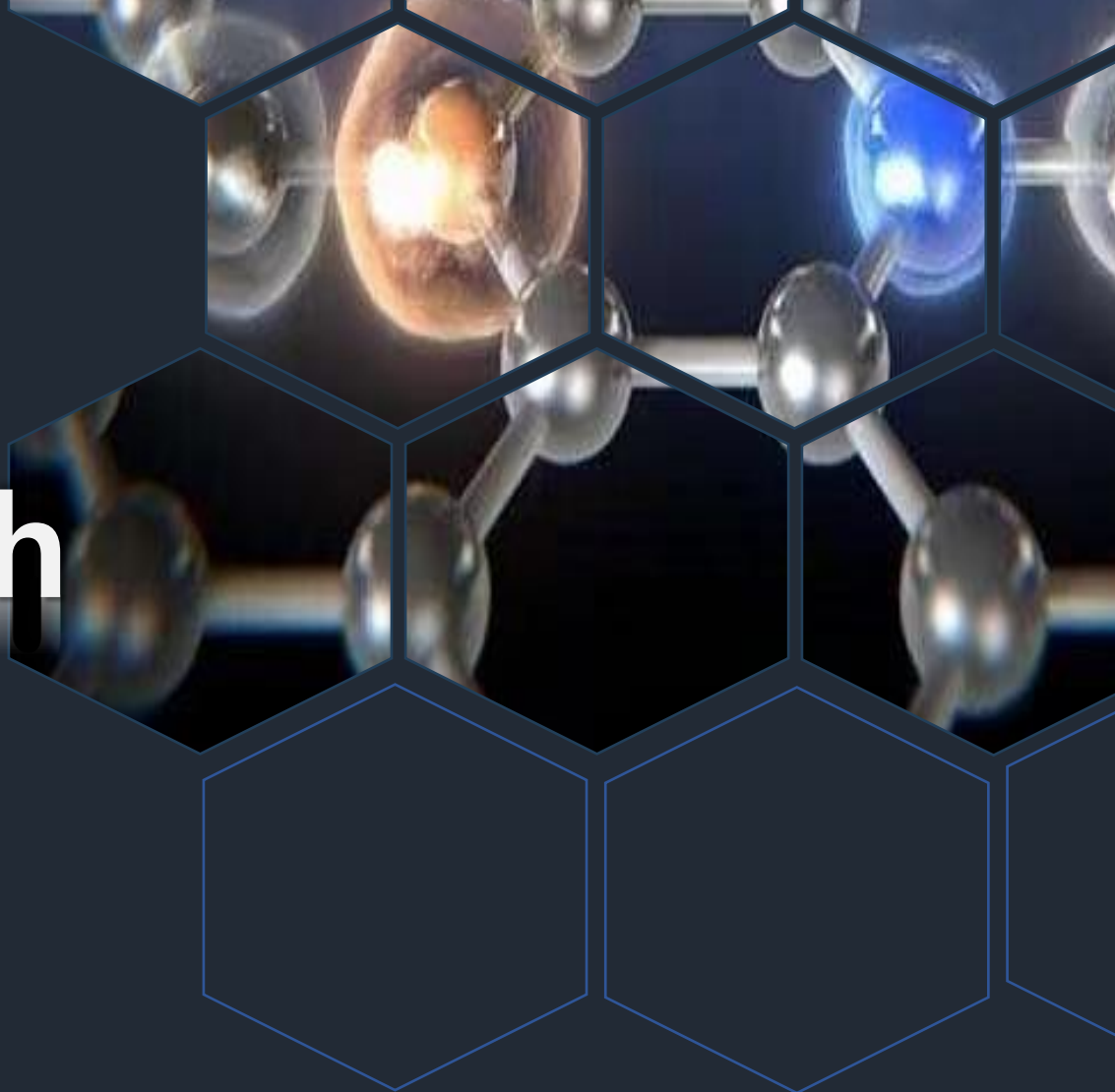




**INSTITUTE OF CHEMISTRY  
CHINESE ACADEMY OF SCIENCES**

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**Key Laboratory of Molecular  
Nanostructure and Nanotechnology  
Institute of chemistry, UCAS**



# CONTENTS

**1** WHY China for PhD in Chemistry catalysis

**2** Research environment

**3** Research Topic and Application

# WHY China for PhD in Chemistry catalysis

- Top research facilities
- Expert mentorship
- Cultural and Personal Growth experience

## 热门关注



S4800场发射扫描电镜冷场(...  
S4800



场发射扫描电镜热场Quanta ...  
FEI Quanta FEG 250



场发射扫描电子显微镜 (Hit...  
S-4800



X射线粉末衍射仪DaVinci(X...  
D8 ADVANCE DAVINCI



场发射透射电子显微镜 (JEO...  
JEM-2100F



多晶X射线衍射仪P2 (PANa...  
Empyrean



多功能光电子能谱仪 (XPS/...  
ESCALAB250XI



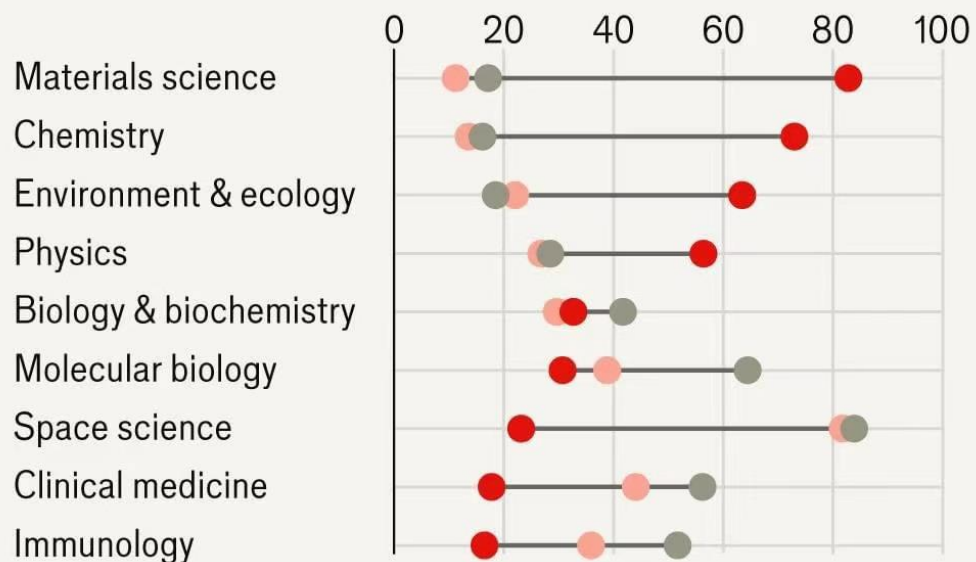
透射电子显微镜 (Hitachi H...  
HT7700



# China has become a scientific superpower

Share of global high-impact papers\* by author location, selected countries/regions, 2022, %<sup>†</sup>

● China ● European Union ● United States



\*Top 1% by number of citations, Web of Science platform

<sup>†</sup>Can add up to more than 100% due to co-authorships

Sources: Clarivate, Web of Science; *The Economist*



## Expert mentorship

### Song, Weiguo

① University of Chinese Academy of Sciences, Beijing, China ② 14523661300 ③ <https://orcid.org/0000-0001-5390-6787> ④ Is this you? Connect to Mendeley account View more

25,830 Citations by 21,182 documents | 293 Documents | 82 h-index View h-graph | View all metrics >

### Scholar Analysis

Scholarly Works (34,768) = single AND (atom AND catalyst) ⊖

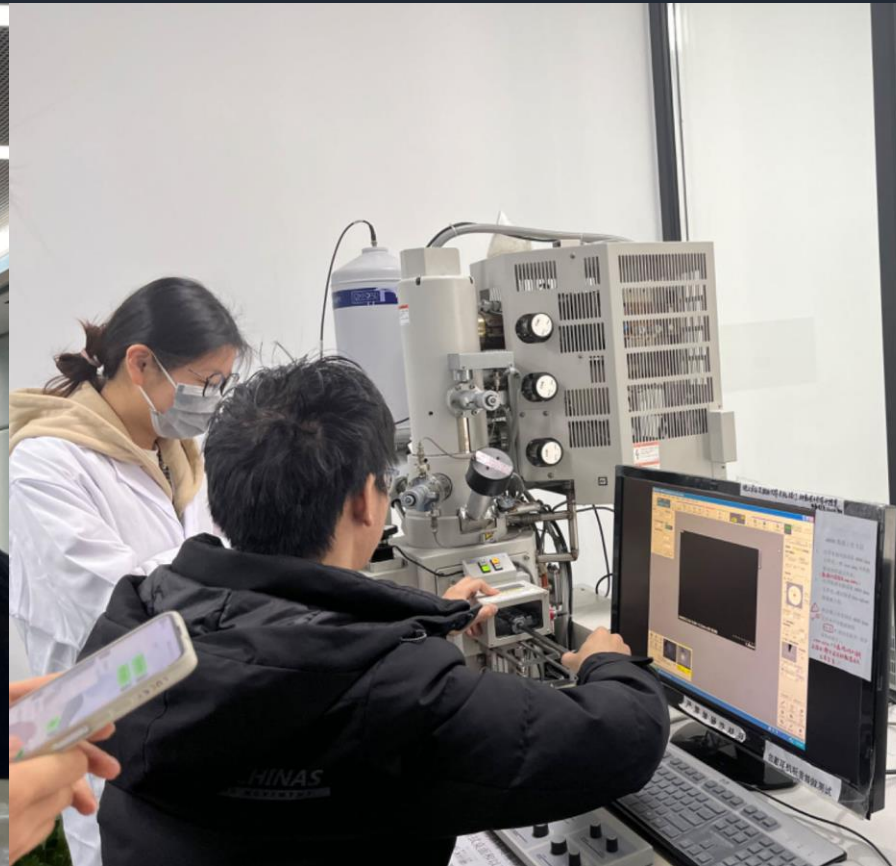
Filters: Year Published = | 2011 - ⊖

| Scholarly Works | Works Cited by Patents | Citing Patents | Patent Citations | Works Cited by Scholarly | Scholarly Citations |
|-----------------|------------------------|----------------|------------------|--------------------------|---------------------|
| 34,768          | 2,388                  | 5,265          | 5,968            | 28,909                   | 1,266,143           |

Scholarly Works Over Time

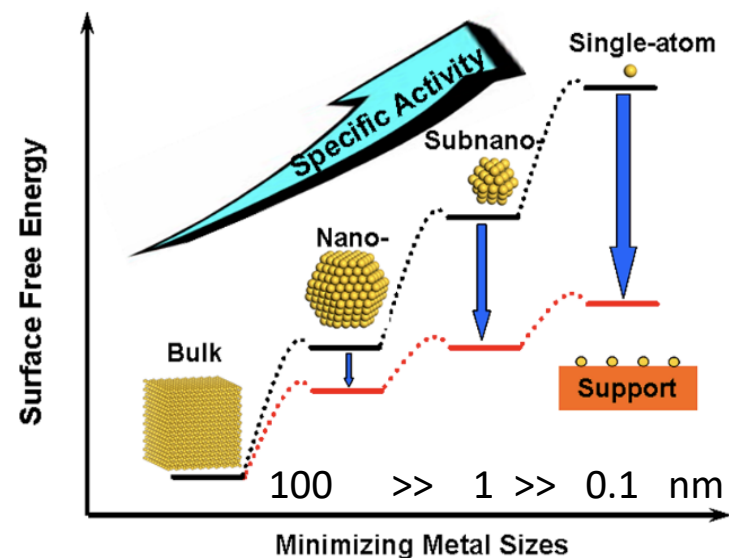
Top Institutions Logo Grid

| Institution                                   | Count |
|---|-------|
| Chinese Academy of Sciences                   | 3,138 |
| Russian Academy of Sciences                   | 2,165 |
| University of Science and Technology of China | 1,160 |
| Tsinghua University                           | 1,026 |
| University of Chinese Academy of Sciences     | 895   |
| Tianjin University                            | 500   |
| Beijing University of Chemical Technology     | 479   |
| Moscow State University                       | 466   |
| Zhengzhou University                          | 434   |
| Dalian Institute of Chemical Physics          | 406   |





## What is Single atom catalyst

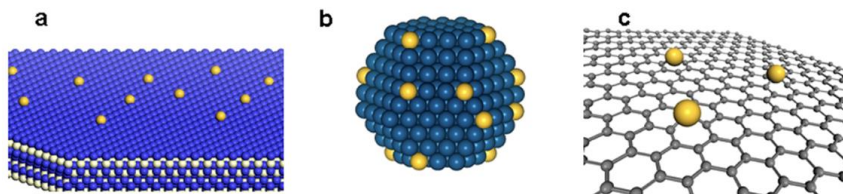


**FIGURE 4.** Schematic illustrate the changes of surface free energy and specific activity per metal atom with metal particle size and the support effects on stabilizing single atoms.

## Some advantages of SACs

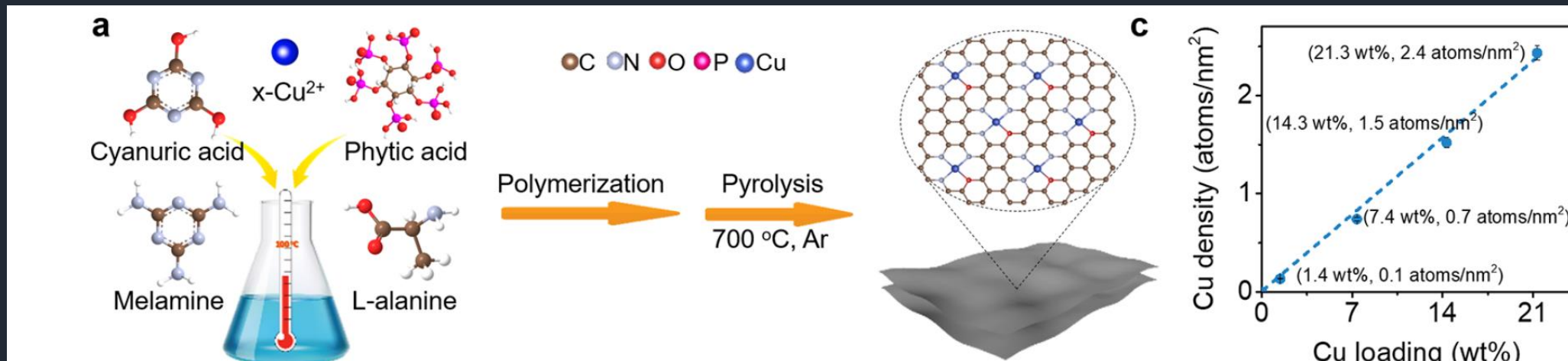
- High Atomic Efficiency
- Enhanced Catalytic Activity
- Selectivity
- Reduced Material Costs

# Research Topic and Application



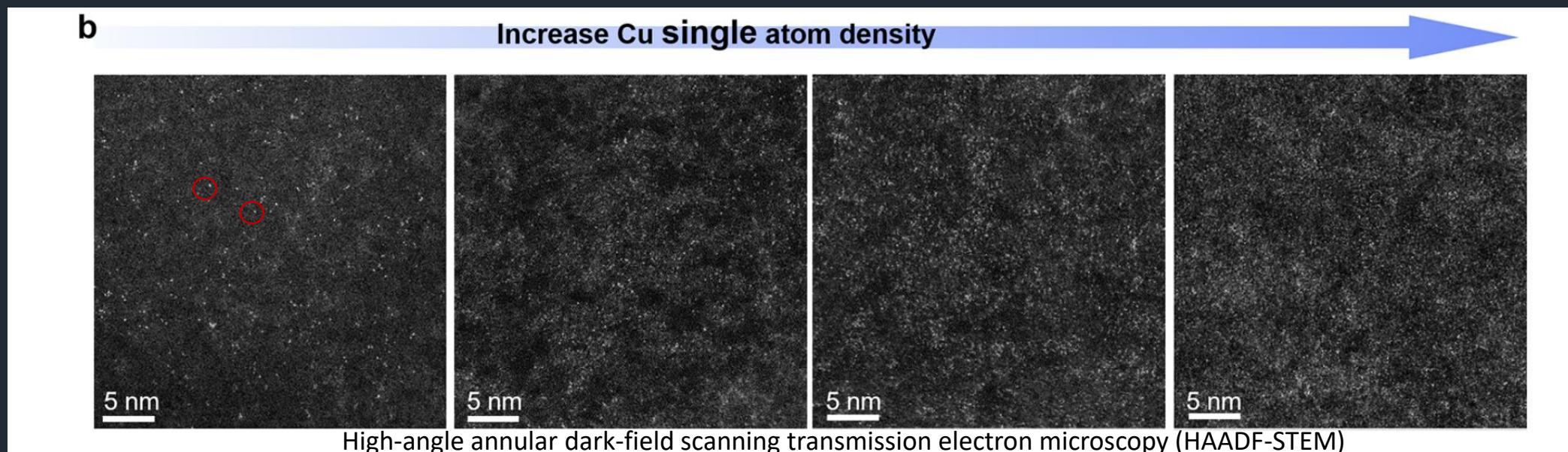
**FIGURE 1.** Schematic diagrams illustrate different types of SACs: Metal single atoms anchored to (a) metal oxide, (b) metal surfaces, and (c) graphene.

## Synthesis



Reference: <https://doi.org/10.1021/acscatal.2c05363>  
 ACS Catal. 2023, 13, 1316–1325

## Characterization





### CO<sub>2</sub> Reduction

value-added chemicals, methane, methanol, or ethylene etc, Carbon credit captured

### Energy

Renewable Energy Storage, Fuel Cells, Oxygen Reduction Reaction (ORR), Hydrogen Oxidation Reaction (HOR)

### Environment

CO Oxidation, Remediation, Advanced ★ Oxidation process, Fenton reaction



### Biomedical

Treatment of cancer, **bacterial disinfections**★, photothermal therapy, **drug carrier**★ and electrochemical and optical assays



**Thank you**