



清华大学材料学院
School of Materials Science and Engineering, Tsinghua University

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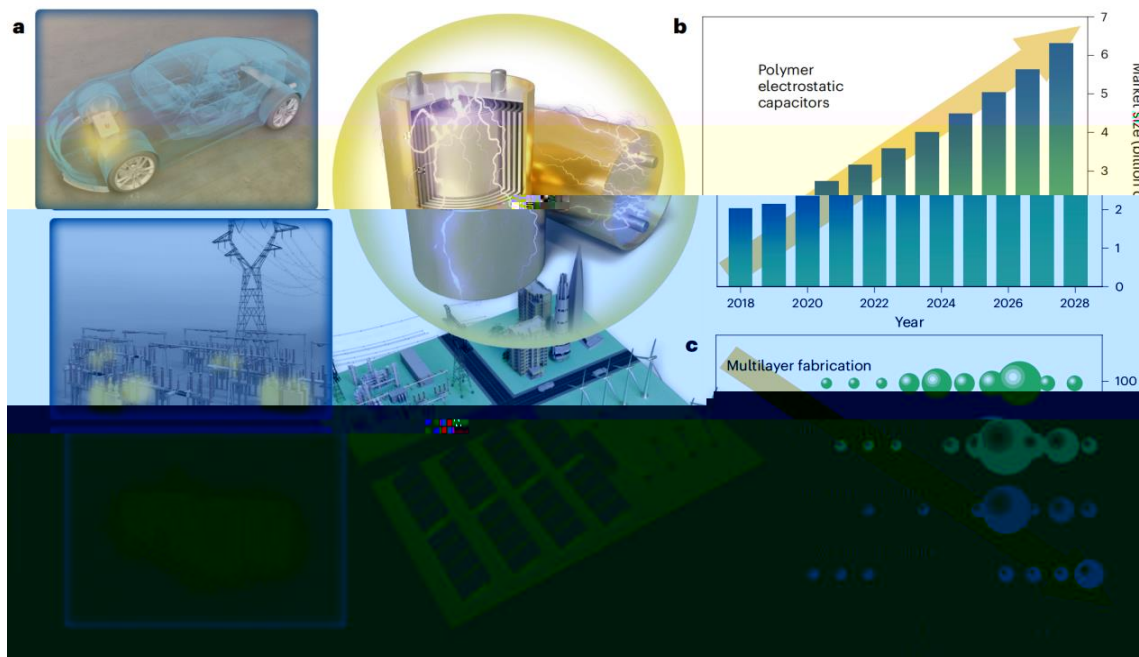
1 3 4

“ ”

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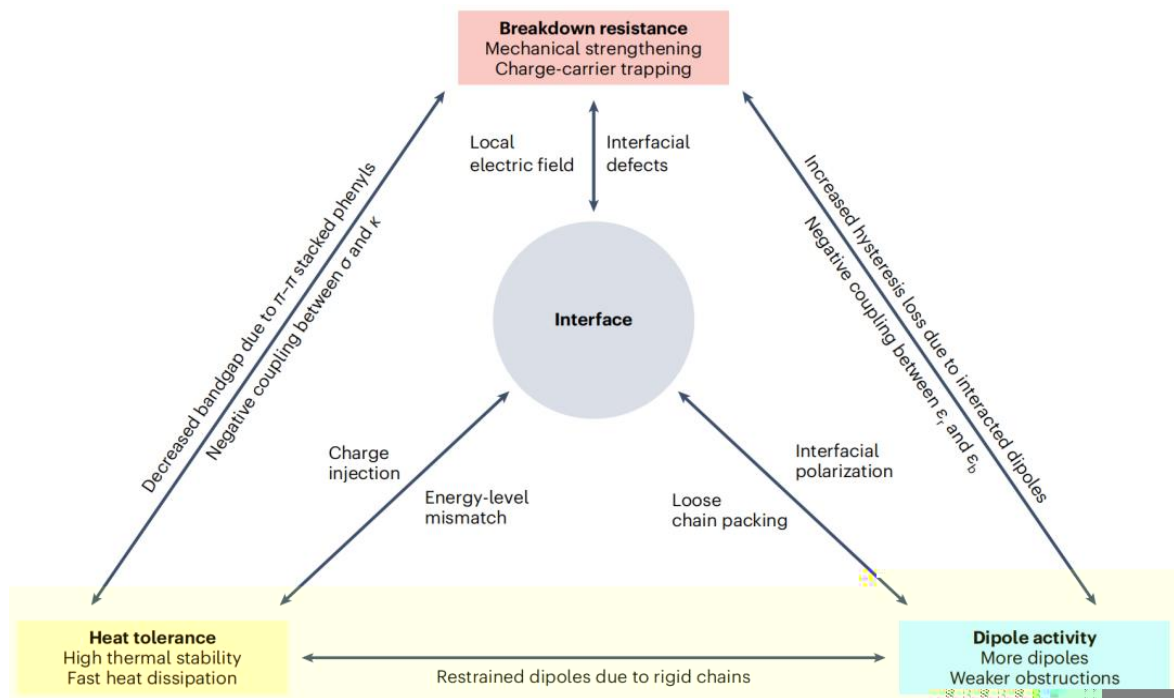
5 J cm⁻³

105



1.

“ ” “ ” “ ”



2.

“

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2020

1

3

W

0.2 wt%
150 200
200 50
8.1 J cm⁻³ 7.2 J cm⁻³ 90%

3.

“ 200

-

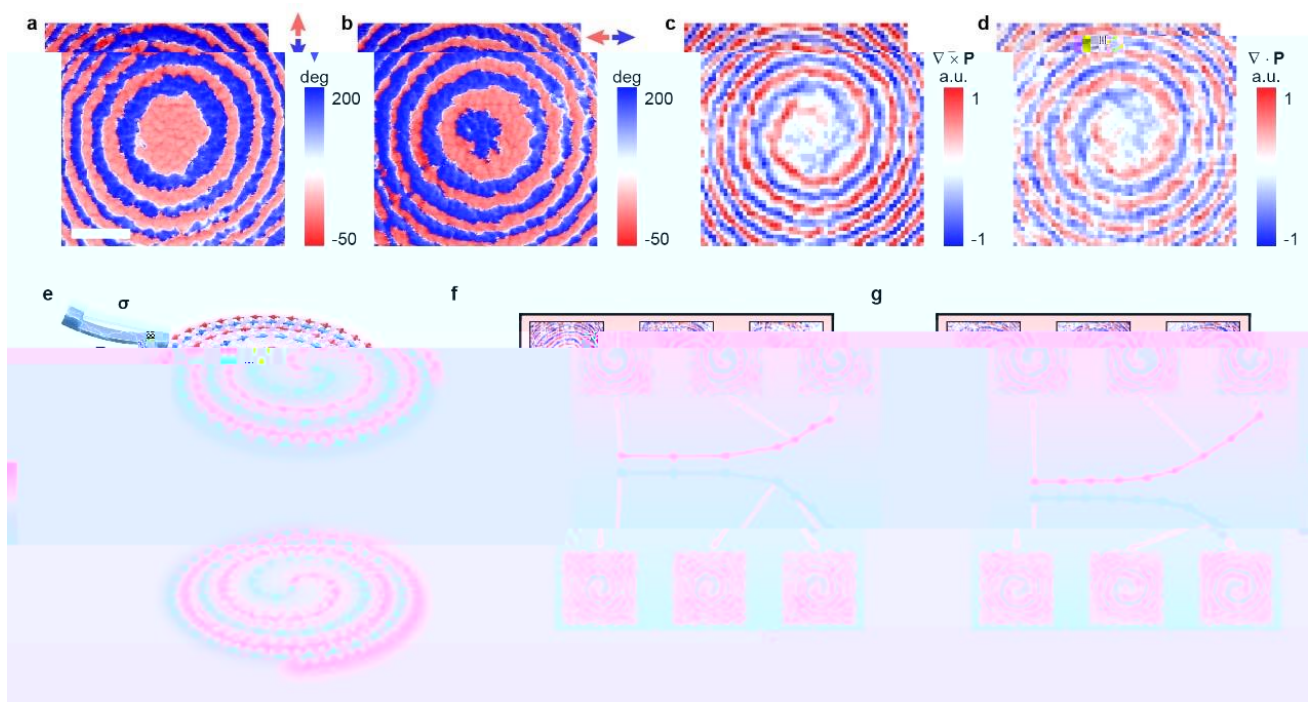
”

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2021

П

130 ° 120 MV m⁻¹ 780 ° 324 MPa



1.
c,d

a,b
e

f,g

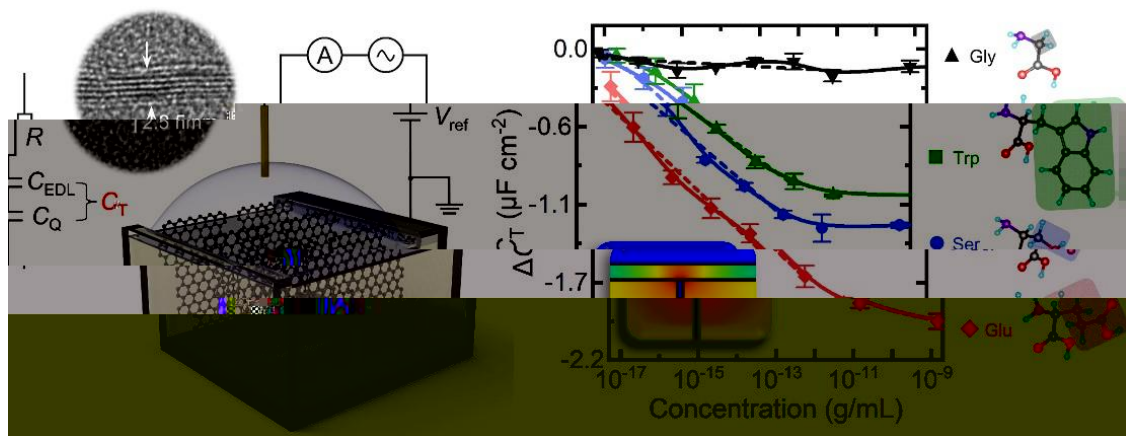
1 8

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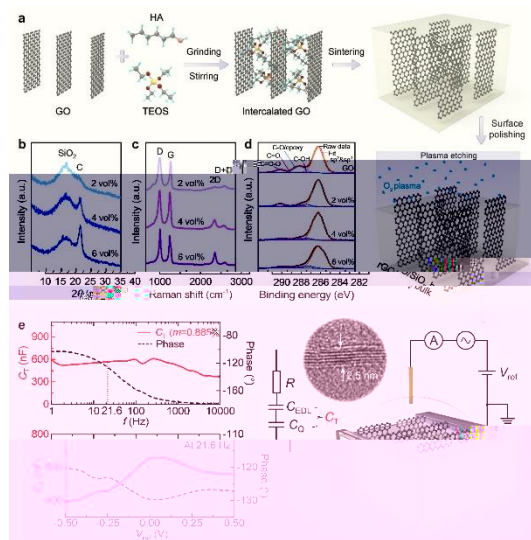
2021

~10 ag/mL



1.

SiO₂



2.

a rGO/SiO₂
XPS e

b-d

XRD

4.

a

b

-

c

-

d-f

g-i

“

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1 3

2016

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1a EFISH PbTiO₃/SrTiO₃ X

1b 1c-g SHG

2a-b EFISH

664% V-1 EFISH

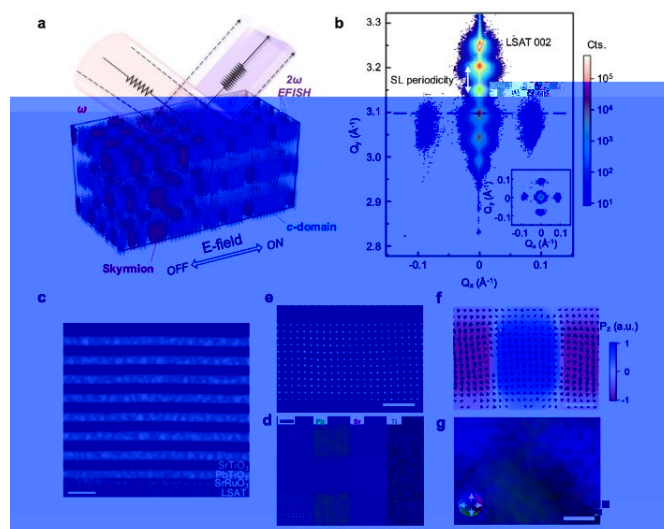
2c 2d 2c SHG

2c EFISH

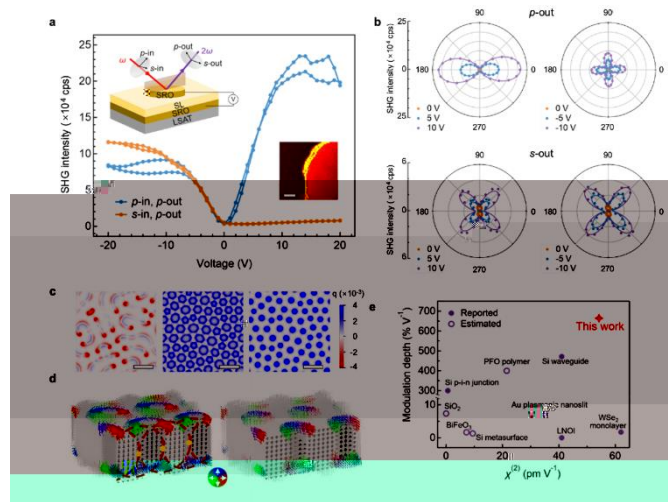
2e SHG

2e EFISH

SHG

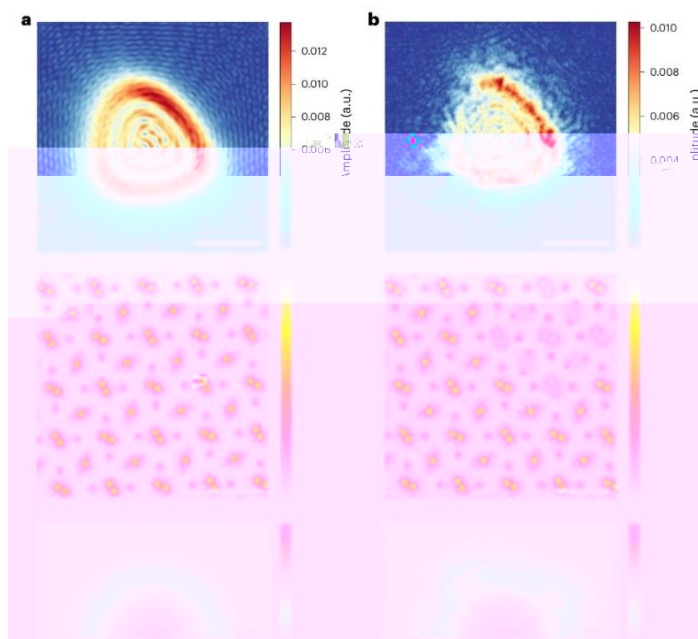


1. PbTiO₃/SrTiO₃



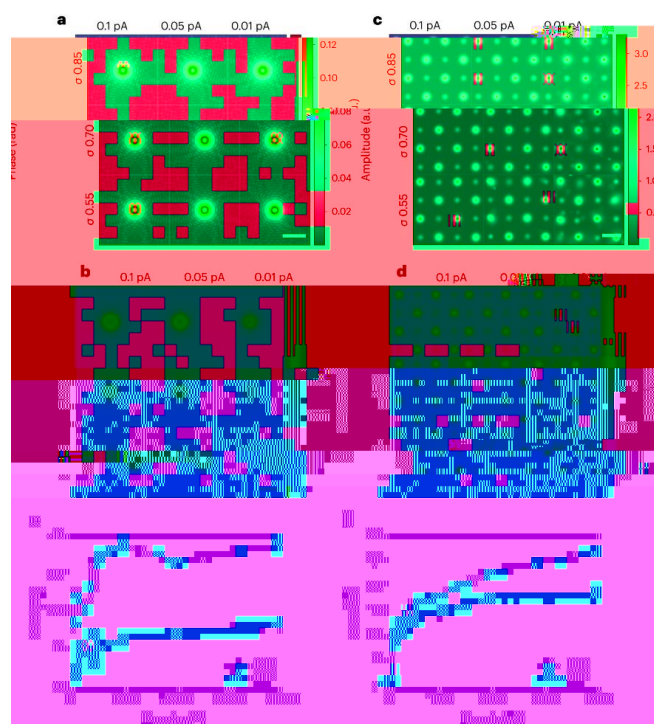
2. EFISH

14 pm 0.14 Å



2.

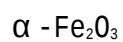
14 pm



3.

CPP LOP (a) LOP (b) CPP (c) LOP (d) CPP (e) (f)

†Dy

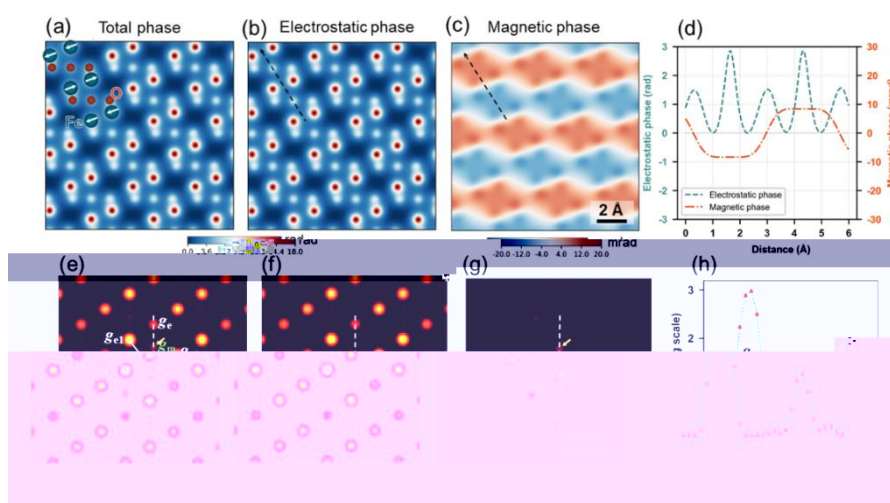


1

Fe

Fe

1%



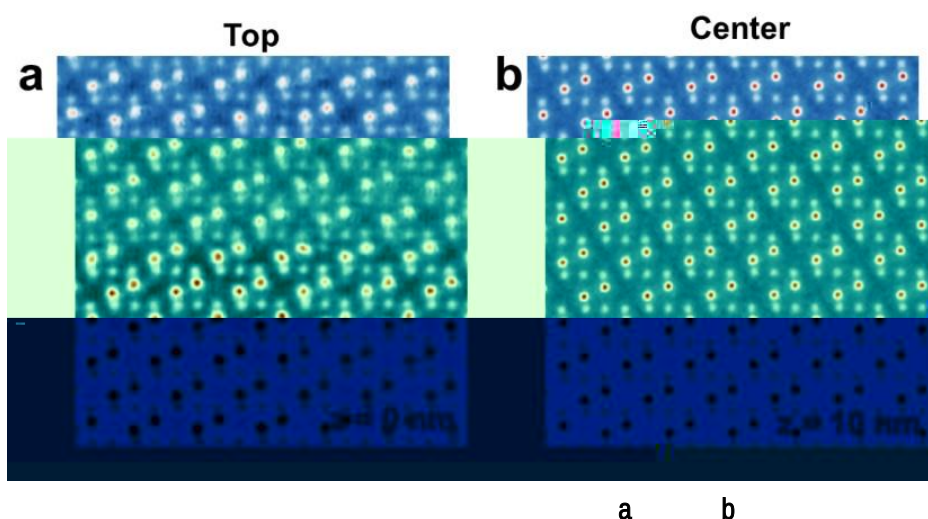
1.

a - d

e -

h

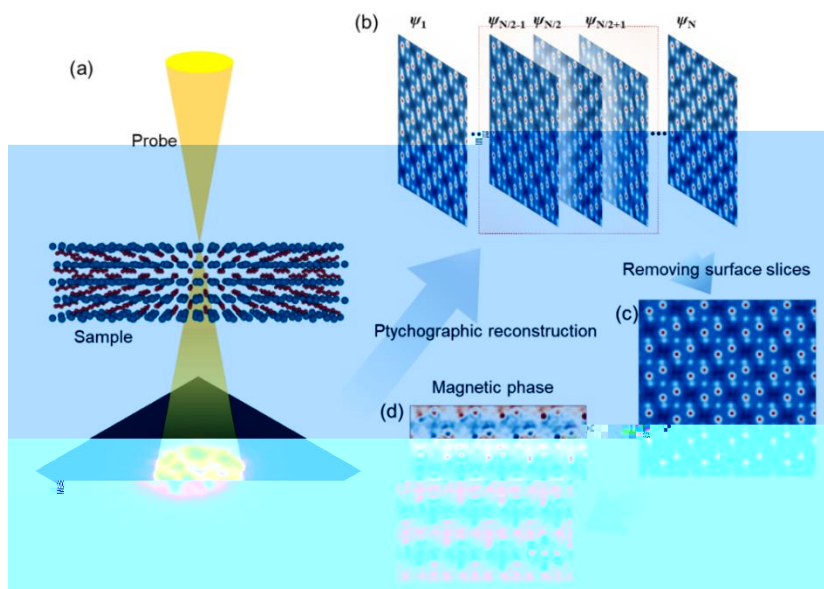
2



2.

a

b



3.

a 4D

b

c

d

“

”

2019

2018

2021

Cu2Se

Cu_2Se

AgSbF_6

1

Cu_2Se

ZT

3.0 1050K

13.4%

120

2

X

F^-

Ag^+

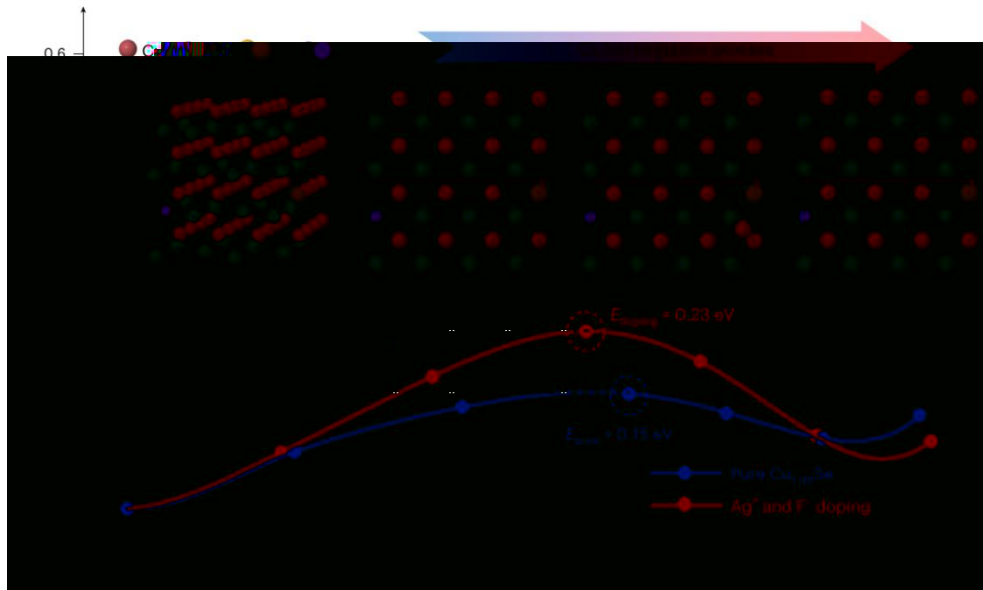
3

Cu

Ag

Cu-F

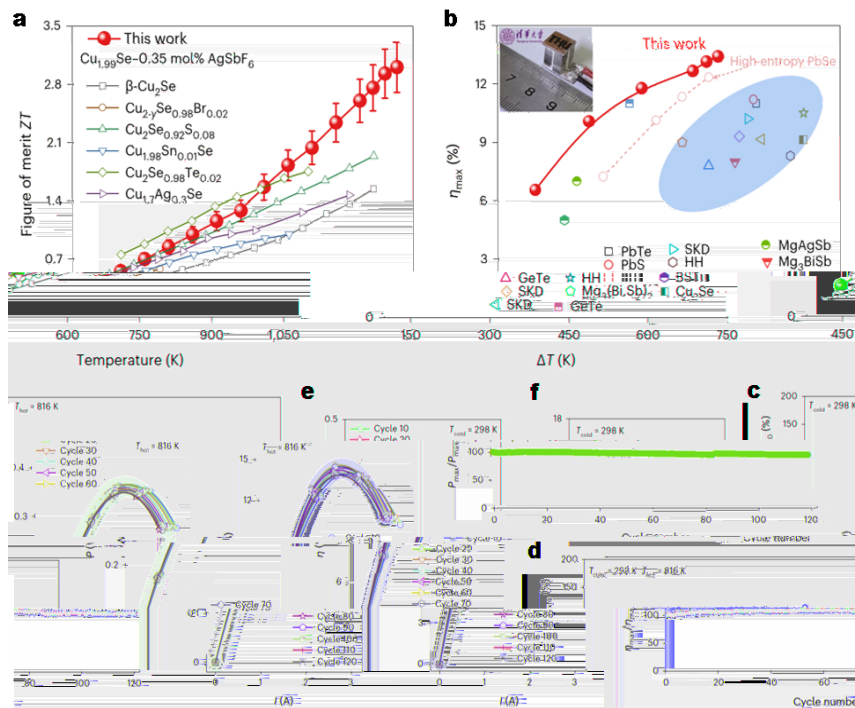
Cu



1. Cu_2Se

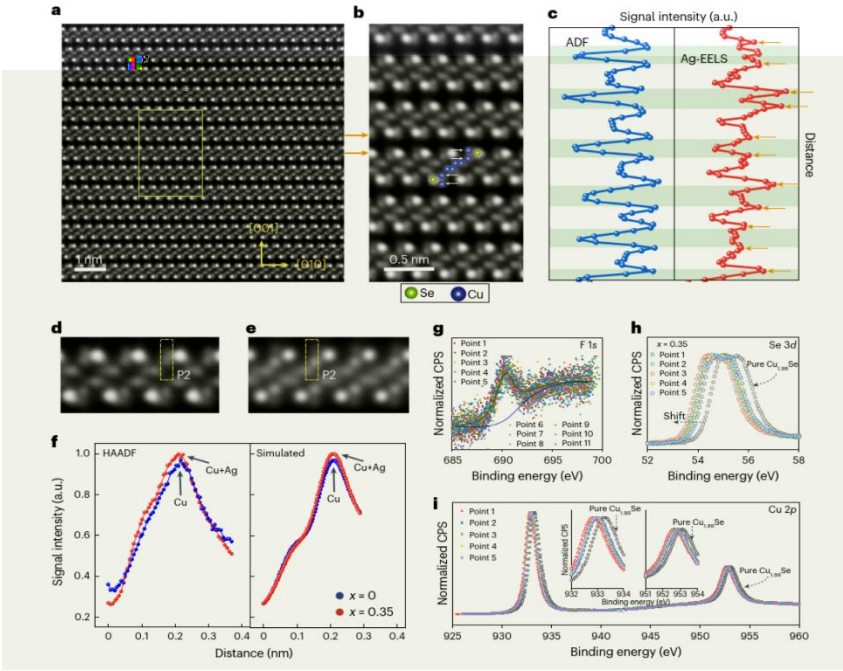
AgSbF_6

Cu



2. AgSbF_6

$\text{Cu}_{1.99}\text{Se}$



3.

2018

1 23

20

2023

3



2023

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1 23

8



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2023

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C

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A205

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2024

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Email zhaozhuang@tsinghua.edu.cn