



Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Open Day of Technology Platforms

Electron Microscopy

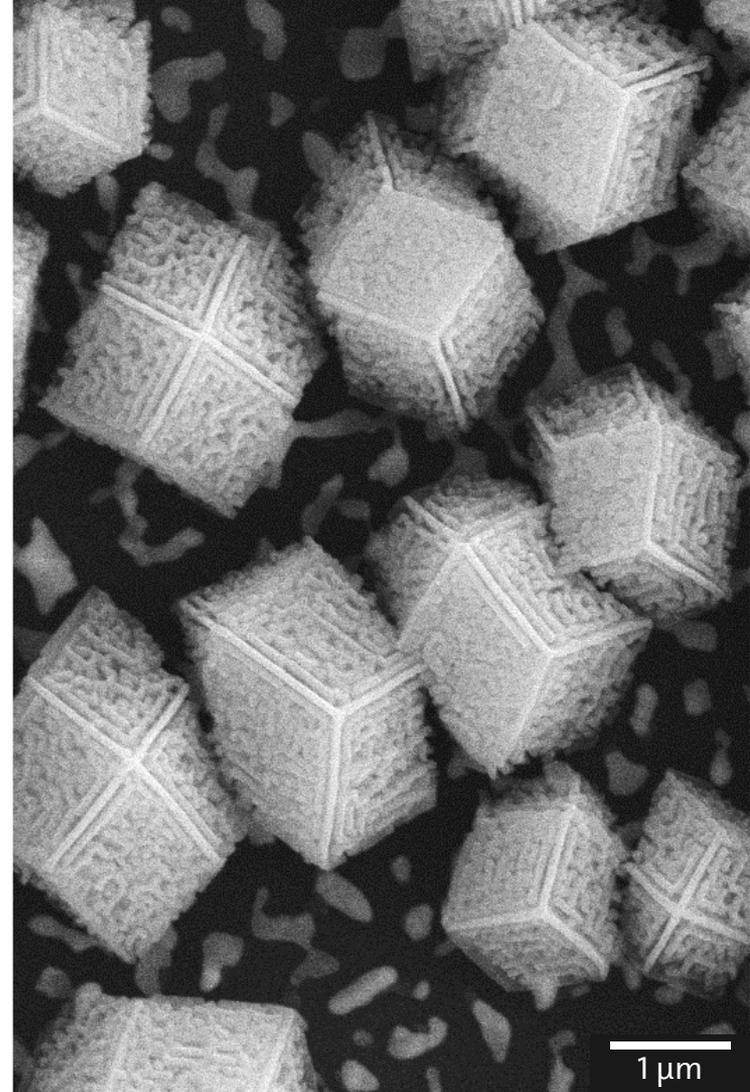
31.01.2024 **Charlotte Ruhmlieb**



Bild: Charlotte Ruhmlieb

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Technology Platform Electron Microscopy



What is inside electron microscopy data? (selection)

Imaging^{T,S}



morphology
size (of particles, pores, etc.)
size distribution
investigation of hybrid nanostructures; phase boundaries

EDX^{T,S}
WDX^S
EELS^T



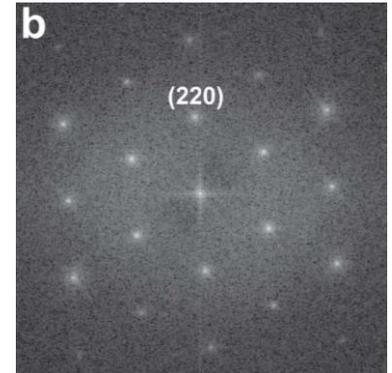
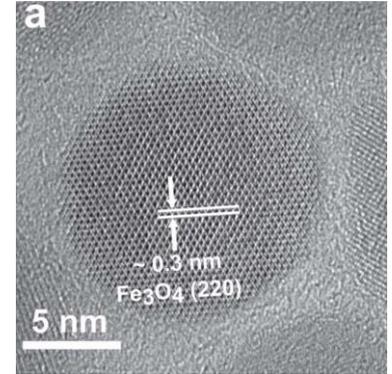
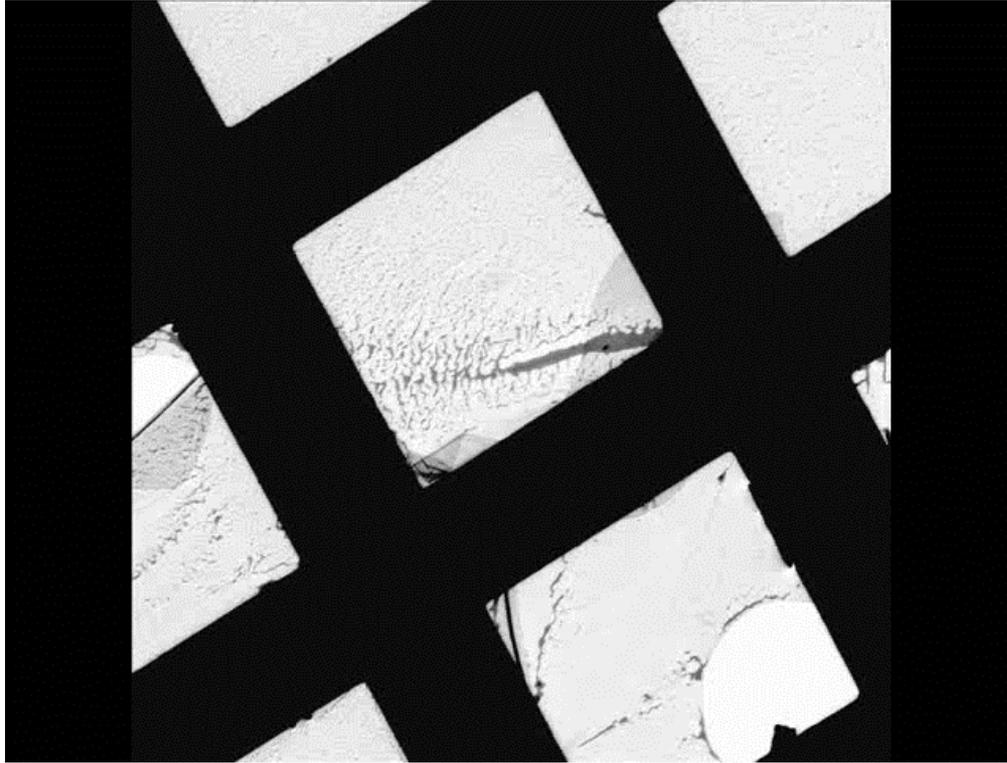
elemental composition (EDX, WDX)
spatially resolved elemental composition (*Mapping*)
oxidation states (EELS)

SAED^T
Atomic resolution^T



investigate crystallinity
identify crystal orientation and growth direction(s)
resolve crystal structure (single crystal, powder)

From grid square to atomic layers



A. Lak *et al.* *Nanoscale*, 2013, 5, 12286–12295.

Sample Requirements

sample must be **conductive!**

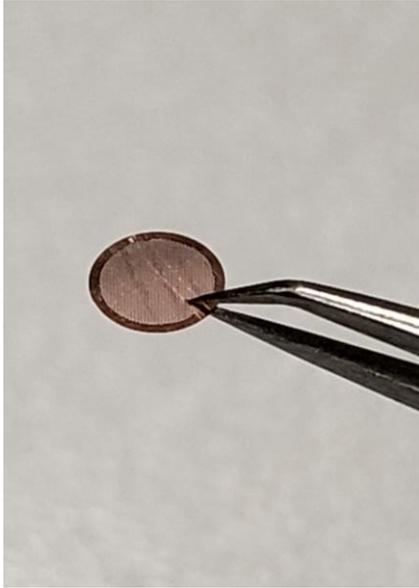
sample must be **dry** and free from any solvents!

sample must be **stable** in electron beam!

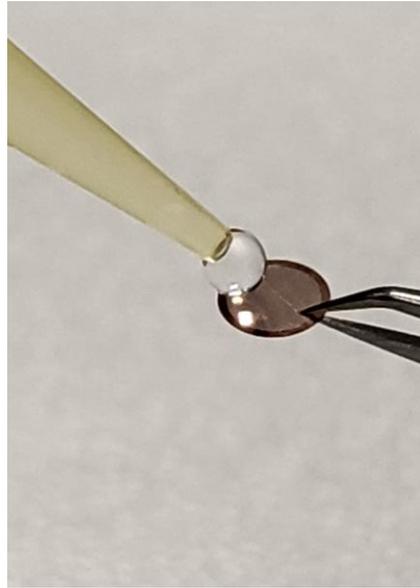
for TEM: sample must be **thinner** than 200 nm!

scientific question must fit to the data we get from EM!

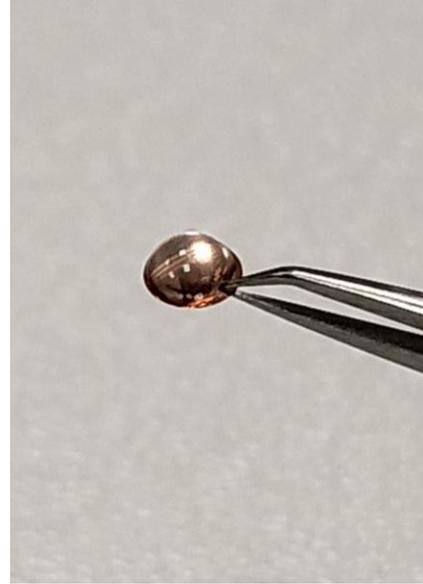
Sample Preparation: Dropcasting on Grids



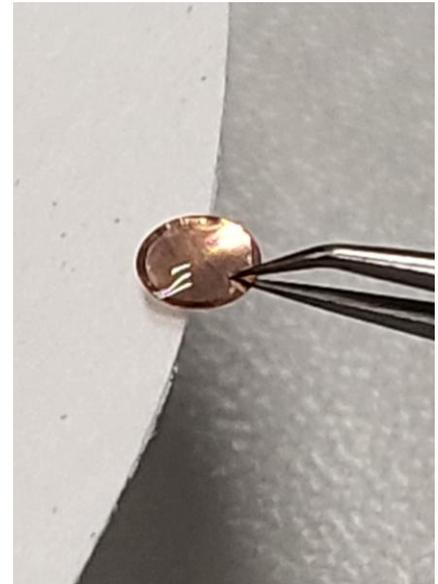
take carbon-coated
metal grid or SiO_2 or
 Si_3N_4 grid



drop 5-10 μL of your
diluted suspension
on the grid

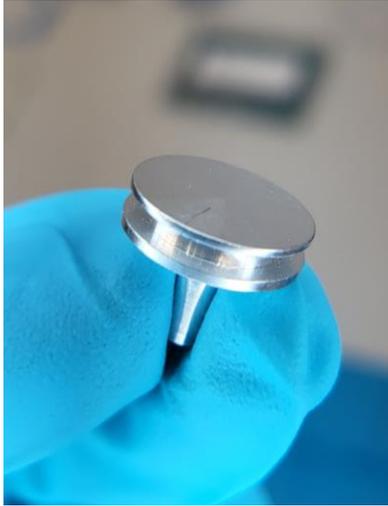


wait 10-15 seconds

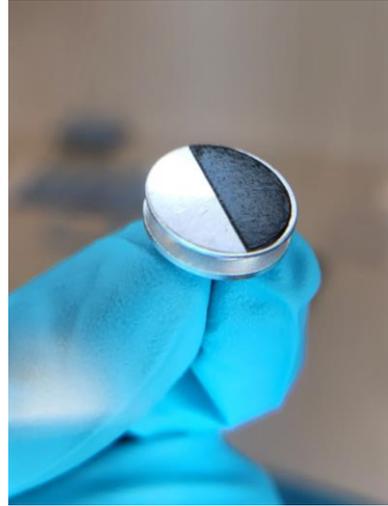


wipe excess solvent
away using filter
paper from beneath

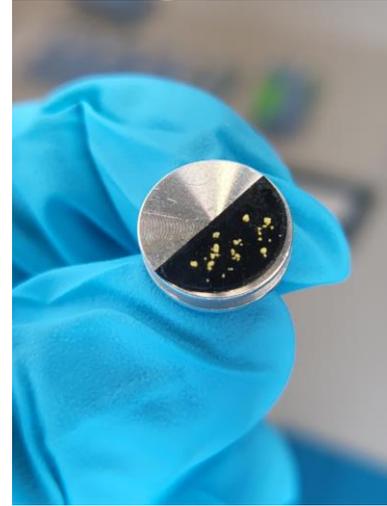
Sample Preparation: Powders for SEM



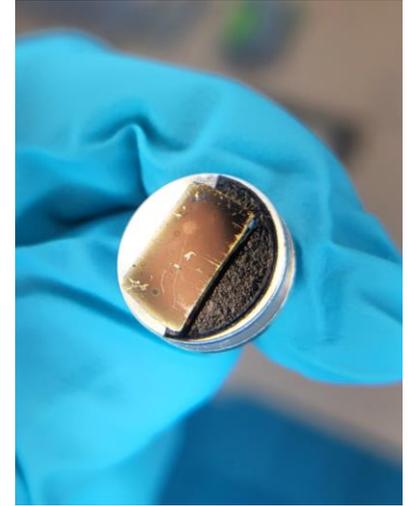
take aluminum stub



put carbon sticker
on stub



deposit a little
amount of sample
on sticker



or put piece of conductive
substrate that is covered
with your sample
on the sticker

Sending requests to EM service: (I) online form

MEASUREMENT REQUEST

We always welcome requests from external clients! If you would like to use our service without being a member of the Department of Chemistry, please direct your inquiry to charlotte.ruhmleib@uni-hamburg.de.

Please make sure to review the applicable [terms and conditions!](#)

* indicates a required field.

General Information

Client*

Institute*

Working Group*

E-Mail*

Phone*

Project*

Sample Information

Sample Name*

Sample Material*

Sample Series?*

Scientific Question*

[Electron Microscopy](#)

Team

Publications

Equipment

Further Analytics

[Measurement Request](#)

Booking Calendar

Open Positions / Internships

Please fill out the [form](#) on our website to send a request for EM measurements.

note:
HR-TEM and Cryo-TEM
measurements will be discussed
and planed beforehand.

Sending requests to EM service: (II) location



Entrance to the „Haus der Moleküle“ (Chemistry Department, Grindelallee 117)

Sending requests to EM service: (III) sample storage



Please bring your sample to the sample storage (institute for physical chemistry, basement, last door left)

We measure your sample(s) as soon as possible. You will find the data on the server „messdaten“ right after the measurements.

note:

We always love to help with the sample preparation and/or with correction interpretation and evaluation of your data. Feel free to ask!

Our Electron Microscopes



FEI Quanta 3D FEG



Zeiss LEO Gemini
1550
+ EDX
+ WDX



JEOL JEM-1011
+ SAED

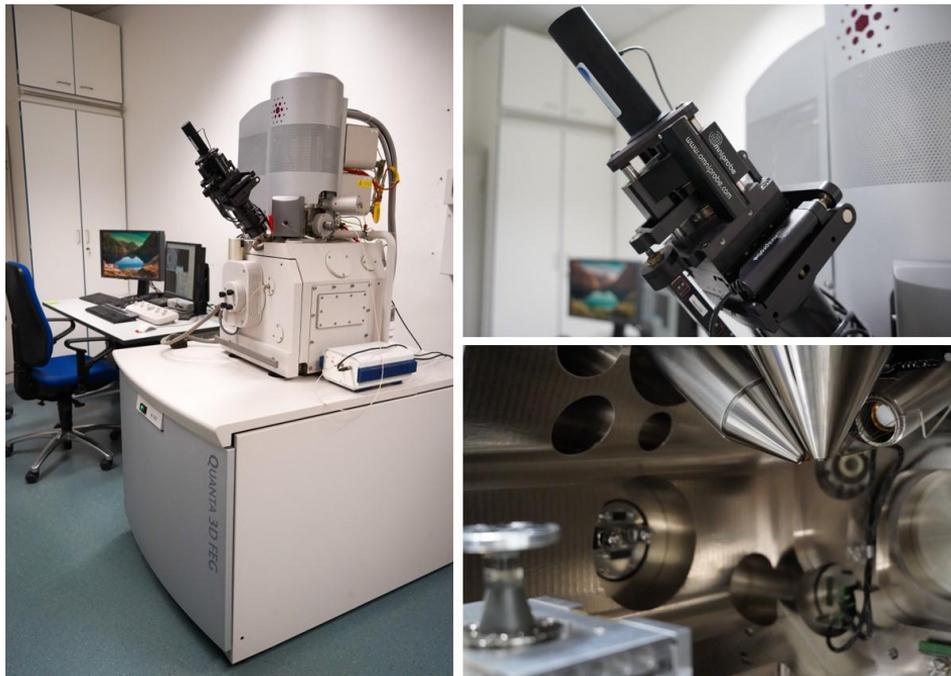


FEI Tecnai G2 Spirit
Twin
+ Vitrobot
+ (Cryo)Ultramicrotome



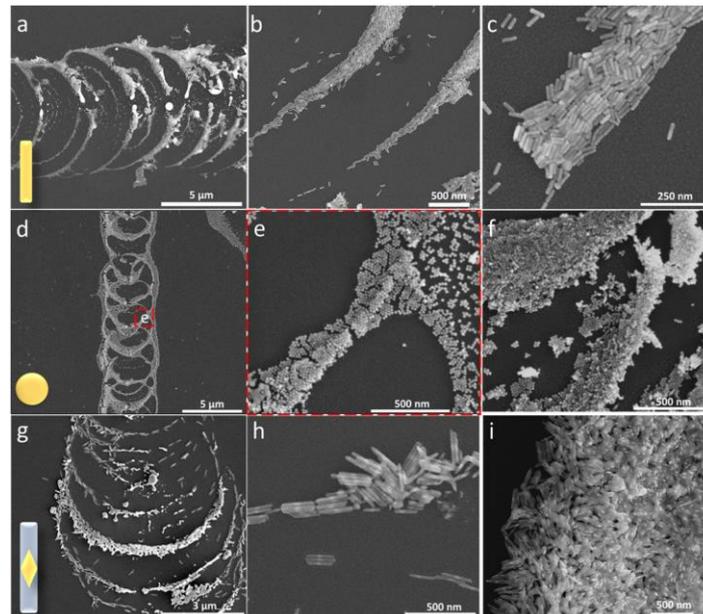
JEOL JEM-2200FS
+ SAED
+ STEM
+ EDX/EDX Mapping
+ EELS

SEM: FEI Quanta 3D FEG



Laser-Driven Bubble Printing of Plasmonic Nanoparticle Assemblies onto Nonplasmonic Substrates

Eric H. Hill,^{*} Claire Goldmann, Cyrille Hamon,^{*} and Marcel Herber



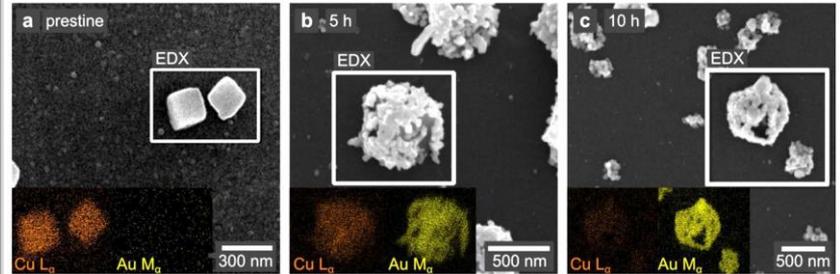
SEM: Zeiss LEO Gemini 1550



scientific reports

Multimodal imaging of cubic $\text{Cu}_2\text{O}@\text{Au}$ nanocage formation via galvanic replacement using X-ray ptychography and nano diffraction

Lukas Grote^{1,2}, Sarah-Alexandra Hussak¹, Leif Albers¹, Karolina Stachnik¹, Federica Mancini^{1,4}, Martin Seyrich^{1,2}, Olga Vasylieva¹, Dennis Brückner^{1,3}, Mikhail Lyubomirskiy², Christian G. Schroer^{1,2,5} & Dorota Koziej^{1,6}✉



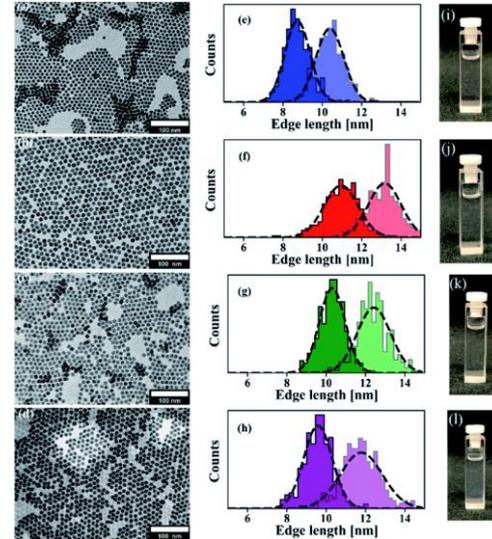
TEM: JEOL JEM 1011



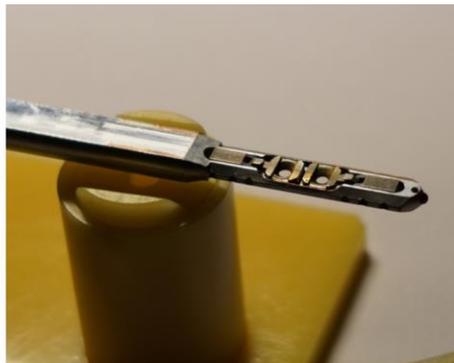
Nanoscale Advances

Bulk-like emission in the visible spectrum of colloidal $\text{LiYF}_4:\text{Pr}$ nanocrystals downsized to 10 nm \ddagger

Rajesh Kombar, ^{†*a} Simon Spelthann, ^{†*b} Michael Steinke, ^b Detlev Ristau, ^{bcd} Axel Ruehl, ^c Christoph Gimmler ^{†*a} and Horst Weller ^{†ae}



TEM: JEOL JEM 1011



nature catalysis

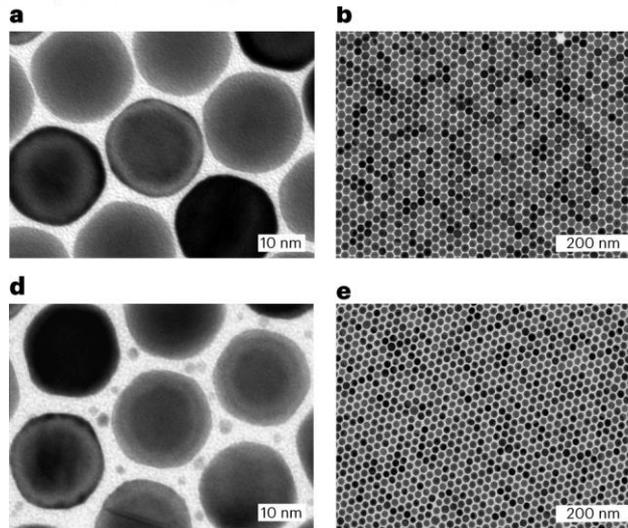


Article

<https://doi.org/10.1038/s41929-023-01053-9>

Plasmonic bimetallic two-dimensional supercrystals for H₂ generation

Matias Herran^{1,7}, Sabrina Juergensen^{2,7}, Moritz Kessens², Dominik Hoewing^{3,4}, Andrea Köppen², Ana Sousa-Castillo¹, Wolfgang J. Parak⁵, Holger Lange^{4,6}, Stephanie Reich⁷, Florian Schulz⁸ & Emiliano Cortés^{1,3}

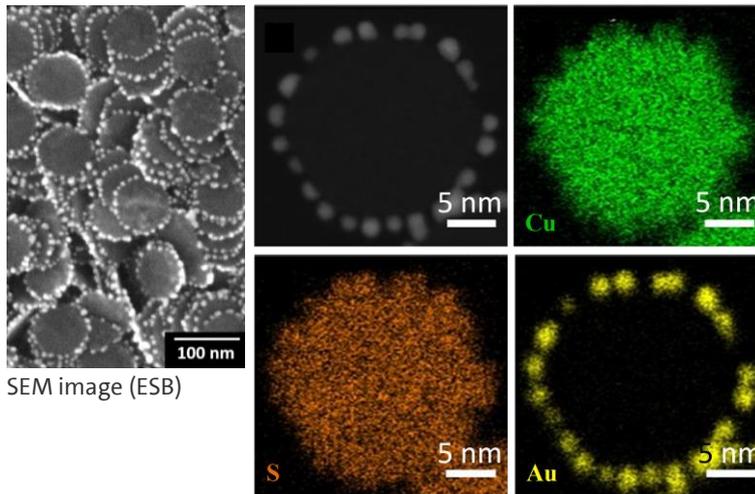


TEM: JEOL JEM-2200FS



Controlled Growth of Gold Nanoparticles on Covellite Copper Sulfide Nanoplatelets for the Formation of Plate–Satellite Hybrid Structures

Thomas Tsangas, Charlotte Ruhmlied,* Sebastian Hentschel, Heshmat Noei, Andreas Stierle, Tobias Kipp, and Alf Mews



SEM image (ESB)

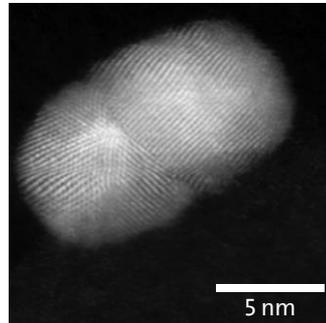
EDX map of a single CuS@Au nanostructure

TEM: JEOL JEM-2200FS

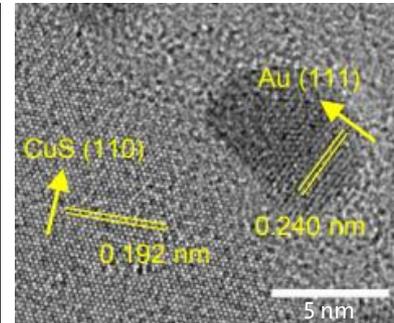


Controlled Growth of Gold Nanoparticles on Covellite Copper Sulfide Nanoplatelets for the Formation of Plate–Satellite Hybrid Structures

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STEM image of Au nanoparticle



HRTEM image of interface between CuS and Au

TEM: JEOL JEM-2200FS



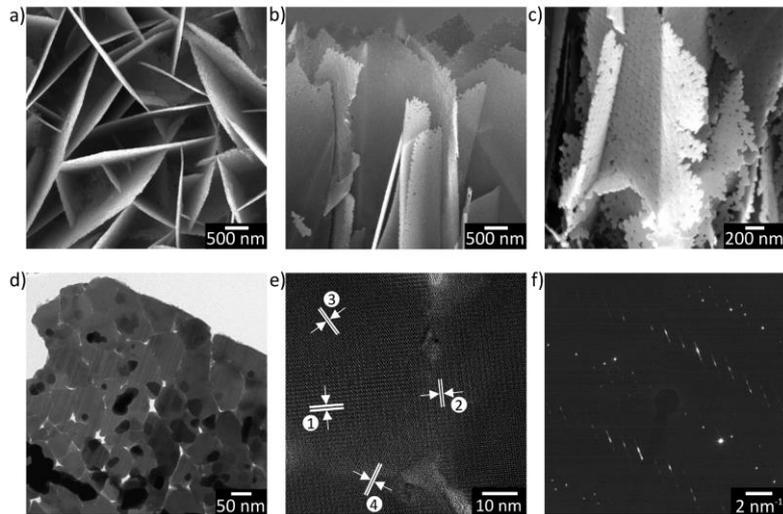
NANO LETTERS

pubs.acs.org/NanoLett

Letter

Two-Dimensional Superstructures from the Gas Phase: Directed Assembly of Copper-Sulfide Nanoplatelets

Maria Taplick, Charlotte Ruhmlieb,* Tobias Kipp, and Alf Mews



Working Together



High-Impact Scientific Journal

your
next
publication
with
advanced
electron microscopy
data

Contact



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Universität Hamburg

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↑
to our
website