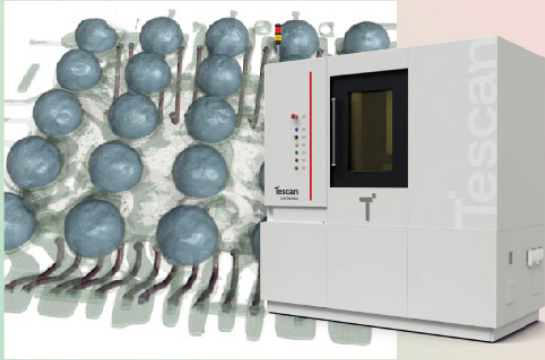


Integrated Semiconductor Workflow

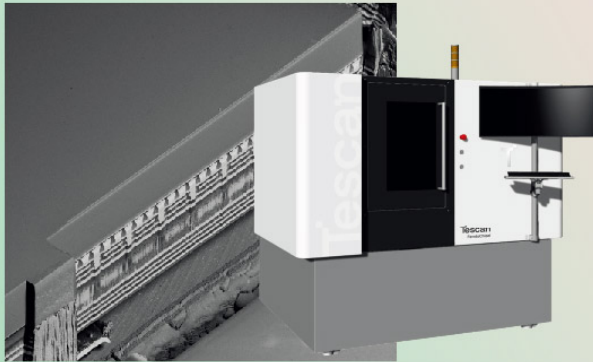


Inspect

Tescan UniTOM HR 2

In-Situ Micro-CT for Non-Destructive Warpage Analysis

- Reveal the smallest features
- High spatial resolution
- True 4D imaging with Dynamic CT
- 3D in situ experiments
- Broad sample compatibility

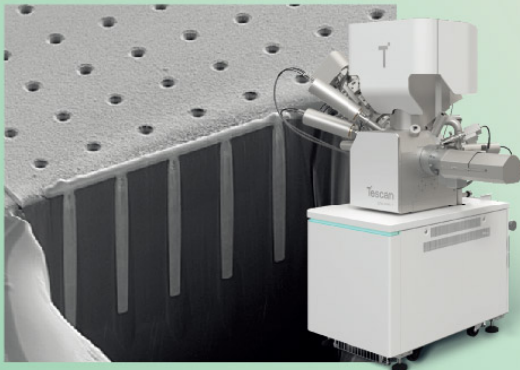


Access

FemtoChisel™

Integrated Laser Processing for Semiconductor Failure Analysis

- Unprecedented surface quality
- Heterogeneous material compatibility
- Minimal debris and redeposition
- Seamless correlation with CT, optical, or SEM images
- Wafer-level scalability
- Nanometer-level precision end-pointing

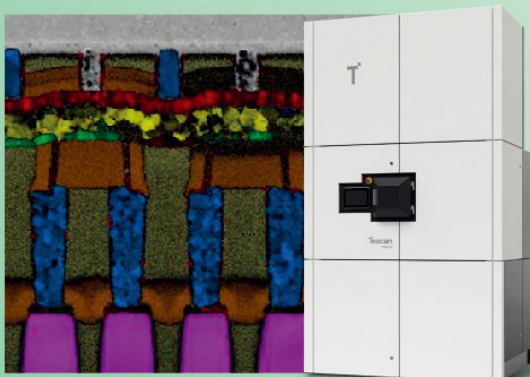


Prepare

Tescan SOLARIS X 2

FIB-SEM Sample Prep with Real-Time SEM Insight

- High-quality, ultra-thin TEM samples
- Precise end-pointing
- Cross sections free of curtaining
- Compatible with polyimide, SiC, ceramics, and glass
- Maximized sample processing throughput
- System readiness automation



Analyze

Tescan TENSOR

Robust 4D-STEM Analysis for Process Development

- 4D-STEM data analysis and processing
- Strain mapping
- Diffraction imaging and tomography
- Precession electron diffraction
- STEM and EDS tomography

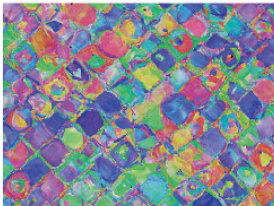
Learn more
about **Integrated
Semiconductor
Workflow** here:



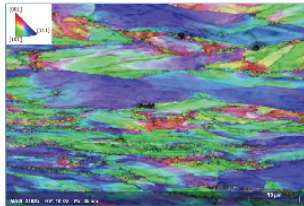
Electron Microscope Analyzers

eWARP – The fastest EBSD Detector Ever

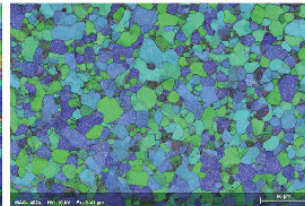
- Direct Electron Detection for maximized signal efficiency
- Ultrafast EBSD map acquisition at low accelerating voltages and beam currents
- Patented on-chip binning enabling ForeScatter Electron (FSE) imaging at up to 350,000 points/second



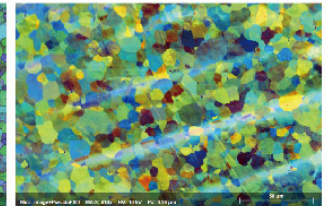
Additively Manufactured (AM) stainless steel
@ 10kV 12nA, 14,437 fps



Severely deformed aluminum alloy @ 10kV 7nA

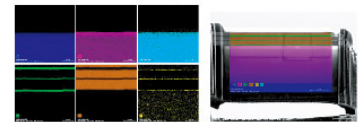
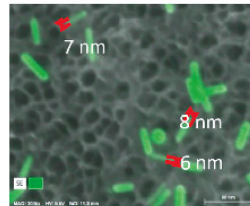
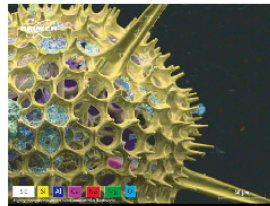
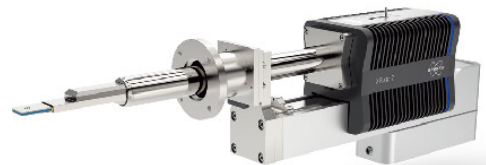


IPF X + Pattern Quality of Graphite
@10kV / 10 nA / 830 fps / Hit rate 92%



XFlash® FlatQUAD – Maximum Efficiency in X-ray Detection

- Innovative annular four-channel design with best solid angle in EDS for SEM
- Unmatched throughput without compromising energy resolution
- Fast mapping for analysis of beam-sensitive or topographical samples



XTrace 2 – Innovative X-ray Source for Micro-XRF on SEM

- Trace element sensitivity @ 5 - 10 ppm LOD with minimal sample preparation
- 50 W X-ray tube power
- Layer thickness analysis capability



Contact Us

Bruker Taiwan Co. Ltd.

Hsin Chu office

3F-3, No.6, Taiwan 1st St., Zhubei City, Hsinchu County 30288,

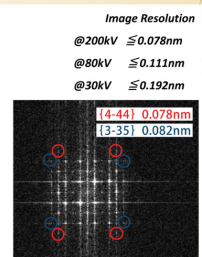
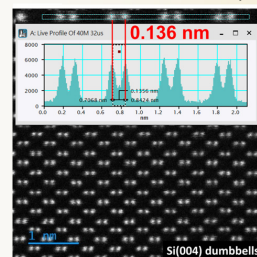
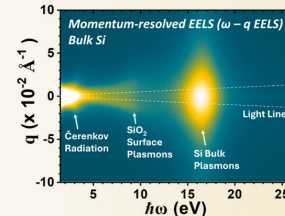
Tel.03-5601212/Fax.03-5601060



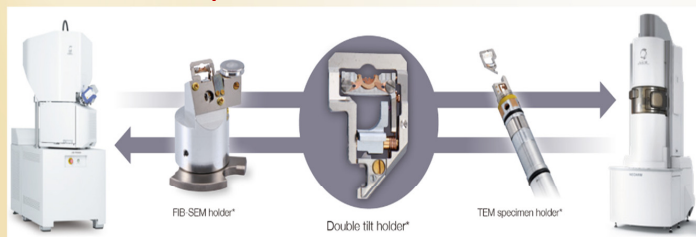
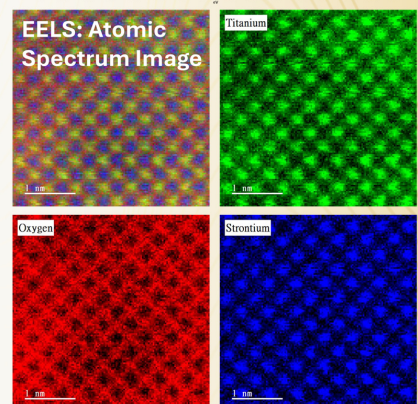
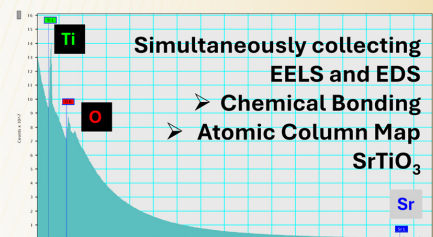
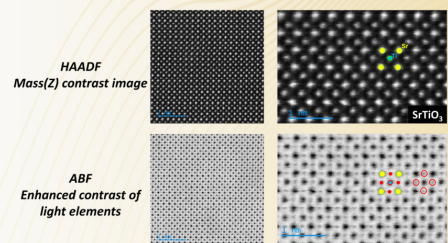
Advanced Å-Scale Verification (Cs-STEM) and Sample Preparation (FIB) Service Platform in TSRI

Technical Specification of Cs-STEM in TSRI

- Cold FEG + Cs-corrector STEM
 - Accelerating voltage: 200, 80, 30 kV
 - STEM Spatial Resolution: 0.78 Å (200 kV)
 - Dual EDX system(100 mm² x2): $\Omega = 1.7$ sr
 - Gatan GIF Continuum ER: Dual EELS/EFTEM/ ω -q EELS system
 - EELS Energy Resolution: < 0.4 eV
 - Enhanced contrast of light elements: (SAAF/DPC images)
 - Lorentz lens: Magnetic field free mode
 - Electron Dose Modulation Synchrony
 - Gatan In-situ 2K Metro Counting Camera
 - Plasma cleaner
 - Images, EDS and EBSD maps in FIB-SEM system
- Service is expected to launch in 2026 Q3.
- **STEMx 4D STEM System**
 - **4D-SPED with Direct Electron Counting Detector**
 - **3D-Tomography holder**
 - **In-situ heating/bias/cooling(or gas) holder [DENS Lightning Arctic/Climate(gas)]**
- Service is expected to be available after 2027.



Spherical aberration corrected (Cs) STEM HAADF/ABF Images



FIB-PS500i

NEOARM Cs-STEM



Thermo Helios
5 Hydra CX
(Xe, Ar, N, O) for Ga-free and large X-SEM



ZEISS
Crossbeam 350
(Laser + Ga) for APT and TEM samples

Unlock Materials. Reveal the Invisible.

從奈米結構到分子化學
完整掌握材料全貌

Electron Microscopy EM 電子顯微分析

元素分析與晶體結構鑑定
EDS | EBSD | BEX

Atomic Force Microscopy AFM 原子力顯微鏡

奈米尺度表面形貌與物性量測
Cypher | MFP-3D | Jupiter XR

Nanoindentation NI 奈米壓痕

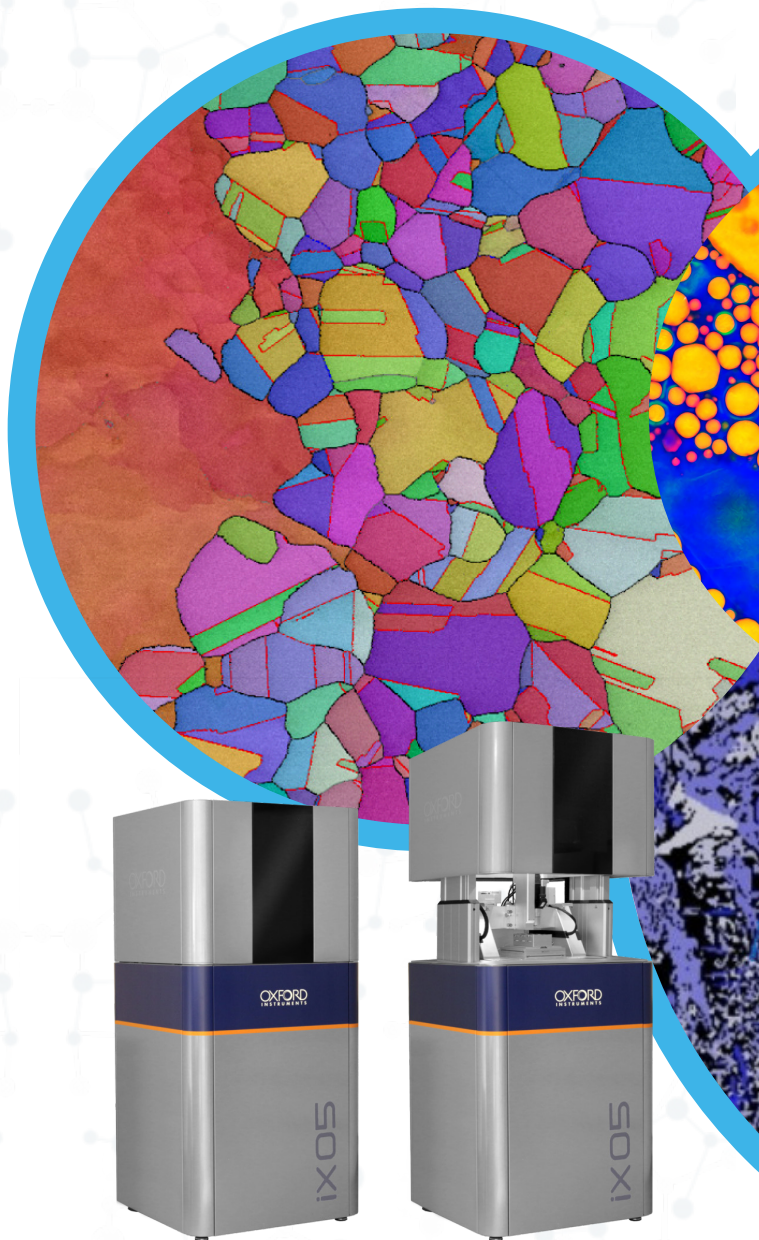
奈米尺度機械性質量測
iX05 | i04 | NMT04

Confocal Raman Microscopes WITec 共軛焦拉曼顯微鏡

化學成分影像與拉曼光譜分析
witec360 | cryoRaman | RISE

Nuclear Magnetic Resonance NMR 核磁共振

分子結構與化學組成分析
X-Pulse | MQC+



第 44 屆 台灣顯微鏡年會會議議程表

08:30-09:10	報到
09:10-10:00	開幕
	理事長致詞 & 貴賓致詞
	頒發 會士 與 優秀年輕學者獎
	大合照
10:00-11:00	特邀演講(I)：國立清華大學 材料科學與工程學系 特聘研究講座教授 台灣電子顯微鏡應用的發展史 演講者：陳力俊 校長 Host: 吳文偉 講座教授
11:00-11:30	顯微鏡技術推廣(I)：TESCAN Faster and More Consistent TEM Lamella Preparation with the new Solaris 2 Ga⁺ FIB-SEM Antonín Doupal Product Sales Leader Host: 謝達斌 副校長
11:30-12:00	台灣顯微鏡學會年會會員大會 第 22 屆理監事委員選舉 羅聖全 理事長
12:00-13:50	午餐時間 (備有午餐餐盒) Poster Session (地點：景德廳外-海報大廳)
13:50-14:15	特邀演講(II)：國立台灣大學 材料科學與工程學系 Probing Materials Inner Space at the Atomic Scale for a Net-Zero Future 顏鴻威 教授 Host: 陳健群 教授
14:15-14:40	特邀演講(III)：國立台灣大學 醫學工程學系 3D Spatial Biology Across Scales 朱麗安 教授 Host: 吳尚蓉 教授
14:45-15:15	顯微鏡技術推廣(II)：捷東公司 Advancing Cryo-EM: Improved Electron Optics and Automated Data Collection for High-Throughput Structural Biology Naoki Hosogi Host: 鮑忠興 博士
15:15-15:40	討論交流時間 (備有點心茶點)
15:40-16:10	顯微鏡技術推廣(III)：布魯克 布魯克平插 EDS 和 eWARP EBSD 微觀分析技術與應用 演講者：焦匪勝 博士 布魯克電子顯微分析 APAC 銷售總監 Host: 鍾采甫 教授
16:10-17:00	頒獎、閉幕

第 44 屆 台灣顯微鏡年會-特邀講者

陳力俊 博士

現 職：台灣聯合大學系統 系統主席

國立清華大學材料科學工程學系 特聘研究講座教授

學 歷：美國柏克萊加州大學 物理系 博士

專 長：低維度奈米材料合成與應用、電子顯微鏡學



簡介

1. 陳力俊系統校長為美國柏克萊加州大學物理學博士，現任台灣聯合大學系統系統主席及國立清華大學特聘研究講座教授。曾任國立清華大學校長、行政院國家科學委員會副主委、台灣聯合大學系統副校長、國立清華大學工學院院長、國立清華大學材料科學工程學系系主任兼所長、美國洛杉磯加州大學材料系研究員、國際期刊「Materials Chemistry and Physics」主編、中央研究院評議員、國家同步輻射研究中心董事長、東亞研究型大學協會會長、斐陶斐榮譽學會理事長、國際材料研究學會聯合會第二副會長、中華民國顯微鏡學會理事長、材料科技聯合會創會會長及中國材料科學學會理事長。
2. 研究領域為低維奈米材料製程、檢測與應用、奈米材料原子動力學、原子分辨顯微鏡學及積體電路金屬薄膜材料。曾獲俄羅斯國際工程學院院士(2013)、美國材料研究學會會士(2011)、美國電化學學會電子與光子學門獎(2010)、世界科學院院士(2009)、美國礦冶與材料學會 William Hume-Rothery Award (2008)、中央研究院院士 (2006-)、清華大學特聘講座教授 (2006-)、教育部第二與第五屆國家講座 (1998-2001, 2001-2004, 終生榮譽)、傑出人才發展基金會講座 (1998-2003, 2006-2011)、清華大學工程講座 (2003-2006)、美國真空學會會士 (2001)、亞洲太平洋先進材料學術院院士 (1998)、國科會傑出特約研究人員(2001)、國科會特約研究人員(1995-2001)、國科會傑出研究獎(1985-95)、教育部年度工科學術獎 (每年一人, 1986)、中山學術獎 (1991)、清華大學第一屆傑出研究獎 (1983)、科技管理學會科技管理獎 (2025)、台灣顯微鏡學會會士(2022)、中技社講座學者 (2020)、台灣鍍膜科技協會終身成就獎 (2018)、台灣真空學會會士 (2011)、中國材料科學學會會士 (2009)、有庠基金會奈米科技講座 (2006)、東元科技獎-高級材料類 (2001)、潘文淵基金會研究傑出獎(1999)、侯金堆會材料科學類傑出研究獎 (1993)、中國材料科學學會陸志鴻獎章 (1993)、新竹中學傑出校友獎 (2007)、台灣大學物理系傑出系友獎 (2009)、竹師附小標竿校友 (2010)。

第 44 屆 台灣顯微鏡年會-特邀講者

顏鴻威 博士



Professor & Deputy Chair

Dept. of Materials Science & Engineering, National Taiwan University

Technology Consultant

Walsin Lihwa Corporation

E-mail: homeryen@ntu.edu.tw Tel: +886-918196735

Address: Department of Materials Science & Engineering, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, 10617 Taipei, Taiwan

BIOGRAPHY

Dr. Hung-Wei (Homer) Yen is a materials scientist and microscopist based in Taiwan, where he leads the Microstructure & Defects Physics Group at National Taiwan University (NTU). His research decodes the fundamental microstructure-property relationships in advanced structural materials, including high-strength steels, biomedical titanium alloys, and high-entropy alloys. By leveraging state-of-the-art characterization techniques, Homer probes the inner atomic space of materials to uncover the mechanisms governing their performance. Recently, his group has pioneered research into hydrogen behaviors in materials, focusing on hydrogen embrittlement and hydrogen storage alloys. Notably, he established Taiwan's first local electrode atom probe (LEAP) service platform, driving critical innovations in materials and semiconductor research. Homer has co-authored over 140 SCI-indexed journal papers (-index: 39), holds 10 patents, and has delivered more than 50 invited global lectures. His cutting-edge work is fueled by an extensive international network spanning the US, Europe, and the Asia-Pacific region.

EDUCATION

National Taiwan University, Taiwan	2006
B.S., Materials Science & Engineering	
National Taiwan University, Taiwan	2011
Ph.D., Materials Science & Engineering	

PROFESSIONAL EXPERIENCES

Associate Professor	Aug. 2018 - Aug. 2022
Dept. of Materials Science & Engineering, National Taiwan University	
Assistant Professor	Aug. 2014 - Aug. 2018
Dept. of Materials Science & Engineering, National Taiwan University	
Atom Probe Scientist	Sep. 2012 - Jul. 2014
Australian Centre for Microscopy & Microanalysis, The University of Sydney, Australia	
Visiting Scientist	Oct. 2011 - Nov. 2011
Department of Mechanical Engineering, The University of Hong Kong, Hong Kong	
Research Associate	Feb. 2011 - Aug. 2012
Dept. of Materials Science & Engineering, National Taiwan University	

Research Areas

1. Microstructure-Property Relationship
2. Design of Frontier Materials: steels, light metals, high-entropy alloy, hydrogen materials
3. Advanced Characterizations: transmission electron microscopy, focused ion beam, atom probe tomography, thermal desorption analysis
4. Computational Materials Science: computational phase diagram, artificial neural network, computational microscopy

Awards

2010 Jeme Tien Yow Engineering Paper Award (Chinese Institute of Engineers, TW)
2016 Excellent Reviewer, Acta Materialia (Acta Materialia Inc.)
2017 Excellent Junior Research Investigators (National Science and Technology Council, TW)
2017 Outstanding Teaching Award-Top 10% (National Taiwan University, TW)
2019 Outstanding Teaching Award-Top 10% (National Taiwan University, TW)
2020 Excellent Junior Research Investigators (National Science and Technology Council, TW)
2020 Outstanding Teaching Award-Top 10% (National Taiwan University, TW)
2020 Young Excellent Scholar (Materials Research Society-Taiwan, TW)
2021 Distinguished Teaching Award-Top 1% (National Taiwan University, TW)
2021 Ta-You Wu Memorial Award (National Science and Technology Council, TW)
2021 Researcher Achievement Award (College of Engineering, National Taiwan University, TW)
2023 Young Chair Professor (National Taiwan University, TW)
2024 Excellent Reviewer, Acta Materialia (Acta Materialia Inc.)
2025 Young Excellent Scholar (Microscopy Society of Taiwan, TW)

Other Roles

2025 International Editorial Board, Materials & Design, Elsevier
2026 Scientific Editor (Triage Editor), Next Energy/Next Materials/Next Nanotechnology/Next Sustainability, Elsevier

Probing Materials Inner Space at the Atomic Scale for a Net-Zero Future

Hung-Wei (Homer) Yen

Department of Materials Science and Engineering, National Taiwan University

Achieving the global target of net-zero carbon emissions by 2050 demands a fundamental paradigm shift in materials design and manufacturing. To drastically reduce industrial carbon footprints, developing advanced green energy materials and optimizing metallurgical processes are critical imperatives. This presentation explores the recent breakthroughs in the nanoscale analysis of green metallurgical and energy materials using atom probe tomography (APT). Specifically, two topics will be discussed: (1) the underlying mechanisms of hydrogen trapping in complex carbides to prevent hydrogen embrittlement and (2) the nanostructural characterization of electrowon iron in green steelmaking. In the first topic, the results show that hydrogen trapping is not the solution to hydrogen embrittlement in very strong steels. In the second topic, the results unveil the heterogeneous distribution of impurity in pure iron. By probing these materials inner space at the atomic level, this work provides critical insights for tailoring next-generation materials essential for a sustainable and green future.

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朱麗安 博士



Li-An Chu

Associated Professor

**Department of Biomedical Engineering, National Taiwan
University Brain Research Center, National Tsing Hua
University.**

E-mail: lachu@ntu.edu.tw

FIELD OF SPECIALTY

Super-resolution microscopy imaging, Fluorescent Microscopy, Light sheet Microscopy, Electrophysiology, Biological Sample Clearing, Animal Behavior, Brain Neuroscience, Deep Learning Image Data Analysis.

EDUCATION

2009-2016 Ph.D. Institute of Biotechnology, National Tsing Hua University, Taiwan

2012-2013 Visiting Scientist Cold Spring Harbor Laboratory, New York, USA

2007-2009 Master Institute of Biotechnology, National Tsing Hua University, Taiwan

2003-2007 Bachelor Power Mechanical Engineering Department, National Tsing Hua University, Taiwan

CURRENT RESEARCH PROJECTS

1. Ultrafast Cyclic Immunofluorescence in CM level organs.
2. Multi-functional lightsheet microscopy.
3. AI models for microscopy image analysis (Green AI).

HONOR

2025 未來科技獎 Best Technology Breakthrough Award at Future Technology Exhibition.

2025 年輕學者研究獎 Young Scholar Award, Microscopy Society, Taiwan

2024 年輕學者研究獎 Young Scholar Award, Biomaterials and Control Released Society, Taiwan

2023 未來科技獎 Best Technology Breakthrough Award at Future Technology Exhibition.

2020 國家新創獎 National innovation award, Clinical applications.

2020 新進教師研究獎 New Faculty Research Award, National Tsing Hua University, Taiwan.

2020 博士後學術研究獎 Postdoc Academic Research Award, Ministry of Science and

第 44 屆 台灣顯微鏡年會-顯微鏡技術推廣(I)：

TESCAN Group

Name: Antonín Doupal

Title: Product Sales Leader for FIB-SEMs

Email: antonin.doupal@tescan.com

Affiliation: TESCAN Group

Antonín Doupal is a Czech technology professional with over 15 years of experience at Tescan, specializing in advanced electron microscopy and semiconductor solutions. With a background in nanotechnology engineering and applied physics from Brno University of Technology, he has held roles in technical support, field service, product specialization, and international business development. He has contributed significantly to the expansion of Tescan technologies across Asian markets, including Japan, South Korea, China, and India. His expertise includes FIB-SEM systems, semiconductor failure analysis, and automation for complex workflows. He currently serves as Tescan Product Sales Leader for FIB-SEMs.



Faster and More Consistent TEM Lamella Preparation with the new Solaris 2 Ga⁺ FIB-SEM

Preparation of high-quality TEM lamellae, thinned to electron transparency at precisely targeted defect locations while minimizing amorphous damage remains one of the most demanding tasks in semiconductor failure analysis (FA) laboratories. Even for moderate node technologies, where <70 nm lamella thickness is sufficient for interface investigation or nanolayer metrology using in-situ 30 keV STEM or standalone S/TEM, achieving consistent results depends heavily on operator expertise.

Operators must manage a complex interplay of parameters, including FIB and SEM beam conditions, pattern placement, and lift-out tool control. These challenges are further amplified when working with diverse material systems, ranging from standard silicon-based devices with metallic interconnects to more demanding substrates such as glass, ceramics, or other hard materials prone to FIB-induced milling artifacts, charging or specimen bending during final thinning.

TESCAN SOLARIS™ 2 addresses these challenges by automating the entire TEM sample preparation workflow for environments where reproducibility and throughput are critical. The AI-driven TEM AutoPrep™ Pro reduces manual intervention by more than 75%, enabling unattended and overnight operation to increase system utilization in multi-user FA labs. In parallel, the new Orage™ 2 gallium FIB column enhances overall performance by delivering up to 40% higher milling throughput while reducing beam-induced artifacts such as curtaining, overspray, and subsurface damage. These improvements extend beyond TEM preparation to cross-sectioning and 3D characterization workflows.

Together, these advancements significantly reduce operator dependency while improving consistency, throughput, and data reliability in semiconductor failure analysis.

第 44 屆 台灣顯微鏡年會-顯微鏡技術推廣(II)：

捷東公司

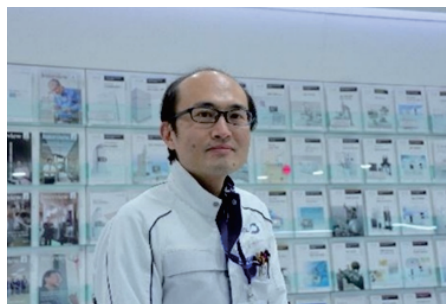
Name: Naoki Hosogi

Title: Manager of cryo-EM development group

Email: nhosogi@jeol.co.jp

Affiliation: JEOL Ltd.

Naoki Hosogi is a Japanese application specialist with over 15 years of experience at JEOL, specializing in advanced cryo electron microscopy and biological solutions. With a



background in structural and cell biology from Kobe University and National Institute for Physiological Sciences, he has held roles in technical and application development. He has contributed significantly to the expansion of JEOL technologies across world-wide markets. His expertise includes single particle analysis (SPA), Cryo electron tomography and cryo FIB/TEM workflows. He currently serves as JEOL Research & Development manager for cryo-EMs.

Advancing Cryo-EM: Improved Electron Optics and Automated Data Collection for High-Throughput Structural Biology

Cryo-electron microscopy (cryo-EM) has emerged as a powerful approach for determining the structures of biological macromolecules in near-native states, with single-particle analysis (SPA) and cryo-electron tomography (cryo-ET) enabling high-resolution and in situ structural insights. In this study, we present an integrated advancement of cryo-EM performance on the CRYO ARMTM 300 II, combining electron-optical improvements, AI-assisted workflows, and automated high-throughput data acquisition. Technological innovations in the electron optical system significantly enhance both imaging quality and efficiency. The implementation of fringe-free Köhler illumination enables flexible beam size control and minimizes interference fringes, thereby improving image quality and dose efficiency while extending the usable range of image and beam shift. This allows stable data acquisition over a large field radius and supports practical throughput of around 1,000 movies per hour. AI-driven workflows such as SmartScope [1] automate square and hole selection, reducing operator dependency and improving reproducibility. These hardware and software improvements provide a robust foundation for efficient and consistent data acquisition. In parallel, substantial advances were made in cryo-ET sample preparation through the development of the Cryo-Lameller system, a next-generation cryo-FIB-SEM platform tightly integrated with CRYO ARMTM workflows. Cryo-Lameller introduces a cartridge-based transfer system compatible with CRYO ARMTM, enabling stable and contamination-reduced specimen handling. The system incorporates a thermal conduction cooling stage that minimizes drift and vibration during operation, as well as new anti-contamination devices.

Reference [1] J. Bouvette, Q. Huang, A.A. Riccio, W.C. Copeland, A. Bartesaghi and M.J. Borgnia, “Automated systematic evaluation of cryo-EM specimens with SmartScope,” elife, vol. 11, e80047, 2022

第 44 屆 台灣顯微鏡年會-顯微鏡技術推廣(III)：

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01.2005 – 09.2007 Gatan UK

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- In charging of the development project of new Alto system for Cryo-SEM;
- Performed quality audit of TEM products including holders and anti-contaminators;
- Supplied customer support for TEM and SEM products (demonstration, training and installation).

報告題目：布魯克平插 EDS 和 eWARP EBSD 微觀分析技術與應用

報告摘要：

本報告介紹布魯克 FlatQUAD 平插 EDS 與 eWARP EBSD 核心技術：前者以超大立體角實現高速、低電壓、無陰影元素分析；後者以直接電子探測實現超高速、高靈敏、高分辨晶體學表徵。EDS+EBSD 技術組合可同步獲取成分、形貌、晶體結構資訊，廣泛應用於金屬、陶瓷、半導體、仿生材料、醫療器械、地質等領域，為材料微觀結構—性能關聯研究提供高效、精準、全面的分析手段。

第 44 屆 台灣顯微鏡年會

廠商位置與海報位置圖



1. 勛傑公司



2. 美嘉公司



3. 閎康公司



4. Bruker



5. 捷東公司



6. 捷東公司

7. Hitachi



8. 汎達



9. 蔡司公司



10. Thermo Fisher



11. 台灣真空學會



第 44 屆 台灣顯微鏡年會

學生論文海報比賽

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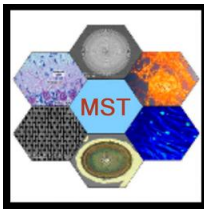
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台灣顯微鏡學會



Microscopy Society of Taiwan

Learning-Based Tomographic Reconstruction from Sparse and Noisy Sinograms Using U-Net

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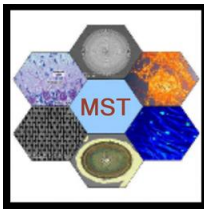
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High-resolution tomographic imaging is essential for structural characterization. To accelerate data acquisition, reducing the number of projections and exposure times is a highly desirable strategy. In tomography, raw projection data is aggregated into a 2D representation known as a sinogram. However, rapid scanning yields heavily degraded sinograms, causing severe streak artifacts from sparse angular sampling and high Poisson noise from limited signal counts. To address this, we propose a robust deep learning workflow using a U-Net architecture [1] to directly map highly degraded sinograms to clean image slices, overcoming the limitations of conventional Filtered Back-Projection (FBP) [2]. Operating over a 0° to 179° range, we simulate rapid scanning conditions by adopting a sparse angular sampling strategy and introducing realistic Poisson noise. Evaluated on simulated structural datasets [3], our model effectively suppresses both artifacts and noise. This pure convolutional approach demonstrates that deep learning can significantly accelerate tomographic workflows while precisely recovering structural details from imperfect sinograms.

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Discipline: Physics and Materials Science.



台灣顯微鏡學會



Microscopy Society of Taiwan

Cross-dimensional Correlative Microscopy for Investigating Nanoscale Surface Morphology of Cu-TSVs via FE-SEM and AFM

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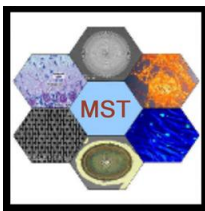
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In this study, a correlative microscopy strategy combining Field Emission Scanning Electron Microscopy (FE-SEM) and Atomic Force Microscopy (AFM) was employed to investigate the nanoscale surface morphology of copper-filled through-silicon vias (Cu-TSVs). To overcome the physical limitations of single-instrument characterization, we performed a side-by-side comparative analysis correlating wide-field 2D SEM imaging with high-resolution 3D AFM topography. This approach enabled the precise identification and localization of nanoscopic features, such as grain boundaries and surface protrusions. Furthermore, an optimized scanning strategy—matching pixel resolution to the AFM probe tip radius (oversampling)—was implemented to ensure high-fidelity 3D structural reconstruction. The results demonstrate that correlating multi-modal detection signals provides a more comprehensive surface profile, establishing an effective methodology for evaluating TSV structural integrity and guiding process optimization in advanced packaging.

Abstract submission is due by May. 15, 2026.

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台灣顯微鏡學會



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Interfacial Diffusion Behaviors and Low Contact Resistance in a Novel Ni/Pd/Si Contact Architecture

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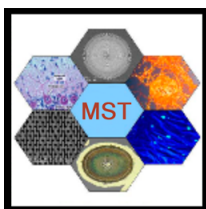
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As CMOS devices scale down, contact resistance increasingly dominates the overall parasitic resistance. Nickel monosilicide (NiSi) is widely used due to its low resistivity. However, at elevated temperatures, it transforms into the NiSi₂ phase, which severely degrades its resistivity. Therefore, the development of novel silicides featuring high thermal stability and low contact resistance has become a focal point of current research.

Recent studies have indicated that introducing low Schottky barrier height (SBH) metals like Pt, Pd, and rare earth elements can reduce contact resistance, but their silicides suffer from high intrinsic resistivity. To overcome this trade-off, this study proposes a novel Ni/Pd/Si structure using a Pd interlayer. Pd and Ni films were sequentially deposited on oxide-stripped p-type Si substrates via e-beam evaporation, followed by rapid thermal annealing (RTA) to form silicide. Electrical measurements confirm that the Pd interlayer preserves the low resistivity of NiSi and significantly improves its contact resistance, while maintaining a low contact resistance phase at elevated temperatures. In this study, X-ray diffraction (XRD) and transmission electron microscopy (TEM) were employed to analyze the interfacial morphology and diffusion behaviors among Ni, Pd, and Si. This study demonstrates that interfacial diffusion effectively optimizes electrical performance, highlighting the potential of the Ni/Pd/Si structure for advanced semiconductor manufacturing

Discipline: ____Biology and Biomedical science or__V__Physics and Materials Science.



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Magnetic and Electrical Modulation of 2D V/Nb co-doped MoS₂ Dilute Magnetic Semiconductors

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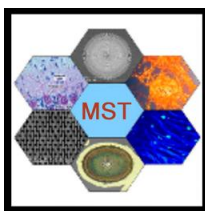
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This study investigates the fabrication and property modulation of 2D dilute magnetic semiconductor MoS₂ through V/Nb co-doping, aiming to explore its magnetic behavior and electrical characteristics in field-effect transistor. Dilute magnetic semiconductors are formed by introducing a small amount of transition metal dopants into semiconductors, enabling the coexistence of semiconducting and magnetic properties and offering great potential for spintronic applications. However, many DMS systems exhibit Curie temperatures below room temperature, which limits their practical use.

In this work, V/Nb-doped MoS₂ were synthesized on SiO₂/Si substrates using a three-zone chemical vapor deposition (CVD) process. Structural and compositional analyses were performed using Raman spectroscopy, photoluminescence (PL), X-ray photoelectron spectroscopy (XPS), and transmission electron microscopy (TEM). FET devices were fabricated to evaluate electrical transport behavior, while magnetic properties were characterized using a superconducting quantum interference device (SQUID). A systematic comparison of different V and Nb doping concentrations was conducted. The results show that V and Nb atoms substitute Mo lattice sites, enabling carrier-type modulation from n-type to p-type MoS₂. In the single V-doping system, the 6% V-doped sample exhibits the best magnetic performance, while 6% V and 3% Nb co-doping shows the most pronounced magnetic enhancement. These results demonstrate that transition metal co-doping is an effective strategy for tuning the magneto-electrical properties of MoS₂ for potential spintronic applications.

Discipline: ____Biology and Biomedical science or v Physics and Materials Science.



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Low-cost formation of 2D ϵ -Ga₂O₃ for the growth of GaN heterostructure

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Gallium nitride (GaN)-based high-electron-mobility transistors (HEMTs) require high-density two-dimensional electron gas (2DEG) while minimizing lattice-mismatch-induced defects at heterointerfaces. Here, we demonstrate a scalable route to fabricate ultrathin two-dimensional ϵ -Ga₂O₃ membranes by liquid metal printing (LMP), in which the self-limited surface oxidation of liquid gallium enables the transfer of continuous oxide layers onto target substrates. After post-deposition annealing at 600°C, the initially amorphous oxide membrane is transformed into crystalline ϵ -Ga₂O₃. The resulting 2D ϵ -Ga₂O₃ layer serves as an intermediate platform for oxide/nitride heterostructure integration and subsequent hydride vapor phase epitaxy (HVPE) of GaN. SEM observations reveal the surface morphology and coalescence behavior of GaN grown on the ϵ -Ga₂O₃ interlayer, while cross-sectional TEM further identifies the ultrathin interfacial oxide layer, GaN/oxide interface structure, and defect evolution near the heterointerface. Importantly, the ϵ -Ga₂O₃ interlayer provides a polarization-compatible template that may promote N-polar GaN growth, offering a potential pathway toward polarization-engineered GaN heterostructures and high-density 2DEG formation without intentional doping.

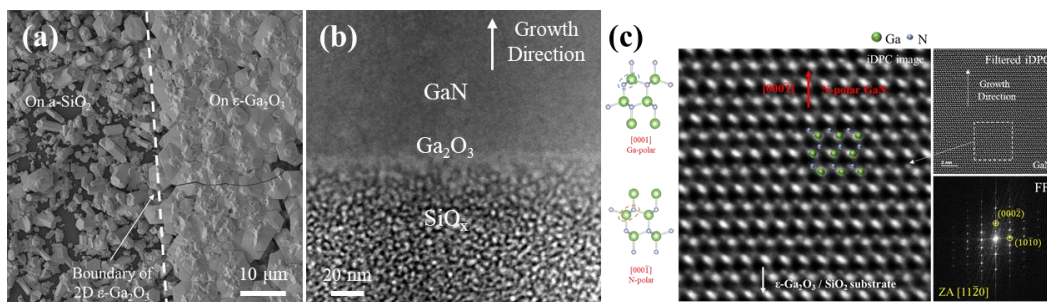


Figure 1. (a) Plan-view SEM image of GaN grown across the boundary between amorphous SiO₂ and LMP-derived ϵ -Ga₂O₃, showing preferential c-axis-oriented GaN on ϵ -Ga₂O₃ compared with randomly oriented growth on SiO₂. (b) Cross-sectional TEM image revealing the GaN/ ϵ -Ga₂O₃/SiO_x heterostructure. (c) Atomic-resolution STEM-iDPC image and corresponding FFT confirming N-polar GaN formation on the ϵ -Ga₂O₃ template.

Discipline: Biology and Biomedical science or Physics and Materials Science.

Overcoming Data Loss in Ptychography via Spatial Frequency Modulation of the Illumination Probe

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Abstract

Ptychography is a type of Coherent Diffraction Imaging(CDI) technique that relies on computational algorithms to reconstruct images from diffraction patterns. It offers advantages such as being lens-less (aberration free) and enabling phase recovery, ultimately providing images with both amplitude and phase information. However, in certain experimental configurations, portions of the detector may be obstructed, typically resulting in significant reconstruction artifacts. In this research, we demonstrate that by modulating the spatial frequency of the probe function, we can overcome these geometric constraints and effectively interpolate the missing spatial frequency data.

Keywords: Ptychography, Phase Retrieval, ePIE, Fourier Space interpolation.

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Direct Laser-triggered Combustion Synthesis of Cobalt Silicide via Co-Si Reactive Multilayers

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Reactive multilayers (RMLs) consist of alternating layers of reactive materials, in which the constituent reagents can react with each other and release exothermic energy. Chemical energy is stored in the periodically stacked reactants and can be triggered by applying external energy to localized regions of the multilayer. The reaction temperature can generally reach 1500 K, while the heating and cooling rates may attain 10^6 and 10^3 K/s, respectively [1]. Self-propagating reactions have also been widely employed as a synthesis technique for the fabrication of large-area, single-phase intermetallic compounds because of their high reaction temperature and rapid reaction rate.

The Co–Si system is generally considered difficult to sustain self-propagating reactions because of its low adiabatic temperature. Therefore, additional activation beyond the initial ignition is usually required in the powder combustion synthesis of cobalt silicides [2]. However, we demonstrate that direct combustion of the Co–Si system can be achieved using reactive multilayers. In this study, direct ignition of Co–Si RMLs was carried out, and the reaction mechanism was further investigated through combustion velocity measurements and phase analysis of post-reaction products by controlling the Co/Si bilayer thickness.

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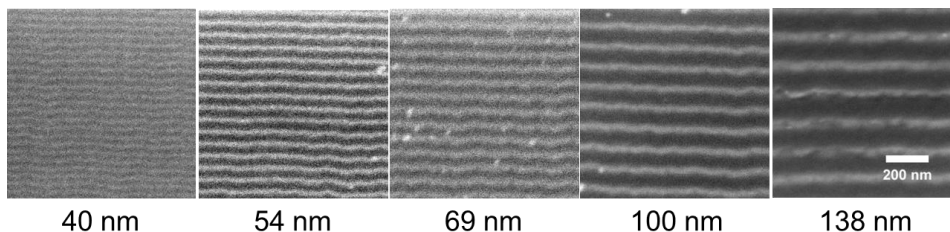
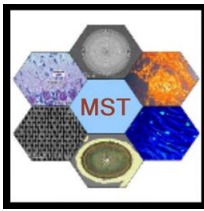
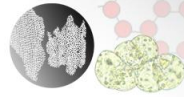


Figure 1. SEM cross-sectional views of as-deposited Co-Si multilayers with different bilayer thicknesses.

Discipline: Biology and Biomedical science or ✓Physics and Materials Science.



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Implementation and Application of the RESIRE Algorithm for STEM Tomographic Reconstruction

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This study focuses on reconstructing the three-dimensional structure of a sample using Scanning Transmission Electron Microscopy Tomography (STEM Tomography). By acquiring 2D projection images at various tilt angles and applying numerical algorithms, the internal structure of the sample is recovered through 3D reconstruction.

The workflow begins with automatic alignment of projection images to correct for sample drift or mechanical errors, followed by the generation of rotation matrices to model the imaging geometry and construct the forward projection matrix A . The reconstruction problem is formulated as minimizing $\|Ax - b\|^2$, where x is the 3D structure and b is the projection data. A gradient descent algorithm with non-negativity constraints is used to iteratively solve for x , with the R-factor computed during reconstruction to monitor convergence.

The final reconstruction is visualized using orthogonal slices and 3D renderings, providing a basis for further structural analysis.

Discipline: Physics and Materials Science.

Depth-Resolved Imaging of Thick Specimens via Multislice Iterative Phase Retrieval Algorithms in 4D-STEM

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Abstract

Traditional ptychography typically relies on the thin-object approximation, which becomes inadequate for thicker specimens due to multiple scattering effects. To address this, multislice ptychography models the sample as a sequence of axial slices, enabling the retrieval of depth-dependent structural information and defect distributions.

This study implements and evaluates multislice iterative phase retrieval algorithms, specifically the 3D extended Ptychographic Iterative Engine and the 3D regularized Ptychographic Iterative Engine, for the reconstruction of thick samples in 4D-STEM. The reconstruction process involves a random selection of scan positions, followed by an iterative cycle of forward propagation through multiple object slices and probe modes, back-propagation, and object-probe updates. Simulation datasets for WS₂ and Au atomic models with varying thicknesses and defect configurations were generated using Dr. Probe software to assess the performance of the algorithms under different conditions.

Keywords: Multislice Ptychography, 4D-STEM, Phase Retrieval, 3ePIE, 3D Reconstruction.

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MOF-Derived Multi-elemental Single Atom Sites for Electrochemical Carbon Dioxide Reduction

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The continuous increase in carbon dioxide (CO₂) emissions has raised significant concerns regarding environmental sustainability and climate change. The electrochemical carbon dioxide reduction reaction (CO₂RR) has emerged as a promising approach for converting CO₂ into value-added chemicals under mild conditions, offering potential pathways toward sustainable energy development. In this study, nitrogen-doped porous carbon materials derived from metal–organic frameworks (MOFs) were employed as supports to synthesize a series of single-atom catalysts (SACs) with different metal combinations, and their electrocatalytic CO₂RR performance was systematically evaluated.

These SACs are stabilized by nitrogen and carbon-based frameworks, and the presence of single atoms was observed via scanning transmission electron microscopy (STEM). CO₂RR results indicate that the trimetallic single-atom system (CuNiFe_SA) exhibits higher current density and product conversion efficiency, suggesting that the interaction between multiple metal single atoms may enhance CO₂ reduction by modulating the electronic structure and local reaction microenvironment.

Overall, this work highlights the effectiveness of multi-metal single-atom catalyst design for CO₂RR and provides valuable insights into the development of high-performance catalysts for efficient CO₂ reduction.

Discipline: ____Biology and Biomedical science or ☒ Physics and Materials Science.

Cross-Domain Robustness of Deep Residual Networks for Optical Aberration Classification

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Abstract

This study presents an automated optical aberration identification framework based on a Deep Residual Network (ResNet-18). By simulating the Point Spread Functions (PSF) of three typical aberrations—Defocus, Astigmatism, and Coma—we generated a synthetic dataset using FashionMNIST for model training. To evaluate the generalization capability, zero-shot domain transfer tests were conducted on MNIST and CIFAR-10 datasets. Experimental results demonstrate that the model achieves over 99% accuracy on the source domain and maintains a robust 94.7% accuracy on the MNIST dataset. Our findings suggest that neural networks trained on physically-informed synthetic data can effectively extract underlying physical features of optical distortions, showing significant potential for industrial inspection and adaptive optics systems.

Keywords: Point Spread Function (PSF), Wavefront Aberration Analysis, Residual Neural Networks (ResNet), Image Classification

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Liquid Metal Printed 2D In–Ga Oxide Optoelectronic Synapses: From Stoichiometric Engineering to Bio-inspired Retinal Neuron Emulation

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Optoelectronic synapses offer a compelling route to transcend von Neumann limitations; however, oxide-based optoelectronic materials remain constrained by trade-offs between quality, scalability, and cost.

We report a vacuum-free, low-temperature (250 °C) liquid metal printing strategy to synthesize large-scale 2D In–Ga oxide with tunable compositions. This approach transforms oxygen vacancies from detrimental flaws into active parameters that govern photocarrier dynamics. By modulating the In/Ga ratio, Gallium serves as a "biological tuning knob," effectively suppressing excess carriers while enabling precise control over synaptic weight evolution.

The optimized In_{0.84}Ga_{0.16}O optoelectronic synapse exhibits a programmable transition from short-term to long-term plasticity, achieving a high PPF index of ~186%, indicative of an optimized balance between carrier trapping and recombination. A distinct compositional synergy is observed, where pure In₂O₃ enhances memory retention, while Ga incorporation accelerates relaxation dynamics. Furthermore, the demonstrated “learning–forgetting–relearning” behavior reveals that fewer optical stimuli are required for memory recovery, highlighting experience-dependent plasticity. The device also enables optoelectronic cooperative modulation through the integration of light-pulse potentiation and adaptive electrical-pulse depression, achieving precise conductance control and stable weight updates over repeated cycling. By integrating these devices into an array architecture, simultaneous sensing and memory functions are successfully realized within a single platform.

Discipline: ____Biology and Biomedical science or____Physics and Materials Science.



The application of Hybrid input-output algorithm with support conditions

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The Hybrid Input-Output (HIO) algorithm is a widely used method for phase retrieval, particularly in coherent diffraction imaging (CDI). By enhancing reconstruction quality and stability, it has become a key technique in modern computational imaging and inverse problem solving.

Introduction

After the sample data (Figure 1.) is analyzed and restored by HIO , the original pattern of the sample in the real space can be obtained (Figure 2.).

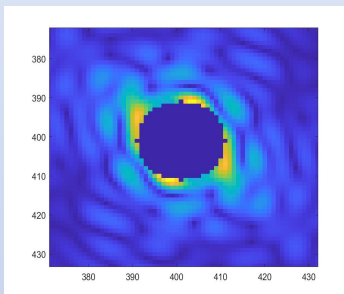


Figure 1.
Coherent X-rays illuminate the sample, and the resulting oversampled diffraction pattern is captured by the detector. A 2D projection of the sample is then reconstructed using Fourier transforms.

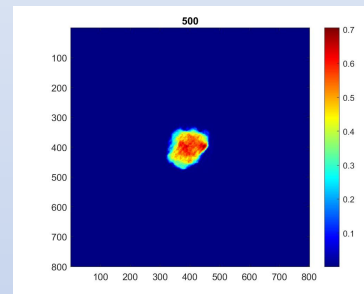
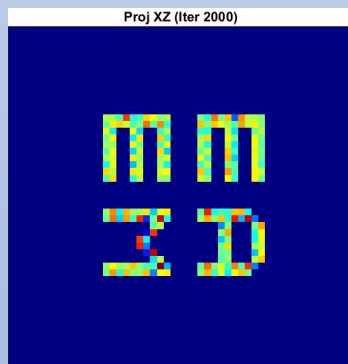


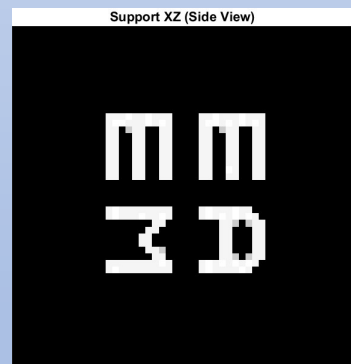
Figure 2.
Solve the data (Figure 1) by using the HIO method.

Experiment and result discussion

The aforementioned shrink-wrap technique can be further extended to the impact analysis of 3D resire. As demonstrated by the xz-projection in Figure 3, the internal gaps within the visualized pattern are completely eliminated through this shrink-wrap approach, and the edges are resolved with greater sharpness.



Figures 3.
This is a 3D optotype chart fabricated using Resire, with the resulting image processed the shrink-wrap technique.



Figures 4.
The support section of the Figure 3 image.

Future Perspectives

However, the shrink-wrap algorithm requires a sufficiently accurate reconstruction to generate a reliable support; otherwise, it may fail. Future work should focus on making the algorithm dynamically adaptive to reconstruction progress to prevent support collapse.

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Correlative SEM and AFM Approach for Quantitative 3D Surface Reconstruction

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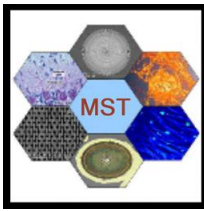
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Scanning Electron Microscopy (SEM) is widely utilized for material surface analysis due to its high resolution and large depth of field. However, conventional SEM images primarily provide two-dimensional surface topographical contrast, making it challenging to directly obtain quantitative 3D depth and volumetric structural information. While traditional methods involving stereo-pairs from tilted samples have been explored, their computational workflows remain complex. This study proposes an innovative machine learning (ML)-based strategy that utilizes SEM images captured at three distinct tilt angles to achieve rapid and precise 3D structural reconstruction [1].

In this collaborative research, we focus on the construction and experimental validation of high-quality datasets. Copper-filled Through-Silicon Vias (Cu TSVs) are employed as the test samples, as their surface microscopic morphology is critical for evaluating semiconductor packaging reliability. Specific tilt-angle SEM images are captured as input features for the model, while Atomic Force Microscopy (AFM) is simultaneously used to scan the same regions to obtain ground truth data—real surface height parameters with nanometric precision—for model training and validation [2]. The current experimental focus lies in the optimization of AFM tip selection and resolution matching. To mitigate the impact of the tip convolution effect on lateral resolution, we have tested AFM tips with various radii and aspect ratios to ensure that the spatial features acquired by AFM align closely with the SEM image resolution. This alignment aims to enhance the predictive accuracy and physical consistency of the machine learning model in 3D structural reconstruction [3].

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Development of an Automated Classification Framework for SEM Image Effects Using CD/PSD Metrology Data

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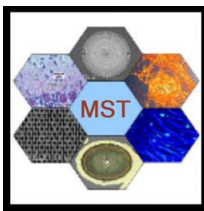
Abstract

As semiconductor manufacturing continues to shrink toward advanced nodes, the metrology accuracy of Critical Dimension Scanning Electron Microscopy (CD-SEM) faces significant challenges from charging effects and instrument parameter fluctuations. This study proposes an automated analysis and classification framework that utilizes edge detection data to diagnose image artifacts. By integrating SMILE software with specialized data processing scripts, the framework is designed to systematically extract key geometric features, Power Spectral Density (PSD), and Critical Dimension (CD) parameters. These parameters aim to establish a mapping between specific data signatures and their corresponding physical effects, such as charging, astigmatism, or scan noise. Current research efforts are focused on constructing a standardized analytical workflow and performing preliminary testing and logic design for feature parameter selection. This framework demonstrates potential for future applications in automated SEM troubleshooting and metrology parameter optimization, ultimately enhancing the efficiency of process monitoring.

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Discipline: Physics and Materials Science.



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Gradient Descent-Based Atomic Coordinate Refinement of Atom Probe Tomography Guided by Electron Tomography

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While atom probe tomography (APT) offers near-atomic-scale three-dimensional elemental analysis, its reconstruction results are susceptible to field evaporation and local magnification effects, leading to spatial distortion of atomic coordinates. On the other hand, electron tomography (ET) provides overall three-dimensional structural information of materials, but its resolution is insufficient to directly resolve the positions of individual atoms. This study proposes an ET–APT fusion atomic coordinate correction method based on gradient descent. It utilizes voxel-based three-dimensional density data reconstructed by ET as structural constraints to optimize APT atomic coordinates.

This method converts the ET reconstructed image into a continuous density potential field and uses its spatial gradient to guide atomic movement, while incorporating interatomic repulsion terms to avoid non-physical overlap. Furthermore, by analyzing the correspondence between elemental atomic order and ET intensity, the method further improves the atomic position correction capability in multi-element systems. Results show that this method effectively enhances the consistency between APT atomic coordinates and three-dimensional structures and provides a framework for atomic-scale structural correction combining ET and APT.

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Discipline: ____Biology and Biomedical science or____Physics and Materials Science.

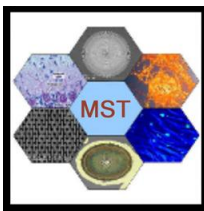
Synergistic Plasmonic and Amorphous-Layer Effects in aTiO₂/Ag/TiO₂ Multilayer Composites: Charge Transfer Pathways and Visible-Light Degradation Performance

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The present study synthesized aTiO₂/Ag/TiO₂ composite materials by coating hollow titanium dioxide (TiO₂) nanospheres, loaded with silver nanoparticles, with amorphous titanium dioxide (aTiO₂) layers of varying thickness. Transmission electron microscopy (TEM) and scanning transmission electron microscopy/energy-dispersive spectroscopy (STEM/EDS) tomography characterized the distribution of silver nanoparticles and the morphology of the amorphous layers. Ag particles were primarily located on the surface of the hollow spheres, with some dispersed within the shell. The amorphous layers displayed three morphologies: discontinuous islands, continuous films less than 5 nm thick, and continuous films greater than 10 nm thick. Optical measurements indicated that composites with amorphous layers thinner than 5 nm (0.3aTiO₂/Ag/TiO₂) showed the strongest visible light absorption and the lowest electron-hole recombination rate. This optimized structure enabled efficient charge separation, resulting in 96% degradation of methyl orange and 99% degradation of rhodamine B within 60 minutes under visible light. Superoxide radicals ($\cdot\text{O}_2^-$) and hydroxyl radicals ($\cdot\text{OH}$) were identified as the main active species. The superior photocatalytic performance is attributed to a metal-mediated heterostructure that couples amorphous, metallic, and crystalline TiO₂ phases. The synergy between Ag-induced plasmonic effects and the defect-rich amorphous layer facilitates efficient charge transfer across interfaces. Additionally, the amorphous coating enhances structural stability and recyclability, underscoring the significant potential of amorphous-crystalline heterostructures for sustainable environmental photocatalysis.



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Tailoring Ag Nanoparticle Position within TiO₂ Hollow Nanospheres: Interfacial Engineering toward Z-Scheme Photocatalysis

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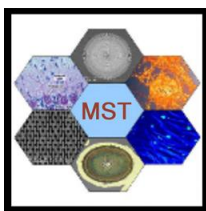
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This study examines how the distribution of Ag nanoparticles affects the photocatalytic mechanism of Ag/TiO₂ hollow-sphere composites. By adjusting the deposition sequence and annealing conditions, we produced two Ag configurations: nanoparticles on the outer surface and nanoparticles embedded within the shell layer. STEM and EELS analysis confirmed the successful fabrication of both structures. XAS and XPS analyses showed that the embedded configuration has stronger interfacial interaction, greater Ag oxidation, and a notable increase in Ti³⁺ content. Photocatalytic tests demonstrated that composites with embedded Ag nanoparticles deliver superior activity and improved cycling stability, supporting robust long-term performance. In situ XANES analysis identified Ti as an electron donor, while both metallic Ag and silver oxide act as electron acceptors. Band-structure analysis using UPS and LEIPS revealed distinct electron-orbital interactions at the heterojunction interface in each nanostructure. As a consequence, we supposed that the embedded Ag-TiO₂ system operates via a Z-scheme charge-transfer mechanism, which maintains the strong oxidation ability of TiO₂ and the strong reduction ability of Ag₂O, thereby significantly enhancing photocatalytic degradation.

Discipline: ____Biology and Biomedical science or____Physics and Materials Science.



Study of Clustering and Precipitation Behavior in a Mg-Zn-Ca Alloy by Atom Probe Tomography

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The properties and performance of Mg-Zn-Ca alloys are strongly affected by the nanoscale clusters and precipitates formed during heat treatments. To thoroughly understand the clustering behavior of Zn and Ca, and the precipitation evolution, atom probe tomography (APT), and related analyses were applied to a Mg-2.15Zn-0.97Ca (wt%) (ZX21) alloy during the aging treatment at 175°C. During the aging treatment at early stages, from the nearest neighbor distributions, the clustering Zn is prior to Ca, followed by the diffusion of Ca into the Zn clusters to form Zn-Ca co-clusters. The significant increase in alloy hardness at the early stage of aging treatments corresponds to the formation of high-density Zn-Ca co-clusters. As aging time extends to 25 hours, peak alloy hardness is achieved, corresponding to the evolution from Zn-Ca co-clusters to the Guinier-Preston (G.P.) zones, the strongest precipitates in the Mg-Zn-Ca alloy system. Correlative electron backscatter diffraction (EBSD), transmission electron microscope (TEM), and APT analysis (Fig. 1) corroborate the presence of the G.P. zones. Prolonged aging after the peak-aged state results in the transformation of the G.P. zones into thermodynamically stable Ca-Mg-Zn precipitates and the decline in precipitate number density, contributing to a decrease in alloy hardness.

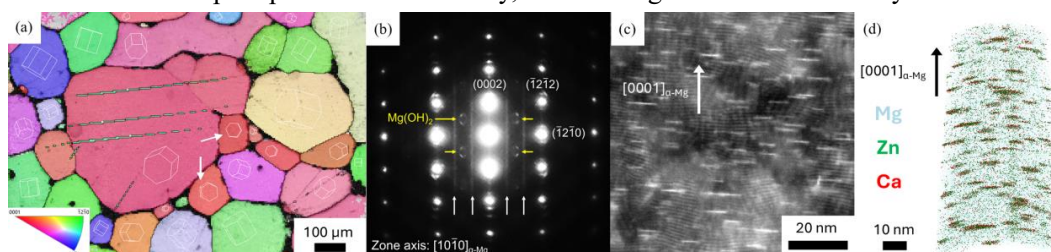


Fig. 1. Correlative EBSD, TEM, and APT analyses of the ZX21-T6, peak-aged sample: (a) EBSD inverse pole figure (IPF-Z) orientation map; white arrows indicate the targeted grains for TEM/APT liftout; (b) selected area electron diffraction (SAED) pattern; (c) annular dark-field (ADF) scanning transmission electron microscope (STEM) image; and (d) APT reconstruction (slice thickness = 15 nm) of the liftout samples.

Investigation of Electron-Matter Interaction Effects on SEM CD Metrology Using CASINO Monte Carlo Simulations

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Abstract

We utilize the CASINO Monte Carlo physical model to simulate electron beam interactions with solid matter, specifically analyzing the imaging characteristics of Cu interconnect lines on Silicon substrates. By systematically adjusting key parameters (beam size, spacing) we observed the variations in Backscattered Electron (BSE) signal distributions. Furthermore, we incorporated line-scan detection techniques through MATLAB to quantitatively analyze the edge enhancement effects and Critical Dimension (CD) deviations within the simulated images.

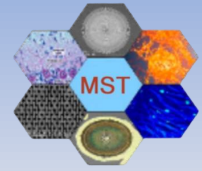
Keywords: SEM image 、 Backscattered Electrons (BSE) Signal 、 CD Metrology 、 Monte Carlo Simulation

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Structural and Electrical Evolution of TZO-Based RRAM Devices Induced by Post-Deposition Annealing



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Abstract

Resistive random access memory (RRAM) is promising for 3D stacking architectures due to its low power, high speed, and scalability. Particularly, TZO-based RRAM offers low cost, high breakdown fields, and excellent thermal stability. In this work, Ti/ZnO-based RRAM devices were fabricated on Si substrates. Initial measurements showed good endurance (200 cycles) and a high on/off ratio (10^1 - 10^2), but suffered from current fluctuations and unstable set/reset voltages. To enhance switching stability, post-deposition annealing was applied. Structural, phase, and elemental distributions (Zn, O, Ti) were characterized using HRTEM, STEM, EDS, and XPS. This study establishes a clear correlation between post-annealing structural evolution and electrical performance, providing critical insights into optimizing TZO-based RRAM for future high-density memory and neuromorphic applications.

Device and Initial Recognition

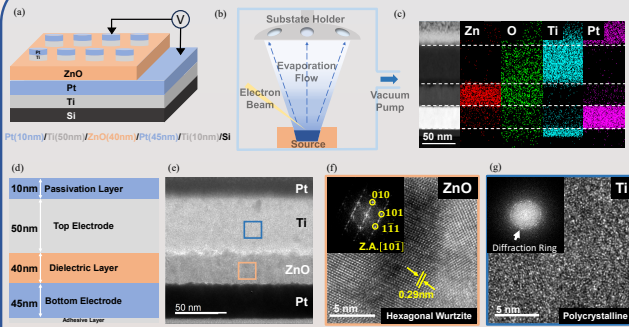


Figure 1. Identification of the initial Ti/ZnO RRAM.

(a) Schematic diagram of the Pt/Ti/ZnO/Pt/Ti/Si RRAM device. (b) The E-beam evaporation process. (c) TEM image of the device and EDS mapping of Zn, O, Ti, Pt. (d) The role of each layer and (e) the cross-section TEM image. (f) Enlarged TEM image and FFT-DP of the dielectric layer ZnO. (g) the top electrode Ti.

Electrical Measurements

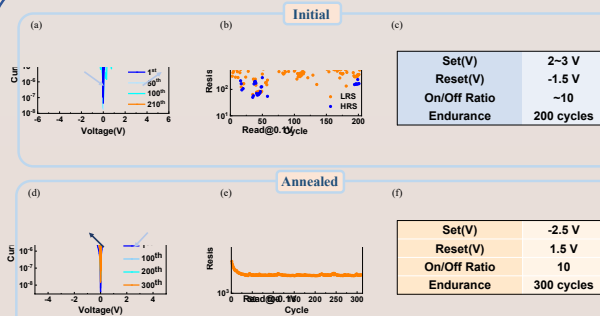


Figure 2. Evolution of Resistive Switching Stability through Annealing Treatment

(a) I-V curves and (b) Endurance characteristic of the initial TZO RRAM device for 200 cycles. (c) Statistics of the initial TZO RRAM device. (d) I-V curves and (e) Endurance characteristic of the TZO RRAM device after 400°C 10 mins annealing. (f) Statistics of the annealed TZO RRAM device.

Acknowledgement

Acknowledgements: The authors sincerely thank the National Science and Technology Council (NSTC) of Taiwan for the support under Grant No. 114-2223-E-A49-001.

Oxygen Vacancy Identified via XPS

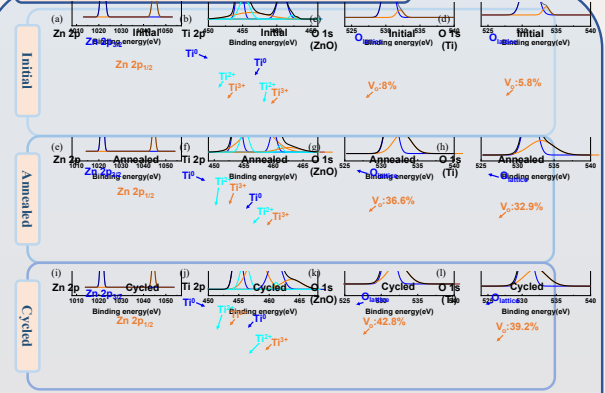


Figure 3. XPS Analysis of Ti/ZnO RRAM.

(a)-(d) Initial state: Minimal oxygen vacancies (V_o). (e)-(h) Annealed: Significant growth of Ti^{3+} and V_o . (i)-(l) Annealed and Cycled: Maximum V_o density achieved after switching.

Device After Annealing

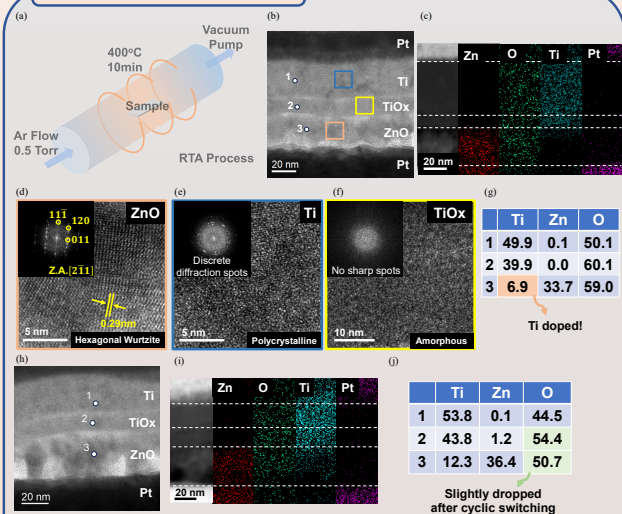
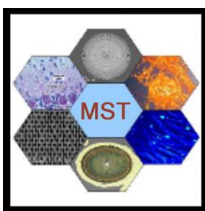


Figure 4. Identification of the annealed and cycled Ti/ZnO RRAM.

(a) RTA process with 400°C, 10mins. (b) TEM and (c) STEM image and EDS mapping of the annealed device. (d-f) TEM image and FFT-DP of the ZnO, Ti, and TiOx layers. (g) EDS point of the annealed device. (h) TEM, (i) STEM image, EDS mapping, and (j) EDS point of the cycled device.

Summary

We fabricated and characterized Ti/ZnO-based RRAM devices, focusing on the impact of post-deposition annealing. Annealing significantly suppresses current fluctuations and stabilizes switching voltages (V_{set} and V_{reset}). HRTEM and STEM analyses reveal that thermal treatment facilitates phase transformation and improves crystallinity. Furthermore, XPS and EDS results indicate that oxygen vacancy redistribution and interfacial reactions at the Ti/ZnO junction are critical for stable conducting filaments. This study demonstrates a direct correlation between microstructure and resistive switching performance, providing a robust strategy to optimize TZO-based RRAM for high-density 3D memory and energy-efficient neuromorphic systems.



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Investigation of Titanium Self-Intercalation in Titanium Diselenide Devices via In Situ Transmission Electron Microscopy

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Two-dimensional (2D) transition metal dichalcogenides (TMDs) have attracted extensive interest in recent years because of their promising applications in electronic, optoelectronic, and catalytic devices. Among Group IV TMDs, titanium diselenide (TiSe_2) is particularly intriguing due to its unique physical phenomena, such as charge-density-wave (CDW) ordering and unconventional superconductivity. In this work, we employed *in-situ* transmission electron microscopy (TEM) biasing experiments to examine the cross-sectional electrical behavior of 1T- TiSe_2 devices. Temperature-dependent *ex-situ* current–voltage measurements were also performed, while atomic-resolution STEM characterization identified Ti-rich regions on the surfaces of multilayer 1T- TiSe_2 flakes. Pronounced current variations were observed during bias-driven phase transitions. Furthermore, electron energy-loss spectroscopy (EELS) revealed substantial changes in the valence states of both Ti and Se. These findings provide insight into the phase transformation mechanism, deepen the understanding of the structural and electrical characteristics of Group IV TMDs, and demonstrate the potential of 1T- TiSe_2 for future TMD-based electronic devices.

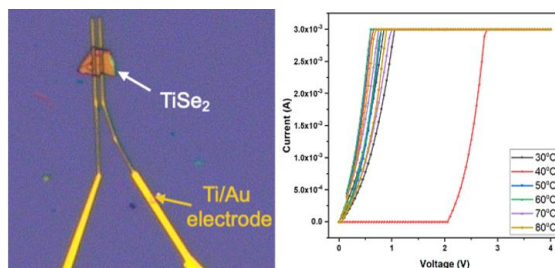


Figure 1. Optical image and temperature-dependent I–V curves of the electroforming process in CDW-based 1T- TiSe_2 devices.

Discipline: ____Biology and Biomedical science or ____Physics and Materials Science.



In-situ TEM Observation of Filament Formation in Copper Oxide Nanowire for Resistive Switching Behavior

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In-situ transmission electron microscopy (TEM) enables real-time visualization of structural and compositional changes, providing invaluable insight for the development of advanced functional materials. Among emerging non-volatile memory technologies, resistive random-access memory (RRAM) has garnered significant attention due to its simple metal–insulator–metal (MIM) architecture, faster switching speeds, lower power consumption, and superior retention characteristics compared to conventional flash memory.[1]

Integrating one-dimensional (1D) nanowires (NWs) into RRAM architecture offers additional advantages, including further miniaturization, enhanced access density, and reduced operating power. In particular, p-type CuO nanowires exhibit axially aligned grain boundaries that serve as efficient ion diffusion pathways under applied bias. [2] Within Ag/CuO NWs/Au structures, the application of an external electric field induces electrochemical metallization (ECM), wherein Ag^+ ions migrate through the CuO matrix and are subsequently reduced, resulting in the nucleation of metallic clusters or filaments.

This study employs in-situ TEM combined with electrical biasing to elucidate key switching phenomena, such as atomic migration, filament formation/rupture, and phase transformations, as shown in **Figure 1**. These direct observations provide mechanistic understanding of the resistive switching behavior in CuO-based RRAM, offering design principles for optimizing next-generation high-performance memory devices

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Discipline: ____Biology and Biomedical science or____Physics and Materials Science.

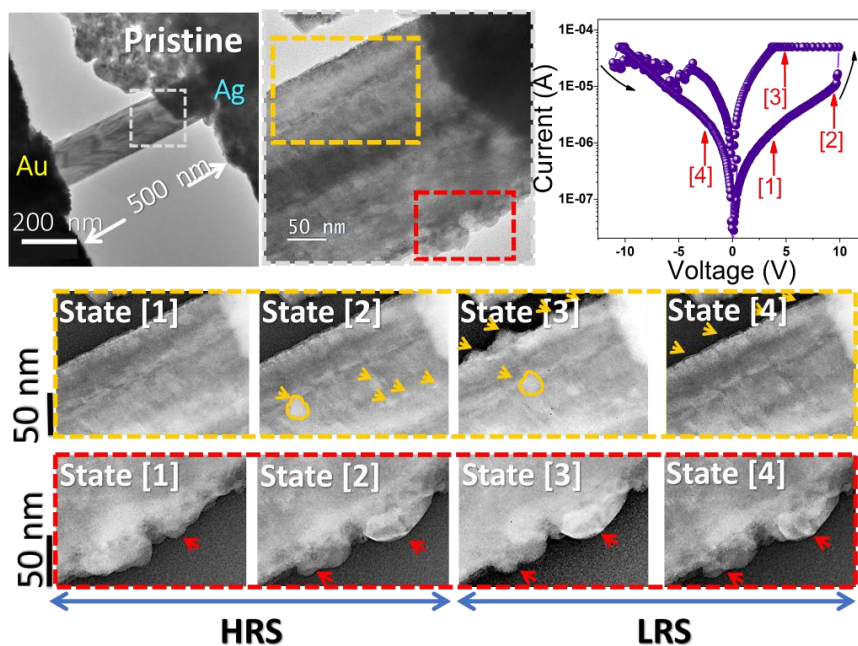


Figure 1. In-situ TEM observation and the corresponding IV curve for the investigation of the dynamic changes of CuO NW under biasing.

Composing an Abstract of the Poster Presentation for the Annual Meeting of the Microscopy Society of Taiwan

Jing-Nan Liu (劉靖南)¹, Chien-chung Chen(陳建群)²,

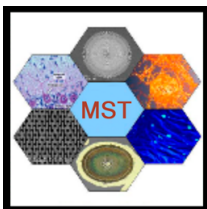
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This document gives the alignment methodology of STEM(scanning tomography electronic microscopy) to higher the 3d reconstruction quality. And how to cleaning the artifacts around the reconstruction. Moreover, we project the reconstruction into the 2d image to re-align the input data, the projection input to reconstruct 3d (not raw dataset). The accuracy value defined is based on the Fourier Slice Theorem. With this definition, we can easily find the precision of the series projection.

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Cu-Induced Electrocatalytic Modification of NiCo Layered Double Hydroxide on Carbon Cloth for Hydrogen Evolution

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Cu-modified NiCo layered double hydroxide (LDH) electrodes were fabricated on carbon cloth through a simple electrochemical deposition process for alkaline hydrogen evolution reaction (HER). The influence of Cu incorporation was examined to regulate the electrode morphology and catalytic response. Scanning electron microscopy showed that NiCo LDH formed nanosheet-like structures on carbon cloth, while Cu modification altered the surface texture and increased exposed active regions. Electrochemical measurements indicated improved HER activity for selected Cu-modified NiCo LDH electrodes compared with pristine NiCo LDH/carbon cloth, suggesting enhanced interfacial charge transfer and accessible reaction sites. This work provides a straightforward strategy to tune transition-metal LDH electrodes and correlates microscopic morphology with electrocatalytic performance.

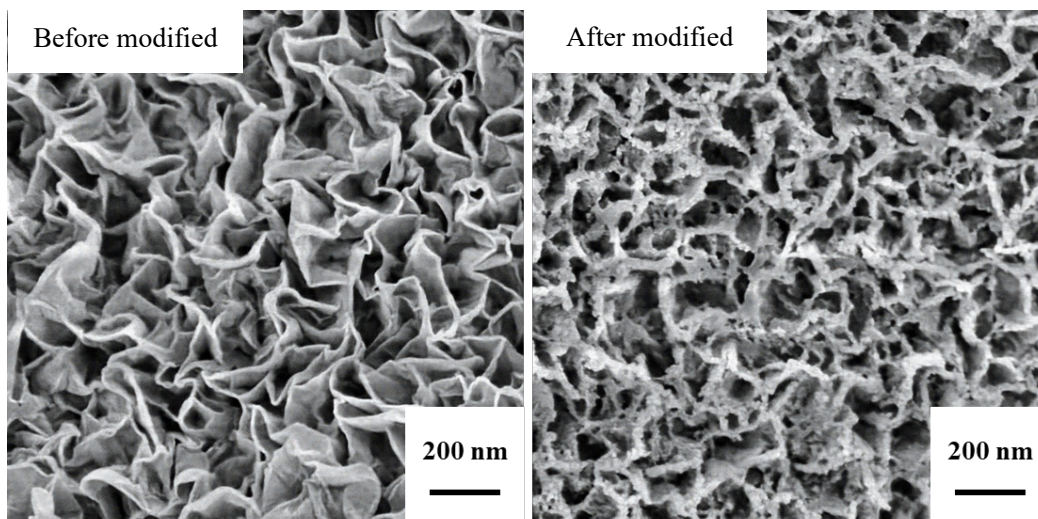
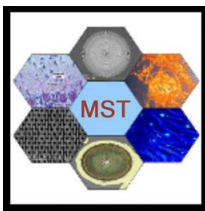


Figure 1. SEM image of Cu-modified NiCo LDH grown on carbon cloth.

Discipline: __Biology and Biomedical science or__Physics and Materials Science.



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ZnIn₂S₄/poly(heptazine imide) (ZIS/PHI) Heterostructure Coupled with Co/N-Doped Carbon for Enhanced Photocatalytic Hydrogen Evolution

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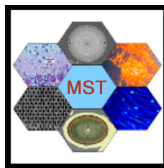
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With the rapid growth of global energy demand, the development of clean and sustainable energy conversion technologies has become increasingly important. Hydrogen energy has received considerable attention owing to its clean nature and high energy density during utilization. Among various hydrogen production strategies, solar-driven photocatalytic hydrogen evolution offers an attractive route toward green hydrogen production by directly converting solar energy into chemical energy.

In this study, ZnIn₂S₄ (ZIS) was employed as the main visible-light-responsive photocatalyst, and its hydrogen evolution performance was enhanced through the synergistic introduction of poly(heptazine imide) (PHI) and MOF-derived cobalt nanoparticle-embedded nitrogen-doped carbon (Co/NC). PHI was coupled with ZIS to construct a heterostructure for suppressing charge recombination. The resulting hydrogen evolution rate of 20 wt% PHI / ZIS reached 0.62 mmol g⁻¹ h⁻¹, which is approximately 2.5 times higher than that of pristine ZIS. In addition, Co/NC serves as a conductive cocatalyst to facilitate electron transport and accelerate surface hydrogen evolution kinetics. This dual-modification strategy demonstrates a feasible approach for improving the photocatalytic hydrogen evolution of ZIS.

Discipline: ____Biology and Biomedical science or ☒ Physics and Materials Science.



Cryo-EM Structure Reveals PSGL-1 Binding at the Five-Fold Axis of EV71

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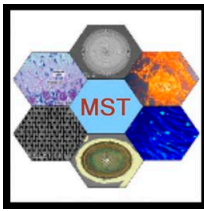
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Enterovirus 71 (EV71) is a major agent of hand-foot-and-mouth disease, can cause severe central nervous system damage and even death in children below 6 years old. In Taiwan, EV71 vaccine protects against infections and severe diseases caused by EV71 only; it does not provide cross-protection against other types of enteroviruses. We previously published that the EV71 particles produced by Human rhabdomyosarcoma cells, called EV-R have triple-point mutations at residues E145G, V146I, and S241L of VP1 relative to the EV-V (EV71 particles produced by African green monkey kidney cells) in consensus sequence analysis [1]. Therefore, we established that EV-R has a higher binding activity with its receptor, P-selectin glycoprotein ligand-1 (PSGL-1) than EV-V. In this study, EV-R was called EV-VP1_{E145G, V146I, and S241L}. We considered that the triple-point-mutation could affect the binding activity of EV71 and PSGL-1. We would like to reveal the cryo-EM structure of EV-VP1_{E145G, V146I, and S241L} in complex with PSGL-1 and examine the critical binding epitopes. Cryo-EM structure showed that N-terminal of PSGL-1 was bound to the 5-fold axis of EV71. In addition, HADDOCK structure prediction revealed that positively charged Lys244 of VP1 and negatively charged Glu47 of PSGL-1 N-terminal were the critical binding residues. Thus, we speculated that a salt bridge was implicated in the interaction between EV71 and PSGL-1. Further site-directed mutagenesis experiments could be performed to validate our findings. Overall, this study could reveal the critical binding sites of Enterovirus and receptors and provide a significant reference for future enterovirus vaccines and antiviral drugs.

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Discipline: ☒ Biology and Biomedical science or ☐ Physics and Materials Science.



台灣顯微鏡學會



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Structure Reconstruction from Simulated TEM Diffraction Patterns of 2D Materials

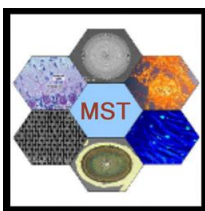
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In this study, we simulate transmission electron microscopy (TEM) diffraction patterns of monolayer 2D material using Dr. Probe. By scanning across the sample with a fine electron probe, a large set of diffraction patterns is generated. These simulated patterns are then processed and reconstructed using MATLAB to verify if the original atomic structure can be accurately recovered. A successful reconstruction confirms the feasibility of using computationally generated diffraction data for atomic-scale structure analysis. This approach offers a promising path toward more efficient and flexible structure determination using computational diffraction pattern reconstruction.

Discipline: Physics and Materials Science.



台灣顯微鏡學會

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Microstructural Design of Nb₂C/ZnIn₂S₄/WO₃ Schottky/S-scheme Heterostructure for Enhanced Photocatalytic Hydrogen Evolution Reaction

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Hydrogen energy is a clean and renewable energy with high energy density and large-scale energy storage. Photocatalytic hydrogen evolution reaction (PHER) utilizes solar energy to split water and produce hydrogen gas, which is a zero-carbon-emission way to produce hydrogen gas. However, low energy efficiency, carrier loss due to recombination and sluggish interfacial charge transfer limit the commercial viability of PHER.

In this work, a Nb₂C/ZnIn₂S₄/WO₃ 2D/2D/1D heterostructure was strategically designed to address the sluggish charge kinetics in PHER. A synergistic charge separation mechanism where an S-scheme heterojunction (ZnIn₂S₄/WO₃) is coupled with Nb₂C is proposed. As a highly conductive MXene material, Nb₂C can form a Schottky barrier with ZnIn₂S₄ to suppress carrier recombination. Because of its higher work function value, Nb₂C can create a stronger internal electric field (IEF) and extract holes from ZnIn₂S₄ more efficiently than the commonly used Ti₃C₂ MXene. Benefiting from the synergistic effect of this S-scheme/Schottky heterojunction, the holes from ZnIn₂S₄ will either be recombined with electrons from WO₃ or be extracted by Nb₂C. Therefore, the electrons with strong reducing ability on ZnIn₂S₄ are preserved to perform PHER. Microscopic observations using SEM have confirmed the successful construction of the 2D/1D ZnIn₂S₄/WO₃ and 2D/2D ZnIn₂S₄/Nb₂C heterostructure. XPS also exhibited binding energy shifts between Zn 2p, W 4f, and Nb 3d orbitals, indicating a strong electronic interaction and S-scheme and Schottky contact at the binary interface respectively. Preliminary photocatalytic tests demonstrated that the binary heterostructure performed enhanced PHER activity, the hydrogen yield of ZnIn₂S₄/WO₃ and ZnIn₂S₄/Nb₂C increased by 7.87 times and 5.71 times respectively, compared to ZnIn₂S₄. Integrating these three materials is expected to exhibit more efficient charge separation by dual heterostructures and perform higher PHER activity.

Discipline: ____Biology and Biomedical science or____Physics and Materials Science.

Orientation Relationship Variety of a High Strength Selecting Laser Melting Manufactured High Entropy Alloy

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Fabrication of high-entropy alloys (HEAs) via selective laser melting (SLM) has attracted considerable attention owing to the unique microstructural features it induces, such as high dislocation density and distinctive phase stability, which are frequently accompanied by complex orientation relationships (ORs). TEM revealed that the main secondary phase L2₁ in SLM Al_{0.2}Co_{1.5}CrFeNi_{1.5}Ti_{0.3} exhibits two primary morphologies: a spherical form, consistent with the classical Kurdjumov–Sachs (KS) OR with the matrix, and a rod-like form, corresponding to a previously unreported OR. HRTEM indicated that the lattice parameter is respectively 5.72 Å and 5.79 Å. EDS further demonstrated compositional differences between the precipitates, with the rod-like L2 phase enriched in Fe and Cr relative to its spherical counterpart. These compositional variations account for the observed lattice parameter differences and ultimately the morphological distinctions.

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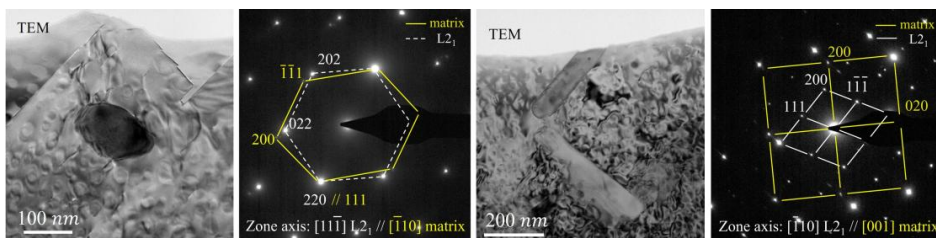
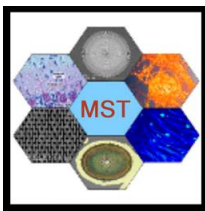


Figure 1. TEM image and diffraction pattern of the(Left) L2₁ phase exhibiting the Kurdjumov–Sachs (KS) OR and (Right) L2₁ the newly identified OR.

Discipline: Biology and Biomedical science or V Physics and Materials Science.



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Multiscale Simulations and Cryo-Electron Microscopy Reveal the Transition Pathway of Dengue Virus-like Particle Nanoassembly

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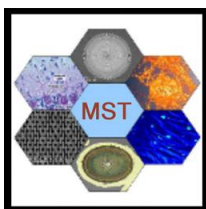
[#]These authors contributed equally to this work.

Dengue virus (DENV) continues to impose a global health burden, and virus-like particles (VLPs) are promising vaccine candidates, owing to their ability to elicit broadly neutralizing antibodies. However, the lack of nanoscale structural insights into the VLP maturation process has limited rational engineering. Here, we report the cryo-electron microscopy (cryo-EM) structure of immature DENV serotype 2 VLPs, revealing prM-E spikes arrayed on a $T = 1$ shell, consistent with mature DENV-2 VLPs and distinct from the virion, which exhibits a $T = 3$ icosahedral lattice. Using multiscale molecular dynamics (MD) simulations, we identified sterically feasible maturation pathways and dynamic lipid remodeling associated with protein rearrangement. We also established a stable CHO-K1 producer cell line for efficient immature DENV-2 VLP production. Together, these findings provide a structure-dynamics framework to guide future dengue VLP engineering and vaccine design.

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Discipline: ☒ Biology and Biomedical science or ☐ Physics and Materials Science.



Multilevel Storage and Linear Optoelectronic Response in Mixed-Dimensional Photomemory

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Abstract

The pursuit of energy-efficient and highly predictable optoelectronic devices is crucial for emerging computing paradigms, including artificial intelligence. This study underscores the profound significance of establishing a linear correlation between optical input and electrical output. Based on a mixed-dimensional photomemory $\text{CsPbBr}_3/\text{Al}_2\text{O}_3/\text{MoS}_2$, a precise control over charge transfer dynamics can be effectively achieved through dielectric thickness modulation. By optimizing the dielectric layer to specific dimensions, our approach enables an optimal charge transfer rate with minimal optical energy consumption, specifically at sub-picojoule levels. These findings highlight a robust strategy for designing high-performance optoelectronic systems with inherently low power consumption.

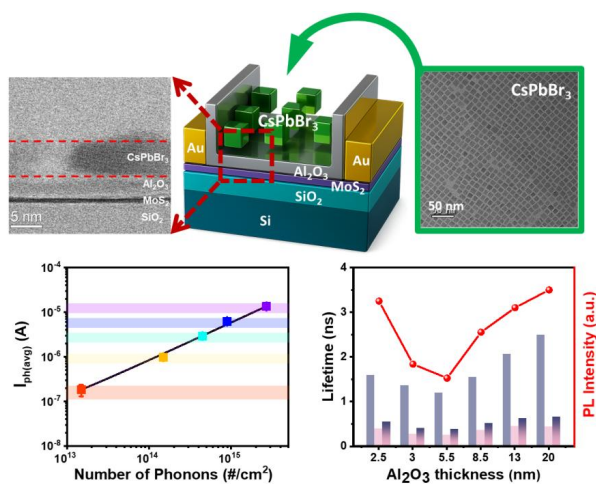
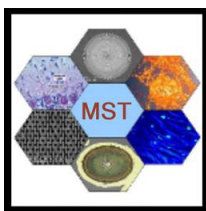


Figure 1. Schematic illustration of mixed-dimensional photomemory.

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Morphology-Engineered ZIF-67-Derived CoS@MXene Heterostructures as High Performance Electrodes

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CoS@Ti₃C₂Tx (CoS@MX), synthesized via a metal–organic framework precursor through a hydrothermal method, represents a promising electrode material for supercapacitors. In this study, ZIF-67 was grown in situ on MXene sheets, followed by a hydrothermal sulfidation process to convert ZIF-67 into CoS. The integration of MXene successfully mitigates the notorious restacking issue commonly observed in conventional active materials. Furthermore, it facilitates the heterogeneous nucleation of ZIF-67, resulting in a reduced particle size; both advantages are highly beneficial for enhancing electrochemical performance. Subsequently, the sulfidation of ZIF-67 was conducted in an autoclave, transforming the initial solid ZIF-67 into hollow CoS structures. This morphological modification significantly accelerates ion diffusion and exposes more active sites. Benefiting from this synergistic synthetic strategy, the optimized CoS@MX electrode delivers a high specific capacitance of 319.0 F/g at a scan rate of 10 mV/s, demonstrating its great potential as a high-performance electrode material.

References

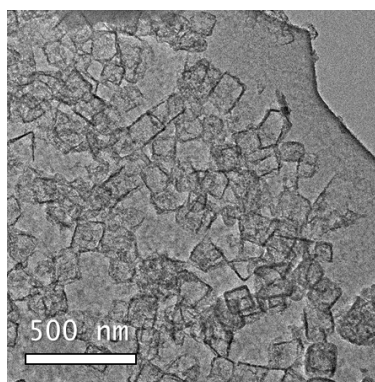


Figure 1. TEM image of the CoS@MX heterostructure.

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Atomic-Scale Investigation of Electromigration Behavior in Cu/SiO₂ Hybrid Bonding under High Current Environment

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Three-dimensional integrated circuit (3D IC) packaging offers significant advantages, such as enhanced computational efficiency through greater integration and shorter interconnection distances. The effective interconnection of layers, particularly through redistribution layer (RDL) technology, is crucial for the successful operation of 3D ICs. While copper remains the preferred material for interconnections, often in conjunction with through-silicon via (TSV) technology for chip-to-chip links, the shrinking dimensions of components present challenges. In particular, the reduction in size may lead to elevated current densities in individual joints, giving rise to issues like electromigration (EM) and potential failure. EM-induced atomic migration may lead to the formation of voids in the interconnection. The accumulation of voids to a critical point may result in an open circuit in the joints, significantly impacting the conductor's reliability. This work delves into the micro-scale aspects of these challenges, complementing previous macroscopic investigations. We aim to elucidate the behavioral mechanisms through atomic-scale observations, employing an *in-situ* high-resolution transmission electron microscope (*in-situ* HRTEM) to observe atomic-scale images of EM. The insights gained from this work not only contribute to the academic understanding of industry challenges but hold potential applications in real-world manufacturing processes.

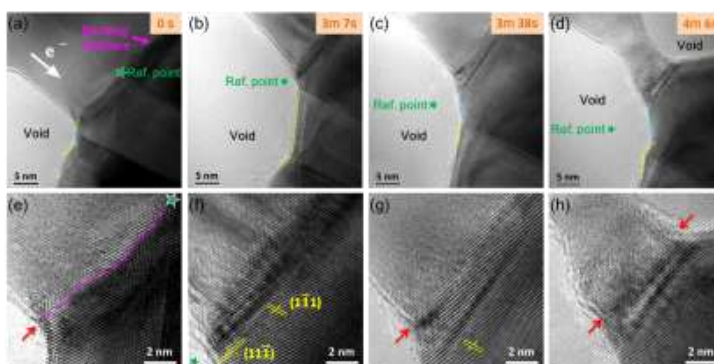
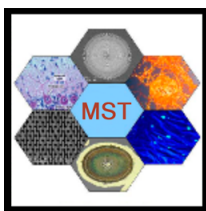


Figure 1. Expansion of the voids along the bonding interface.

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TEM/STEM Investigate Electromigration Behavior in Ruthenium Nanowires

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In recent years, device miniaturization has become a critical challenge in microelectronics. Three-dimensional integrated circuit (3D IC) technology offers a promising pathway to fulfill this demand. Beyond performance considerations, the reliability of 3D ICs is equally crucial, with electromigration (EM)-induced failure being one of the major concerns. Copper has been widely employed in 3D IC packaging due to its relatively high resistance to electromigration. To further enhance reliability at high current density, this study gives an insight that ruthenium (Ru) has the potential. In this work, SiO₂/Ru/SiO₂ thin film was deposited on a silicon substrate by physical vapor deposition (PVD), and the specimens were fabricated to be devices being like nanowires (NWs) by focused ion beam (FIB). The nanowires were applied to current density of 10⁷ A/cm² to induce atomic migration. Structural changes were explored by transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM). Ruthenium atoms were observed to diffuse with electron current, and the nanowires remained intact even after more than 40 hours of current stressing.

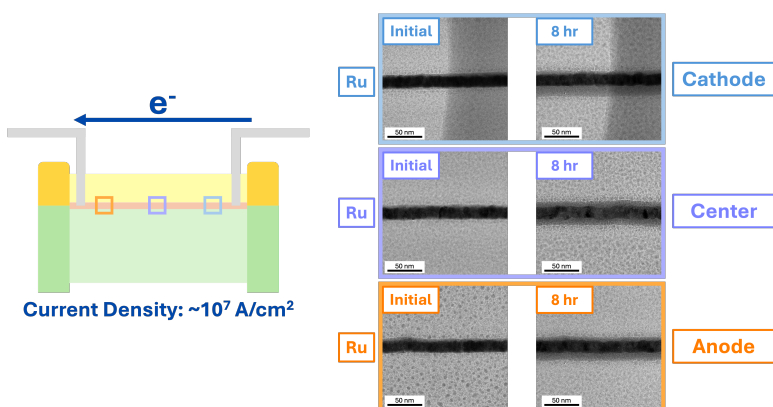
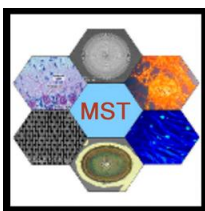


Figure 1. Schematic and TEM images of Ru NWs under current stress

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(hk1) Preferred Orientation and Charge Transport Optimization in Sb_2Se_3 Photocathodes via Vapor Transport Deposition

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Due to its suitable bandgap and excellent optical absorption coefficient, antimony selenide (Sb_2Se_3) is widely regarded as a highly promising photocathode material for photoelectrochemical (PEC) water splitting. However, the unique quasi-one-dimensional crystal structure of Sb_2Se_3 leads to significant carrier transport anisotropy; the parallel-to-substrate orientation commonly observed in conventional thin films often restricts the vertical collection efficiency of photogenerated electrons. To overcome the geometric transport limitations of this low-dimensional material, this study fabricated Sb_2Se_3 thin films with an (hk1) preferred orientation via the vapor transport deposition (VTD) process. Preliminary microstructural analysis indicates that this process effectively guides the 1D (Sb_4Se_6)_n ribbons away from the conventional parallel growth mode. This unique (hk1) preferred orientation is expected to improve charge transport along the [001] axis. Current findings demonstrate the feasibility of the VTD process in modulating the crystal orientation of anisotropic semiconductors, and further suggest that this (hk1)-oriented Sb_2Se_3 thin film holds significant developmental potential and research value for further enhancing photoelectrocatalytic hydrogen evolution performance.

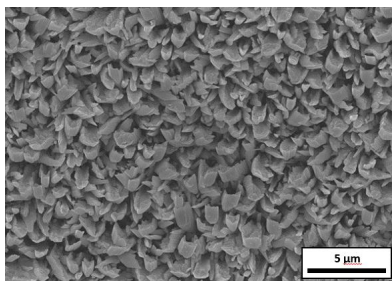
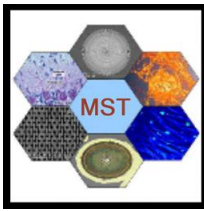


Figure 1. SEM image of Sb_2Se_3 thin film

Discipline: ____Biology and Biomedical science or ☒ Physics and Materials Science.



Unveiling Atomic Migration at Cu/SiO₂ Hybrid Bonding Interface Under Low-Temperature Annealing

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As device scaling has entered the nanometer range, size down-scaling faces physical limitations and sharply rising manufacturing costs. At this point, 3D IC has emerged as a critical pathway to extend Moore's Law. As bonding techniques mature, we must further study the bonding mechanism of Cu-to-Cu joints at the sub-micrometer scale.

In this work, we conduct experiments to analyze the bonding interface and structural defects of fine-pitch Cu joints under different annealing conditions. To achieve adequate bonding quality, we perform in-situ high-resolution transmission electron microscopy (HRTEM) thermal experiments. It provides real-time observation of diffusion behavior, lattice rearrangements, and grain growth. The results reveal that surface pretreatment plays a significant role in the bonding process, and we can improve device performance by eliminating the straightforward bonding interface. Based on the above, the initial interface morphology determines nano-scale defects transformation, such as void evolution and cross-interface grain growth. Therefore, *in-situ* thermal experiments can directly correlate microstructural changes with electrical performance. It enables more precise verification of device lifetime, thereby guiding the development of next-generation high-reliability packaging structures.

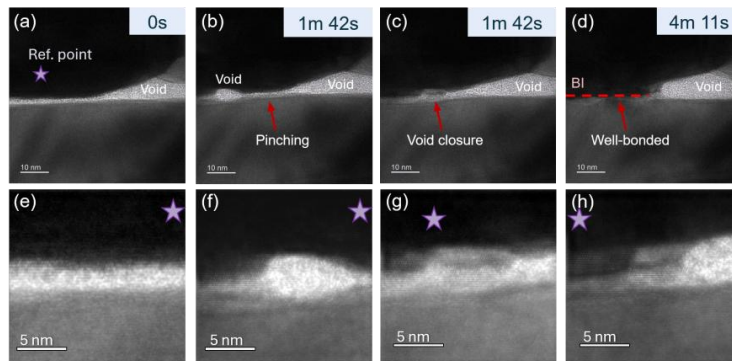
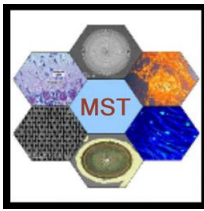


Figure 1. Void shrinkage model of interfacial gap.

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Thickness-Dependent Structural Evolution and Structure–Property Correlation in Two-Dimensional Gallium Oxide

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The preliminary microstructural analysis was conducted on gallium oxide transferred using PDMS as a carrier, revealing its layer number-dependent changes at the nanoscale. Combining SEM, AFM, and TEM analysis, we can have a more comprehensive understanding of the effects of different thicknesses on crystals, stress, and lattices. At the same time, we will further explore how structural changes affect the electrical and optical properties of materials, and establish a complete correlation map between the process, structure and performance of gallium oxide materials through comparative analysis of different preparation conditions and growth mechanisms.

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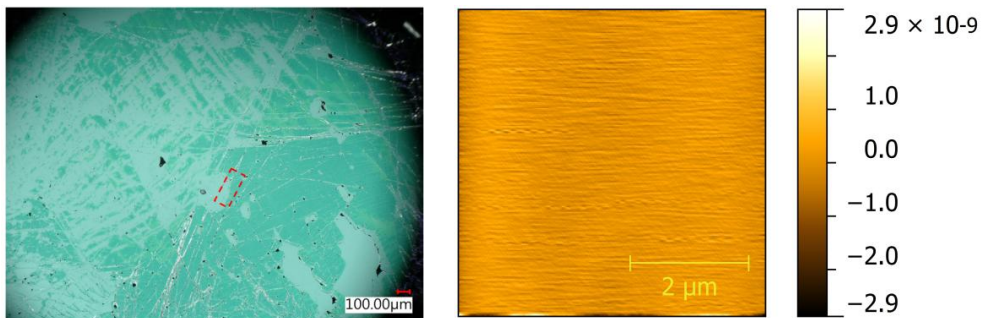


Figure 1. AFM image of thin gallium oxide from liquid metal

Discipline: Physics and Materials Science.

In Situ TEM Reveals Energy-Dependent Electron-Beam Nanosculpting in WS₂/SrTiO₃ Heterostructures

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To circumvent the device degradation caused by polymer residue in conventional lithography, this work introduces an alternative, resist-free fabrication route for 2D semiconductor integration. We employ quasi-2D freestanding SrTiO₃ (FS-STO) membranes as clean, natural hard masks for nanoscale patterning. Through in-situ thermal transmission electron microscopy (TEM), the energy-driven pore formation and structural dynamics within the FS-STO are systematically investigated. Utilizing these thermally evolved profiles, we realize highly precise, localized patterning on WS₂ layers, as confirmed by high-resolution TEM (HRTEM) imaging. Beyond revealing the fundamental beam-matter coupling at the atomic scale, our findings establish a robust and contamination-free template scanning approach tailored for constructing pristine 2D heterostructures.

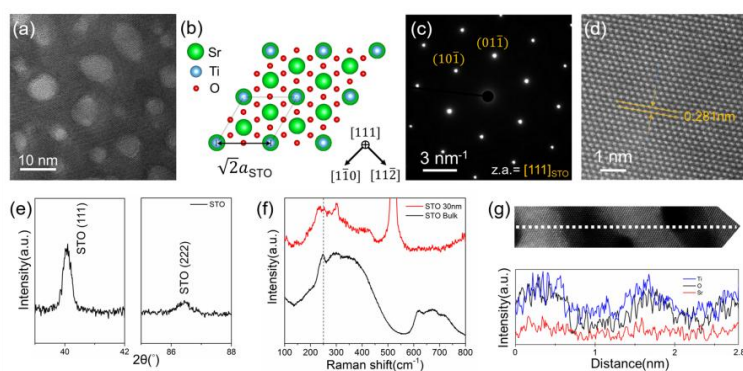


Figure 1. Fundamental structural and chemical characterizations of the holey FS-STO membrane.

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Atomic-Scale Insights into Resistive Switching and Neuromorphic Behaviors in Antiferroelectric-Based Memristive Devices

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Resistive random-access memory (RRAM) is a promising next-generation non-volatile memory due to its simple structure, fast switching speed, low operating voltage, and CMOS compatibility. Recently, ferroelectric and antiferroelectric materials have attracted attention because their polarization-modulated switching may improve device performance and reliability. In this work, PbZrO_3 (PZO) and $\text{La}_{0.5}\text{Sr}_{0.5}\text{MnO}_3$ (LSMO) were grown on 0.05 wt% Nb-doped SrTiO_3 substrates by pulsed laser deposition, followed by Ag top-electrode deposition. The Ag/PZO/LSMO/Nb:STO device exhibited reproducible SET/RESET behavior over 500 cycles. HRTEM, atomic-scale STEM, and XPS were used to investigate structural and chemical changes before and after electrical cycling. In addition, synaptic behaviors such as LTP, LTD, and PPF were studied to evaluate the potential of PZO-based devices for neuromorphic computing. This work aims to clarify the relationship between structural evolution, resistive switching, and synaptic plasticity in antiferroelectric PZO-based memristive devices.

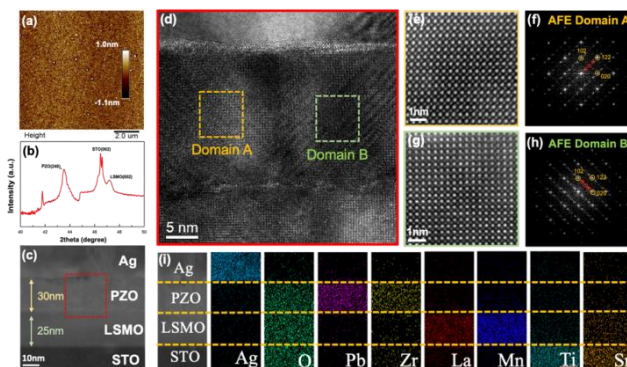
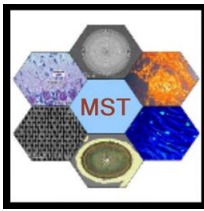


Figure 1. Characterization of the Pristine Device

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Evolution of Planar Defect Structures in a Cryogenically Deformed Duplex Lightweight Steel

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Duplex lightweight steels show excellent strength-ductility synergy due to their heterogeneous microstructures and complex deformation behavior. In this work, the cryogenic deformation behavior of a duplex lightweight steel consisting of FCC austenite and D0₃ intermetallic phases was investigated using tensile testing and microstructural characterization techniques. Compared with room temperature deformation, tensile deformation at 77 K led to a remarkable increase in yield strength together with more pronounced planar deformation features. TEM observations revealed dense planar slip bands, stacking faults (SFs), and defect network structures formed during localized deformation.

The reduced TWIP activity observed at 77 K appears inconsistent with the conventional expectation that lower stacking fault energy promotes deformation twinning. Ongoing work is focused on clarifying the roles of short-range ordering, defect interactions, and interphase constraints in the suppression of twinning under cryogenic deformation.

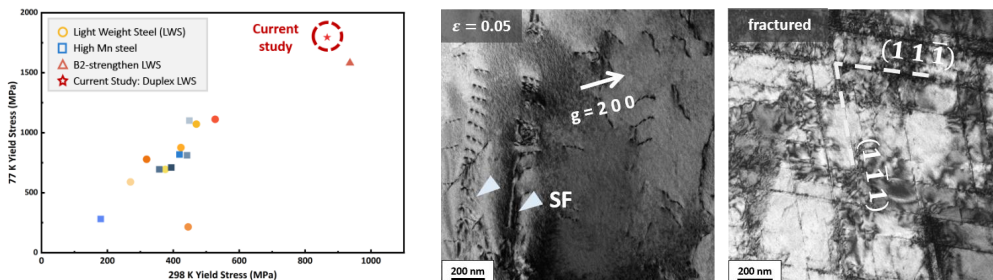
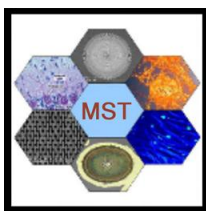


Figure 1. Cryogenic strengthening (left) and evolution of planar defect structures in duplex lightweight steel (right)

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Discipline: Biology and Biomedical science or V Physics and Materials Science.



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Toward Concurrent Improvement of Processability and Productivity in Selective Laser Melting of Ti-48Al-2Cr-2Nb Alloy

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Ti-48Al-2Cr-2Nb alloy, commonly referred to as Ti4822, is a promising lightweight structural material for high-temperature applications owing to its low density, high specific strength, and excellent oxidation resistance. However, the poor room-temperature ductility and high cracking susceptibility of TiAl alloys remain major obstacles to their fabrication by selective laser melting (SLM).

In this study, layer thickness and scan strategy were systematically designed to concurrently improve the processability and productivity of SLM Ti4822 alloy using a coarse powder feedstock. Two layer thicknesses, 60 and 90 μm , were selected according to the particle size distribution of the alloy powder. Compared with the thinner layer condition, the larger layer thickness is expected to provide better compatibility with the coarse powder by improving powder bed packing density. As a result, the thicker-layer condition exhibited reduced cracking and porosity, indicating that appropriate matching between powder size and layer thickness is critical for defect suppression. In addition, different scan strategies, including single high-energy scanning and two-step scanning strategies, were applied with 0° and 67° scan rotation angles to examine their influence on thermal behavior and defect formation.

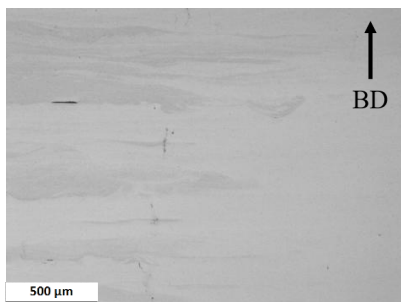
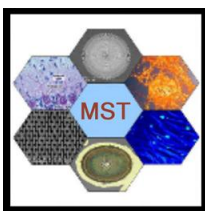


Figure 1. Cross-sectional optical micrograph of SLM Ti4822 fabricated by a two-step scanning strategy.

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Impact-Induced Phase Evolution and Fracture Mechanism of a β -Ti Golf Club Face Alloy

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Impact testing is commonly used in the golf industry to evaluate the performance of clubface materials. However, experimental results have shown that impact performance does not exhibit a positive correlation with either ductility or fatigue strength. Therefore, this study aims to clarify the impact fatigue fracture mechanism of a β -Ti alloy through microstructural characterization.

In addition to the β matrix, the ω phase, which may contribute to embrittlement, was observed in the original microstructure prior to impact testing. As the number of impacts increased, α/α' phase formation was observed, accompanied by a gradual increase in its volume fraction. EDS mapping further revealed pronounced elemental partitioning, suggesting the involvement of thermal effects during the impact process. Moreover, the fracture path identified by EBSD was predominantly transgranular. These results suggest that impact-induced phase evolution and thermally assisted elemental partitioning play important roles in the fracture behavior of the β -Ti alloy.

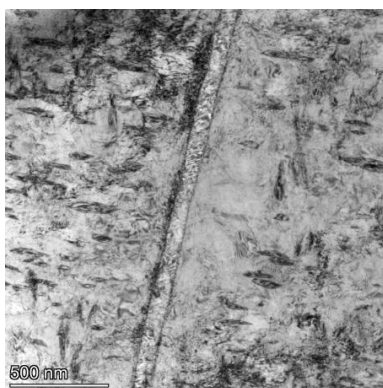


Figure 1. α/α' phase distribution of a sample after impact test

Discipline: ____Biology and Biomedical science or ☒ Physics and Materials Science.

Effects of Grain Size on Mechanical Response to Hydrogen in Alloy 209 Stainless Steels

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Alloy 209 stainless steel (A209SS) is a high-nitrogen austenitic stainless steel known for its excellent mechanical properties, superior corrosion resistance, and high resistance to hydrogen embrittlement (HE) [1]. However, the reason for its low HE susceptibility remains unclear. The results reveal that plastic deformation of A209SS occurs mainly through dislocation slip and twinning, and hydrogen charging further decreases the SFE, resulting in twin densification. The failure is mainly characterized by transgranular fracture propagating along (111) slip/twin planes, indicating that the HE is dominated by the HEPMD mechanism. Furthermore, grain refinement suppresses hydrogen embrittlement effectively due to the formation of a high density of fine twins that alleviate stress concentration, while the grain boundaries facilitate crack deflection and elevate fracture toughness. These results clarify the influence of hydrogen on the deformation of A209SS, helping to achieve improved resistance to HE in industrial hydrogen transportation/storage environments.

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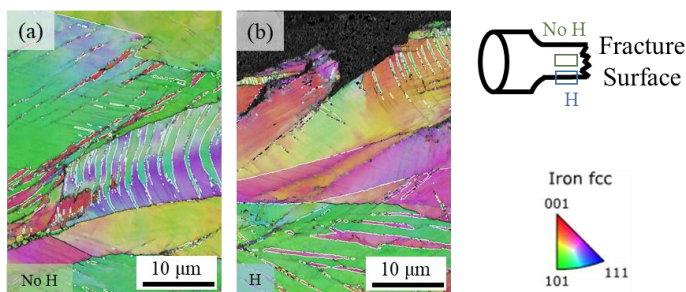


Figure 1. EBSD analysis of hydrogen-charged A209SS after deformation at the (a) center region and (b) surface region.

Discipline: ____Biology and Biomedical science or ☒ Physics and Materials Science.

Study the phase contrast imaging using a microfocus X-ray source

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The transmission type imaging of an object with uniform thickness can be formed because the transmitted light experience different refraction index of the material of the object laterally. In the X-ray region, the refraction index usually written as $n=1-\delta+i\beta$, where δ proportional to electron density and β proportional to X-ray absorption coefficient. The phase contrast based on the different of δ instead of β . In the phase contrast image, the phase of the X-ray will be different after passing through the material with different refraction index. For the phase contrast imaging techniques, a contrast enhancement at edge of an object can be found if the lateral coherence length (transverse coherent) is long enough. This is a natural result of Fraunhofer diffraction. Phase contrast to enhance the edge image is important when the density contrast cannot be seen clearly. For example, to image the blood vessel in muscle, these two materials with essentially the same density, thus only phase contrast technique can image the blood vessel without using dye containing heavy elements. To achieve phase contrast image, an X-ray source with very low transverse coherence (parallel beam with very low beam divergence) is needed. We used 15 micro-meter micro-focus X-ray source, and the sample placed 1.2 m away. A TE cooled CCD detector coupled with CsI:Tl scintillator to detect the image. Fig. 1 shows a test of plastic sheet (PVC, 0.082 mm) with phase contrast and absorption contrast. The edge enhancement factor is 170%.

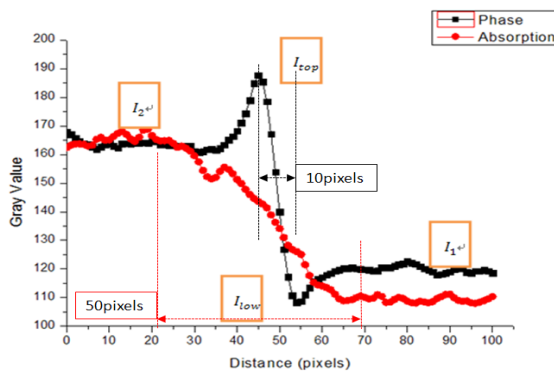


Fig. 1 The test of edge enhancement factor (170%) between phase contrast (black curve) and density contrast (red curve) on an edge of 0.082 mm plastic sheet.



Electrical Characteristics of RRAM Devices Using Non-Metallic Electrodes

Hsin-Jung, Li(李欣容)¹, Jui-Yuan Chen(陳睿遠)¹

¹Department of Materials Science and Engineering, National United University, Miaoli, Taiwan.

This study aims to investigate the application of non-metallic electrodes in resistive random-access memory (RRAM).

Conventional metal electrodes often introduce uncontrolled ion migration and interfacial redox reactions, leading to variability in filament formation and degraded endurance. To address these limitations, non-metallic electrodes are proposed to suppress excessive ion diffusion and regulate interfacial processes. By modifying the electrode–dielectric interaction, improved switching uniformity and enhanced device stability can be achieved.

References

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2. Oh, I., Kim, S., & Pyo, J. (2022). Resistive Switching and Synaptic Characteristics in ZnO/TaON-Based RRAM for Neuromorphic System. Nanomaterials.

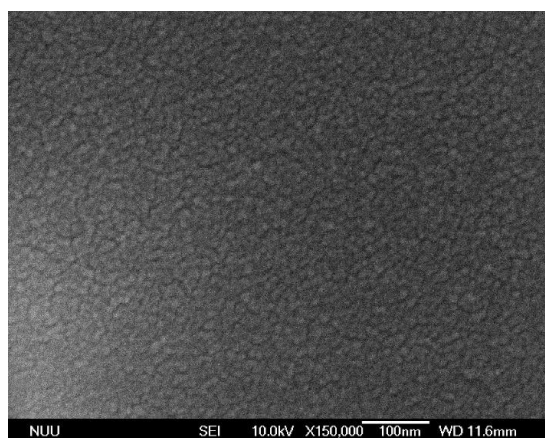


Figure 1. Top-view SEM of TaN

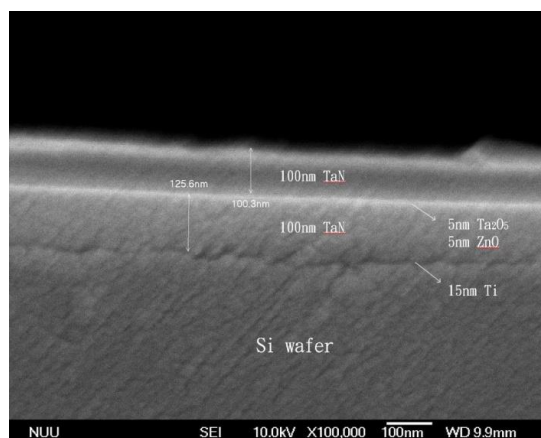
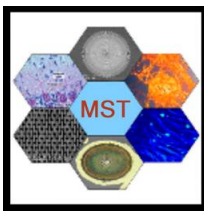


Figure 2. SEM cross-sectional image of TaN



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Martensite Refinement and Austenite Modification in Mn-Alloyed 9%Ni Steel via Flash Annealing

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*homeryen@ntu.edu.tw

9%Ni steel with a tempered martensitic matrix and retained austenite is widely used in liquefied natural gas (LNG) storage tanks due to its excellent cryogenic toughness. This study aims to reduce energy consumption and material cost by partial substitution of Ni with Mn and adopting a flash annealing process. A 9%NiMn steel was developed, and both 9%Ni and 9%NiMn steels were subjected to direct quenching followed by flash annealing and tempering (DQFT), as well as conventional lamellarizing and tempering (DQLT). Microstructural characterization shows that flash annealing significantly refines the martensitic structure and modifies the morphology and distribution of retained austenite without increasing the volume fraction of retained austenite. The refined martensitic structure induced by flash annealing is considered to be one of the key factors responsible for the enhanced cryogenic toughness of DQFT-9%NiMn steel. The present results demonstrate that flash annealing provides an effective route for tailoring the microstructure of Mn-alloyed 9%Ni steel and suggest the potential of DQFT-9%NiMn steel for next-generation energy storage applications.

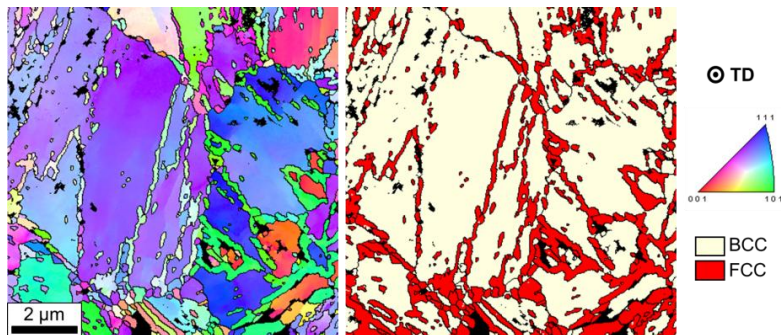
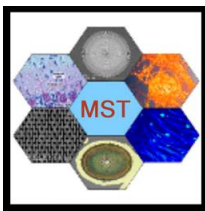


Figure 1. TKD analysis of DQFT-9%NiMn steel.

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EBSD Investigation of Grain Growth and Texture Evolution in Q-Switched Laser Crystallized Poly-Si Films

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Polycrystalline silicon (Poly-Si) films crystallized by a Q-switched pulsed laser were investigated using Electron Backscatter Diffraction (EBSD). Laser crystallization was performed at powers ranging from 6 to 10 W. The original 150 nm-thick Poly-Si films were thinned to approximately 50 nm by chemical mechanical polishing (CMP). EBSD characterization was conducted using a Thermo Fisher Scientific Helios 5 Hydra PFIB equipped with an Oxford Instruments Symmetry S3 EBSD detector.

The average grain size increased initially and then decreased with increasing laser power, reaching a maximum of approximately 655 nm at 7 W. Texture analysis revealed a dominant $\langle 100 \rangle$ preferred orientation along the Y direction for samples processed between 6 and 9 W, indicating directional grain growth [1]. At higher laser powers, both grain size and texture intensity decreased, suggesting enhanced grain competition and possible re-nucleation effects [2]. These results provide insight into the grain growth and texture evolution of Q-switched laser-crystallized Poly-Si films.

References

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2. A Hara et al, Jpn. J. Appl. Phys. 43, 1269–1276 (2004).

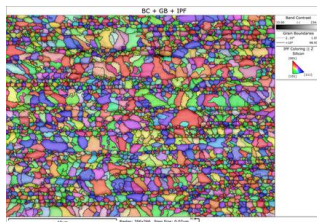
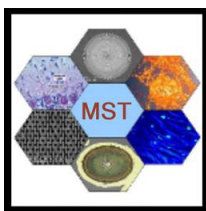


Figure 1. EBSD orientation map of the 7 W laser-crystallized Poly-Si film.

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Comparative Analysis of $\text{Al}_x\text{Ga}_{(1-x)}\text{N}$ Thin Films Using Different Ion Sources for TEM Lamella Fabrication

Chien-Chung Hsu (許建中), Chiung Chih Hsu (許瓊姿), Chien-Ting Wu (吳建霆), and Kun-Lin Lin (林昆霖)*

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In this study, Plasma Focused Ion Beam (Xe-FIB) and Gallium Focused Ion Beam (Ga-FIB) techniques were used to prepare lamellae from $\text{Al}_x\text{Ga}_{1-x}\text{N}$ epitaxial layers [1]. The specimens were subsequently analysed using Transmission Electron Microscopy (TEM) and Energy-Dispersive X-ray Spectroscopy (EDS). The results demonstrate that the choice of FIB preparation method significantly affects the elemental ratios determined by EDS. Specifically, Ga-FIB preparation introduces an artificially elevated Ga content of approximately 4 at% compared to Xe-FIB preparation. Furthermore, X-ray Photoelectron Spectroscopy (XPS) measurements yielded Al ratios consistent with the EDS results obtained from Xe-FIB specimens, providing independent validation of the composition. These findings underscore the importance of selecting an appropriate specimen preparation method for accurate compositional analysis of $\text{Al}_x\text{Ga}_{(1-x)}\text{N}$ -based heterostructures.

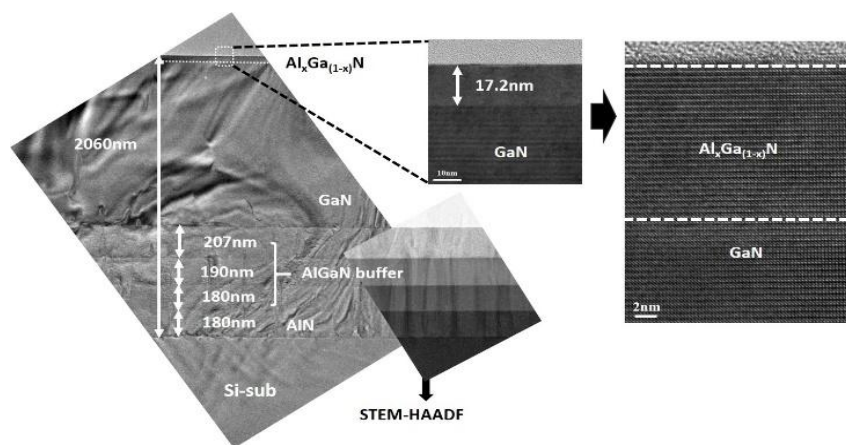
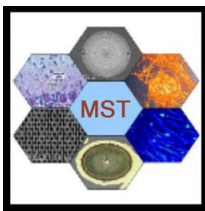


Figure 1. TEM image is shown of various thin films of the silicon substrate.

References

1. W. H. Cantrell, and W. A. Davis, J. Microsc. vol. 282, pp. 101–112, (2021).

Discipline: Biology and Biomedical science or ✓Physics and Materials Science.



Low Temperature and Low Pressure Hydrogen Storage for ZK60 Hydrogen Storage Alloy Manufactured from Atomized Powder

Ya-Xuan Liang (梁雅瑄)¹, Chiao-Ping Chang (張喬苹)¹, and Hung-Wei Yen (顏鴻威)^{1*}

¹ Department of Materials Science and Engineering, National Taiwan University, Taiwan

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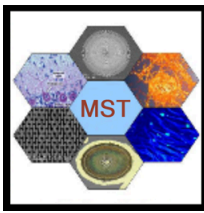
Hydrogen energy is considered a promising alternative to fossil fuels in the context of global decarbonization. Solid-state hydrogen storage using magnesium-based alloys has attracted attention due to their high theoretical capacity (7.65 wt. %). However, a key challenge is the high energy demand required for hydrogen absorption and desorption processes. This study investigates whether operating under low-temperature and low-pressure conditions can improve storage performance while reducing energy consumption. Although lower pressure may enhance hydrogen uptake, low temperature often leads to incomplete desorption, limiting stable cycling under standard operating conditions.

In this work, we examined the effects of temperature, pressure, desorption strategy, and evacuation duration on the cycling performance of porous magnesium-based materials. A low-temperature, low-pressure approach combined with extended vacuum evacuation was adopted to increase the driving force for desorption and improve overall cycling stability. Under this strategy, stable cycling behavior was successfully achieved within five cycles.

The results demonstrate that under 280 °C and 1 MPa, applying a 90-minute vacuum desorption step enables the system to complete stable absorption–desorption cycling. Compared with the standard 300 °C, 3 MPa condition, the low-temperature/low-pressure mode exhibits slower absorption kinetics but achieves a significantly higher maximum hydrogen storage capacity while maintaining effective desorption when sufficient driving force is provided.

These findings highlight a feasible pathway for reducing energy consumption during hydrogen cycling and improving the practical performance of solid-state hydrogen storage systems based on magnesium alloys. Furthermore, the results confirm that stable hydrogen absorption–desorption cycling under low-temperature and low-pressure conditions is indeed achievable.

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Atom Probe Tomography Analysis of Clusters and Precipitates in AA7075

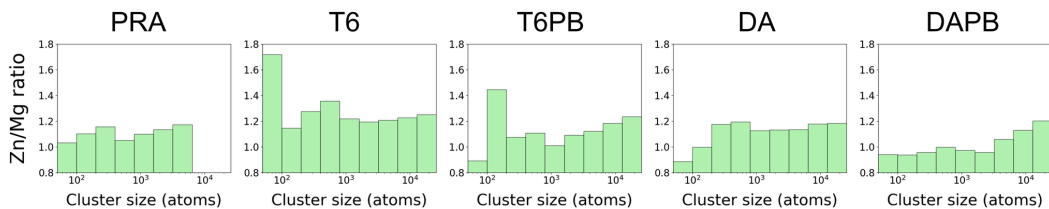
Chia-Chen He(何佳臻)¹, Tung-Hua Hsieh(謝東樺)¹, Ting-Jui Hung(洪鼎睿)¹, and Hung-Wei Yen(顏鴻威)^{1*}

¹ Department of Materials Science and Engineering, National Taiwan University, Taipei, Taiwan

7xxx-series aluminum alloys are heat-treatable structural materials with high specific strength; therefore, characterizing clusters and precipitates formed during aging is essential for understanding their strengthening behavior.

In this study, atom probe tomography (APT) was used to investigate the chemical composition and solute-atom behavior of clusters and precipitates under different aging conditions. The three-dimensional datasets were analyzed using the Friends-of-Friends method, followed by additional calibration and data-processing procedures to effectively separate clusters and precipitates from the matrix. The reconstructed datasets, as shown in **Figure 1**, were used to evaluate the compositional evolution of clusters with different sizes. The results indicate that the copper content within the precipitates tends to increase after high-temperature aging, suggesting progressive Cu enrichment during precipitate evolution.

(a)



(b)

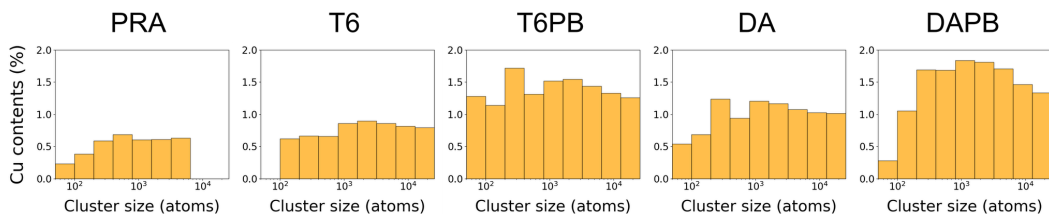


Figure 1. Average solute atoms content in clusters with different sizes under different aging conditions. (T6 was aged at 120 °C, and the DA condition underwent an additional aging treatment at 180 °C.)

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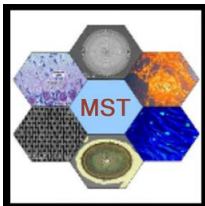
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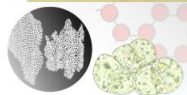
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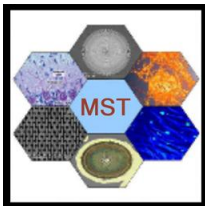
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學校單位 國立陽明交通大學分子醫學博士
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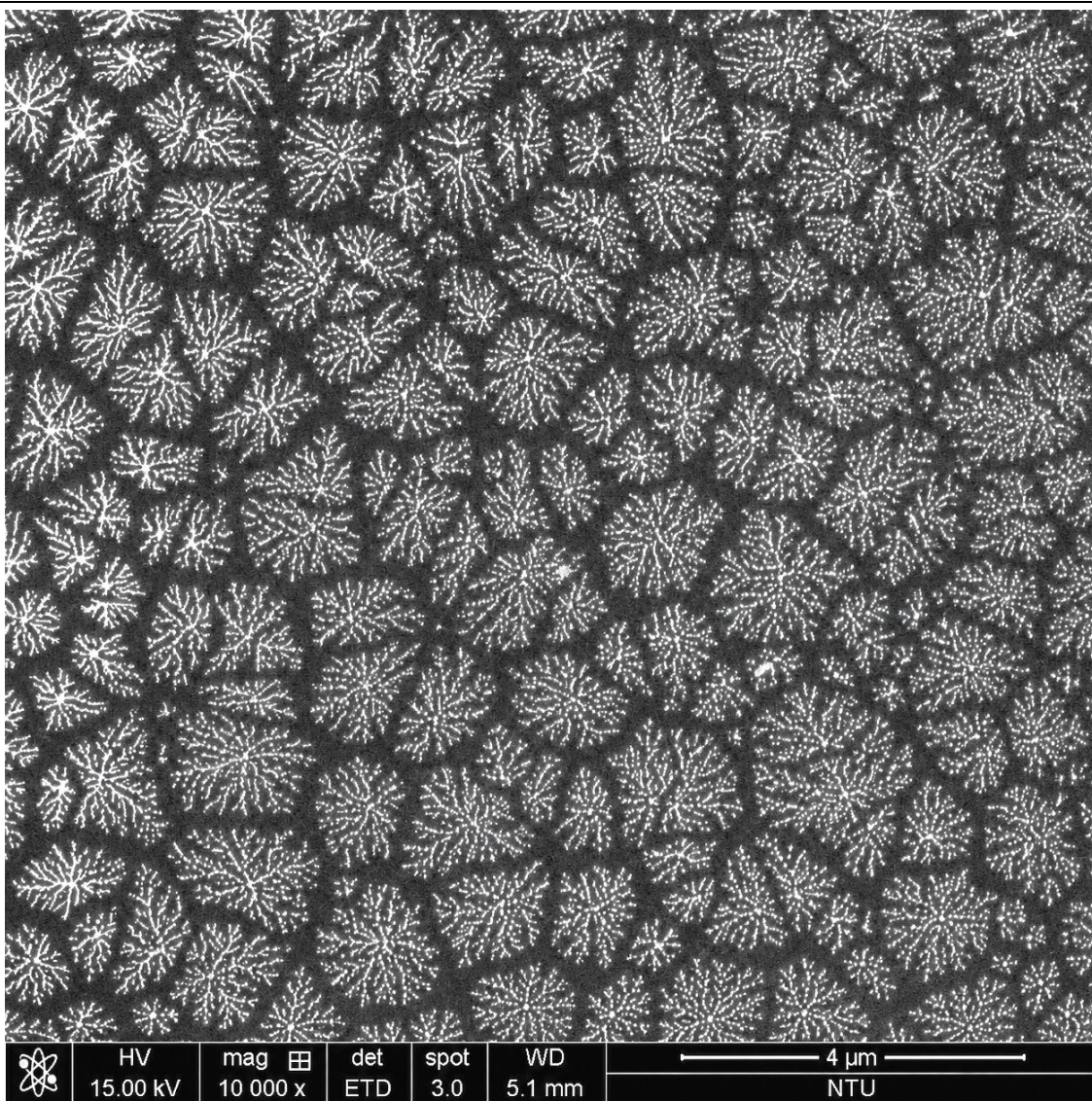
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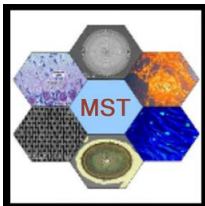
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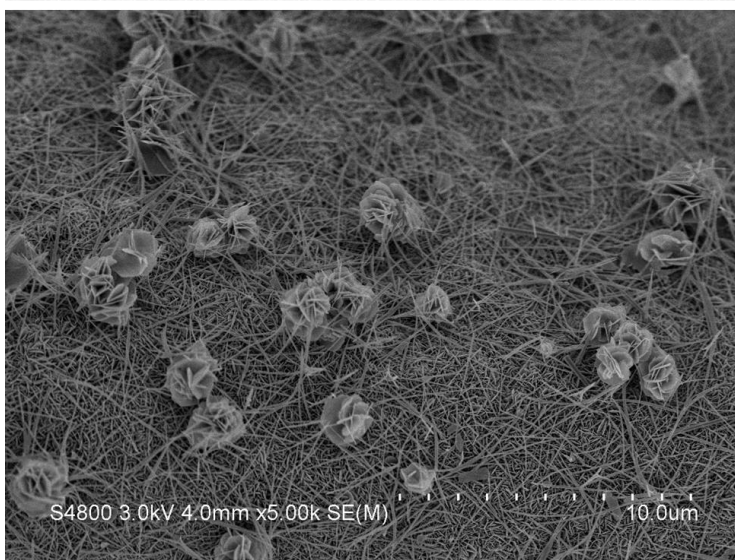
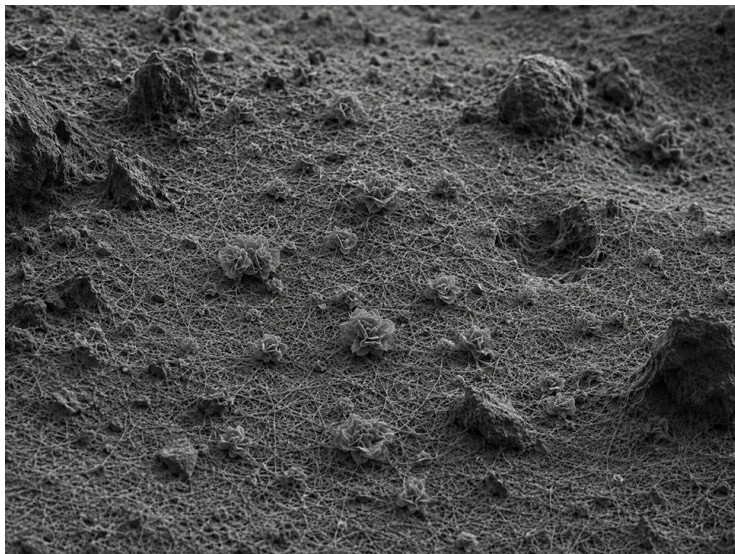
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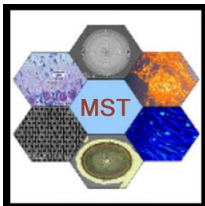
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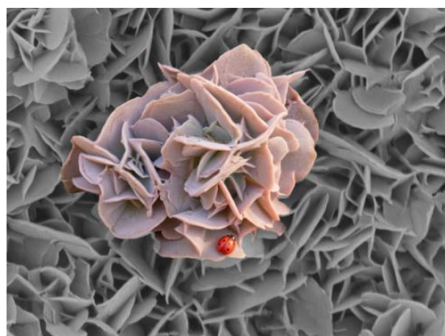
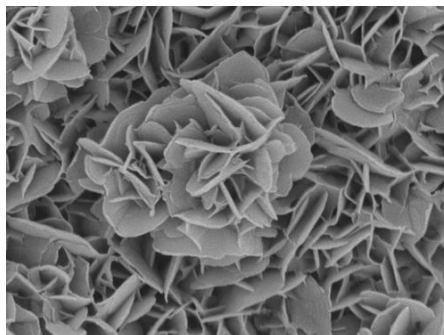
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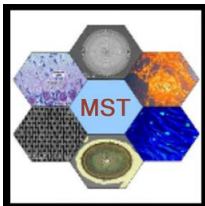
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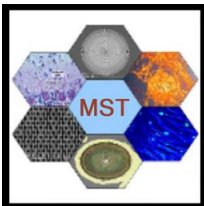
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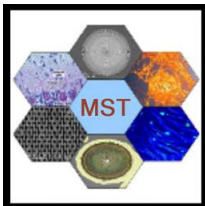
Ti₃₀Zr₂₀Ni₅₀ 合金經 600 °C 時效處理後之背向散射電子影像，針狀析出物如同散落的牙籤。

作者姓名 潘世軒、陳志軒

學校單位 臺灣大學材料科學與工程研究所

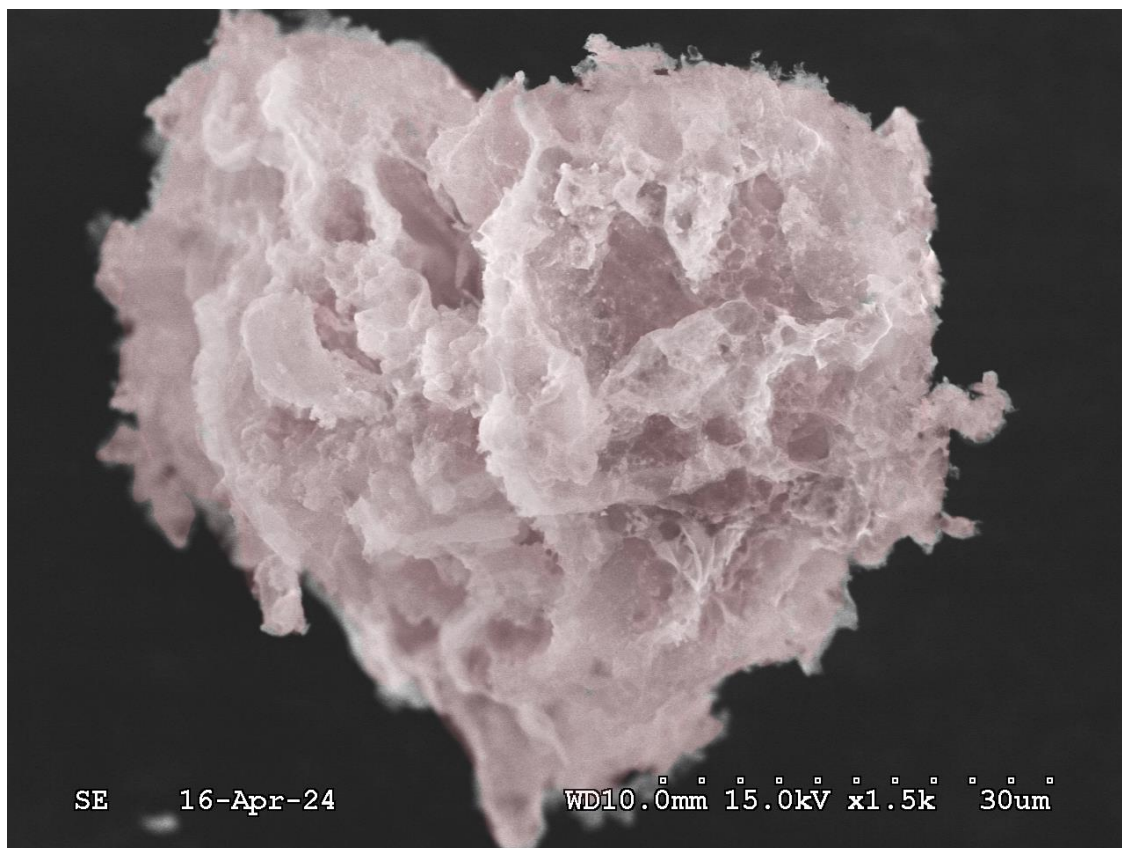
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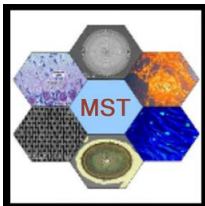
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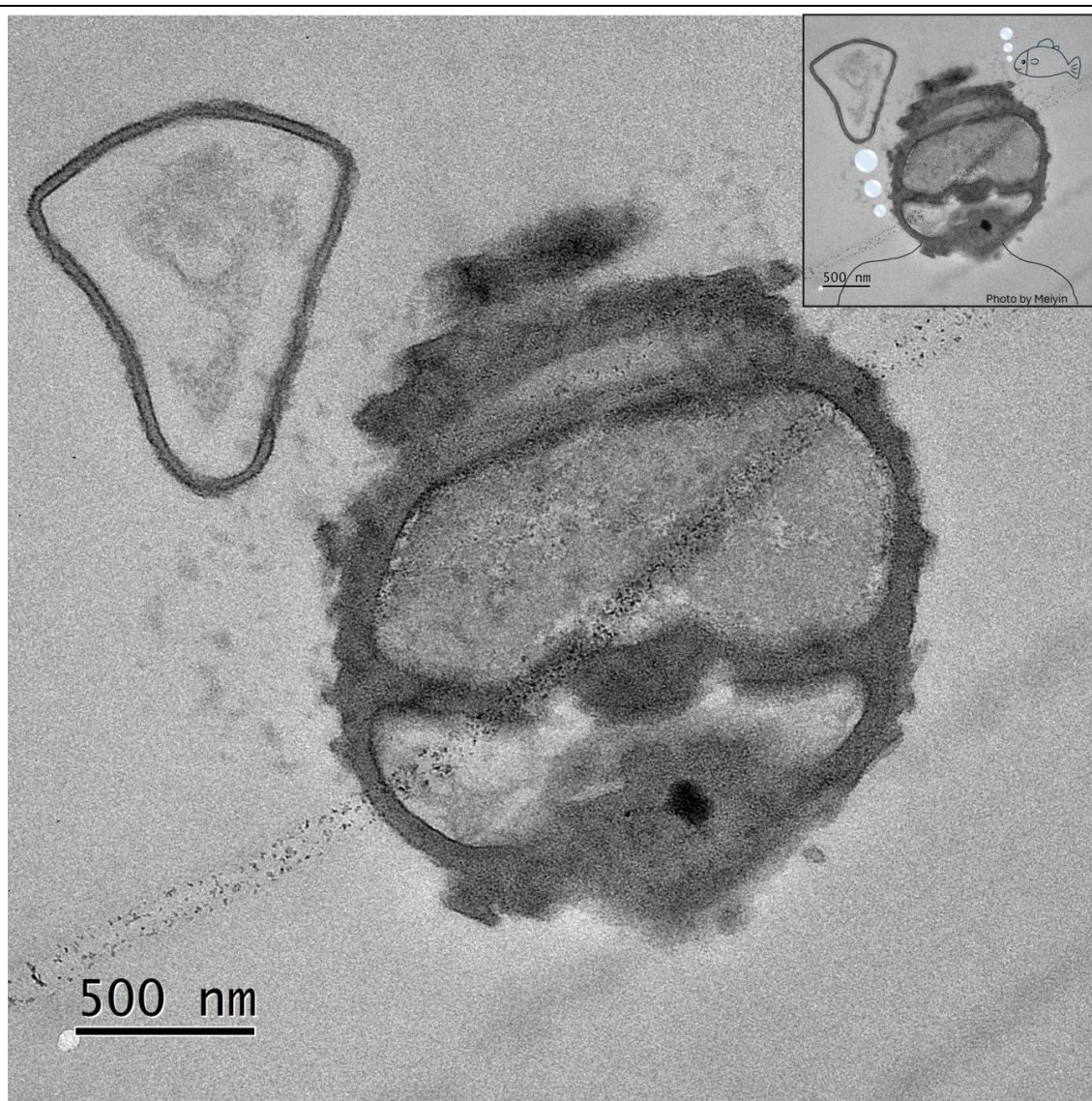
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作品內容

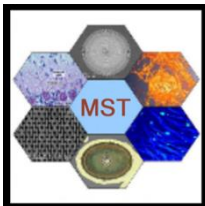
透過穿透式電子顯微鏡觀察到藻類細胞型態似於一名潛水員。

作者姓名 葉美吟

學校單位 國立成功大學 牙醫系暨口醫所

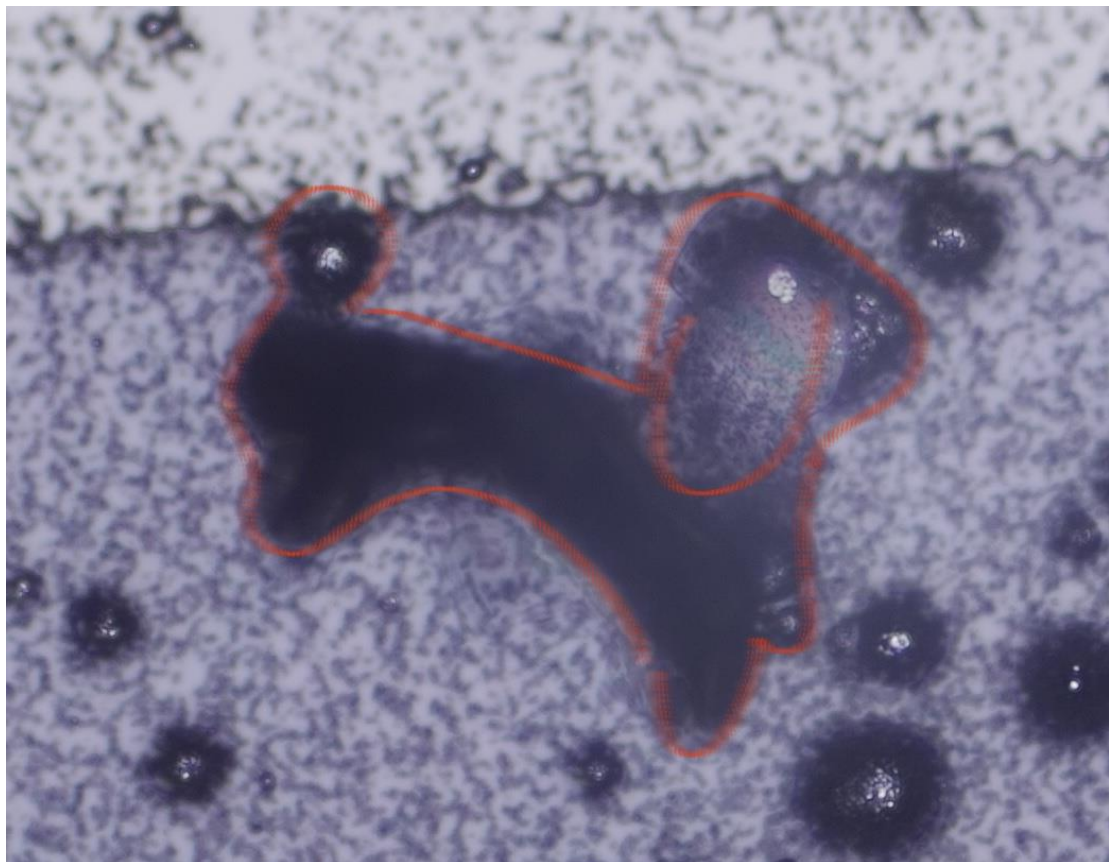
E-Mail rickysmile5201@gmail.com

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作品名稱 迷你來福!!!

作品內容

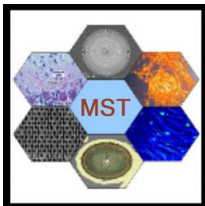
微觀下的液態金屬，化作小黑狗來福，正雀躍地向前奔跑。

作者姓名：劉威辰

學校單位：逢甲大學材料系

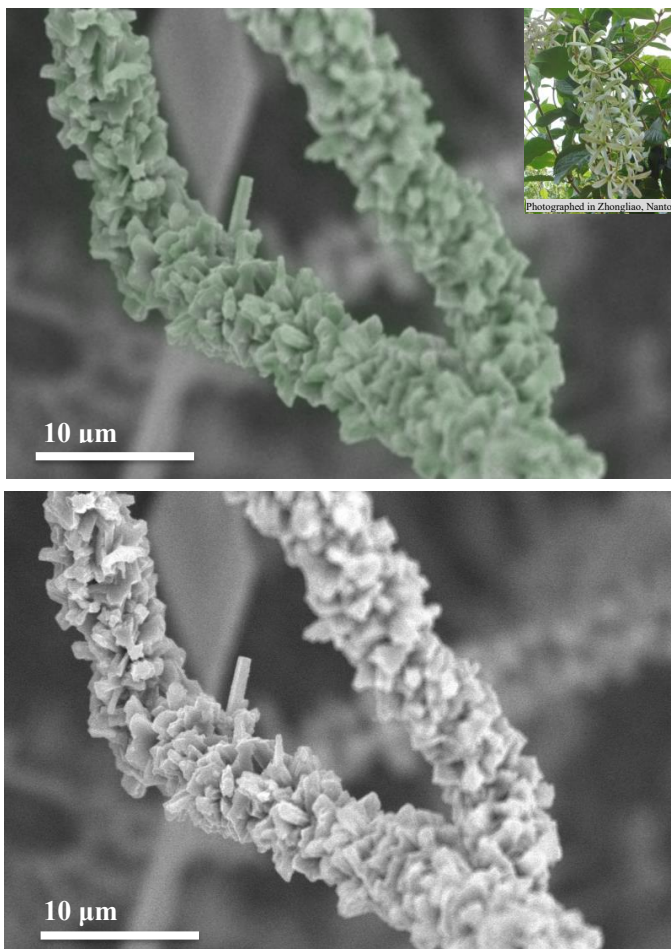
E-Mail：we920107@gmail.com

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作品名稱 微境裡的錫葉藤

作品內容

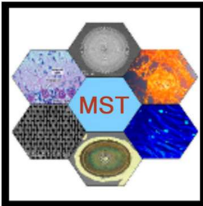
氧化鎳奈米線沿線狀骨架延展，表面團簇依附生長，如錫葉藤般在微觀世界中垂墜纏繞，展現材料結晶的秩序與生命感。

作者姓名 劉若妤、黃浚瑋

學校單位 逢甲大學材料科學與工程學系

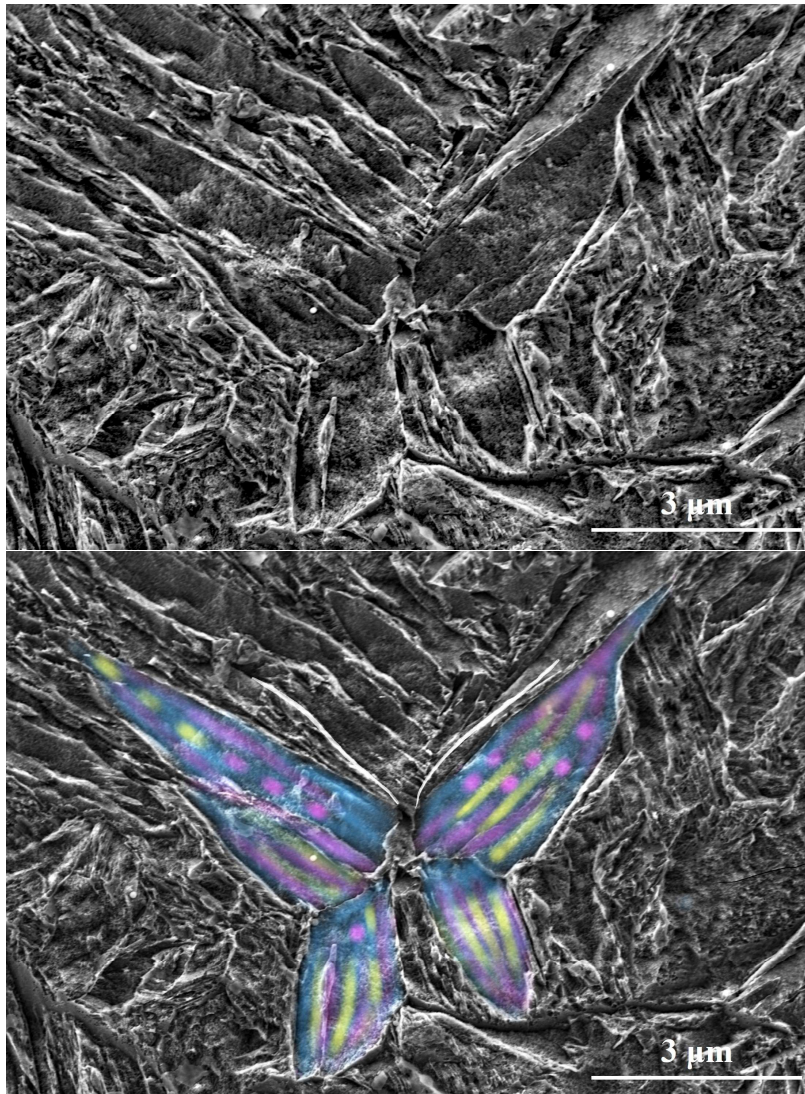
E-Mail ruoyu1313@gmail.com

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作品名稱 相變之翼：淬火之蝶

作品內容

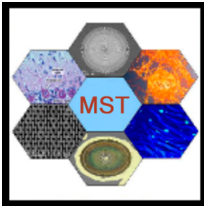
歷經高溫淬火的麻田散鐵，如彩蝶破繭展翼，舞出堅韌與新生。

作者姓名:陳冠廷,江羽柔,鍾采甫

學校單位:陽明交通大學
材料科學與工程學系

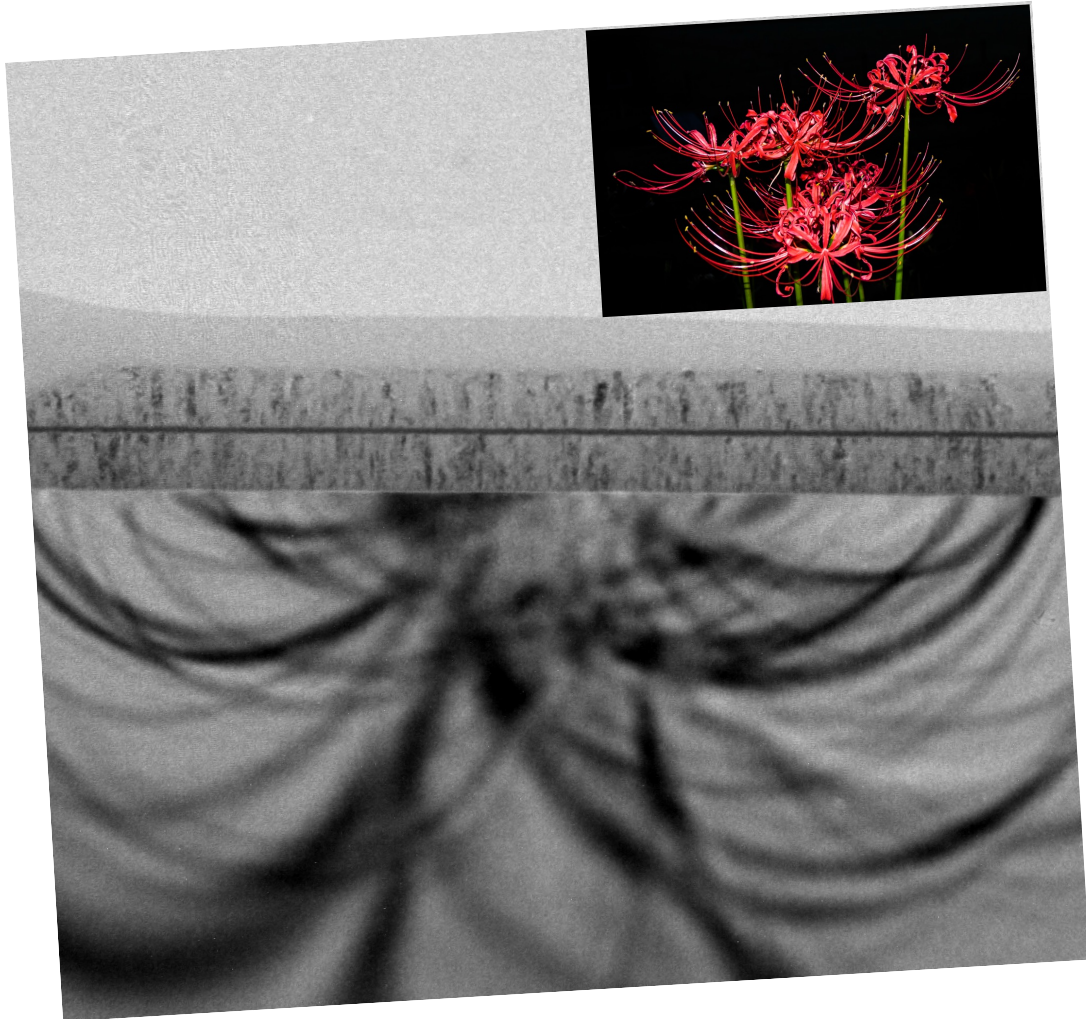
E-Mail:ktchen.en13@nycu.edu.tw

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作品名稱 駐足彼岸

作品內容

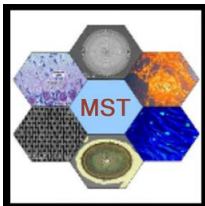
電子束穿透 $\text{TiN}/\text{HfO}_2/\text{TiN}/\text{Si}$ 薄膜結構的瞬間，將冰冷的材料截面轉化為富有生命感的微觀花景。影像下方放射狀的花瓣紋理，來自 TEM 試片局部 bending 所造成的厚度與繞射對比變化，宛如彼岸花於微觀世界中綻放；上方多晶薄膜堆疊，則彷彿橋上駐足的親子，正驚嘆著這支由電子與材料交會而成的絕世花景。

作者姓名 周士翔、吳建霆、林昆霖

學校單位 國立陽明交通大學

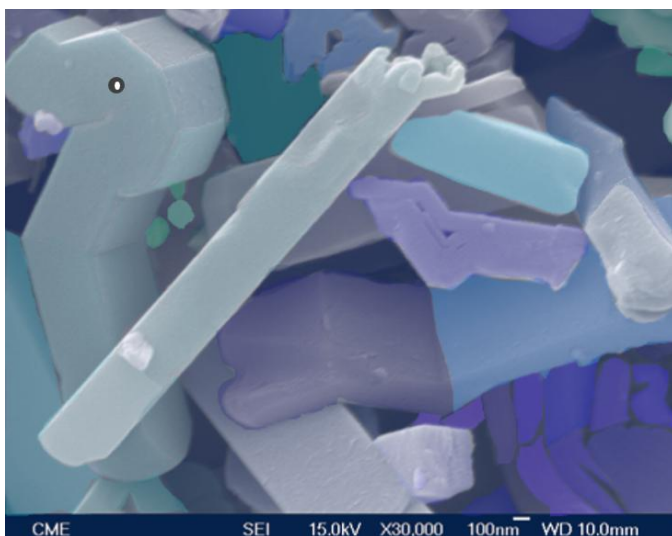
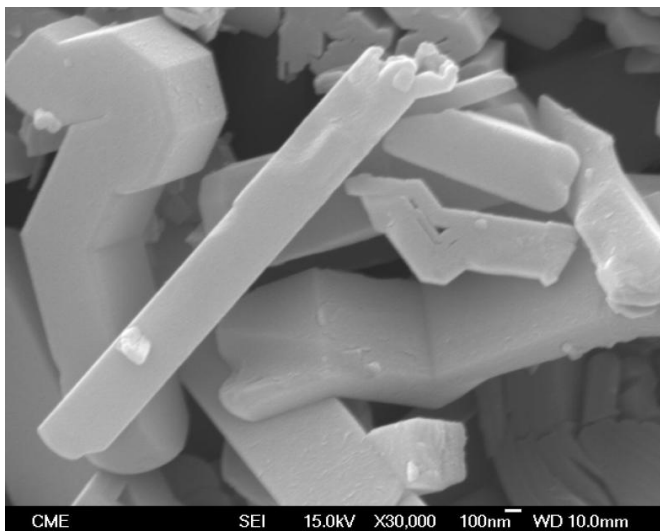
E-Mail s2014101818@gmail.com

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台灣顯微鏡學會

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作品名稱：鈮海奇遇

作品內容

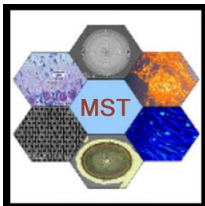
鈮酸鋁晶貌如海馬悠游、珊瑚綻放於微觀海洋。

作者姓名：陳語萱

學校單位：東海大學化材系

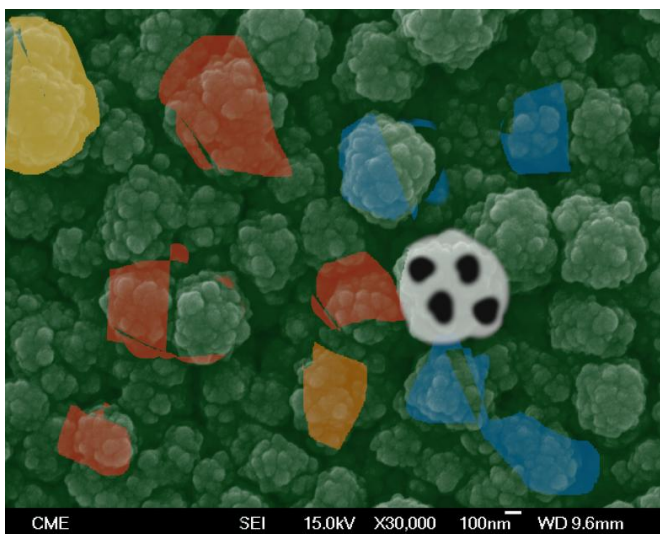
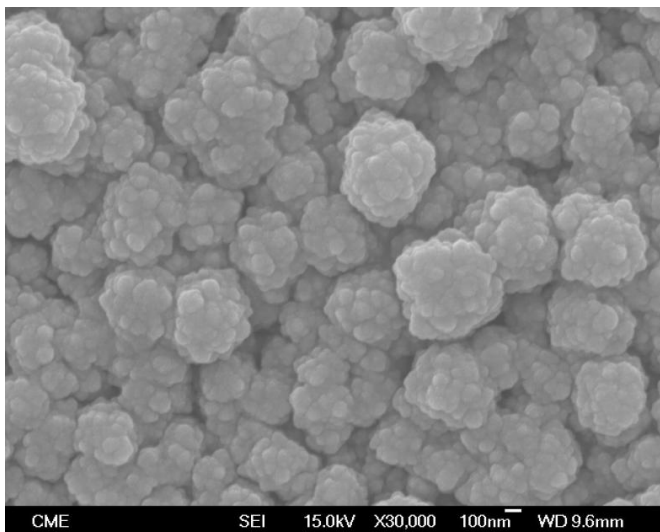
E-Mail：g14310010@thu.edu.tw

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台灣顯微鏡學會

Microscopy Society of Taiwan



作品名稱 微觀封裝競技場：奈米顆粒的界面攻防戰

作品內容

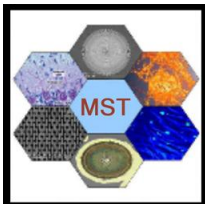
奈米顆粒微觀球場，象徵先進封裝界面材料間的競爭、協作與平衡

作者姓名 黃昱傑

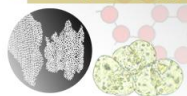
學校單位 東海大學化材系

E-Mail b3689139@gmail.com

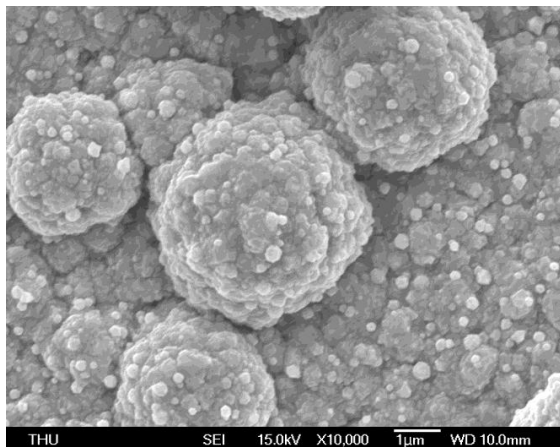
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台灣顯微鏡學會



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作品名稱 在銅離子太空中遨遊

作品內容

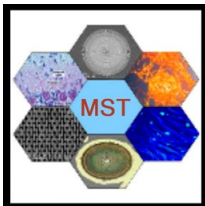
化鍍銅顆粒化身小太空人，遨遊微觀銅離子宇宙。

作者姓名 羅昱安

學校單位 東海大學化材系

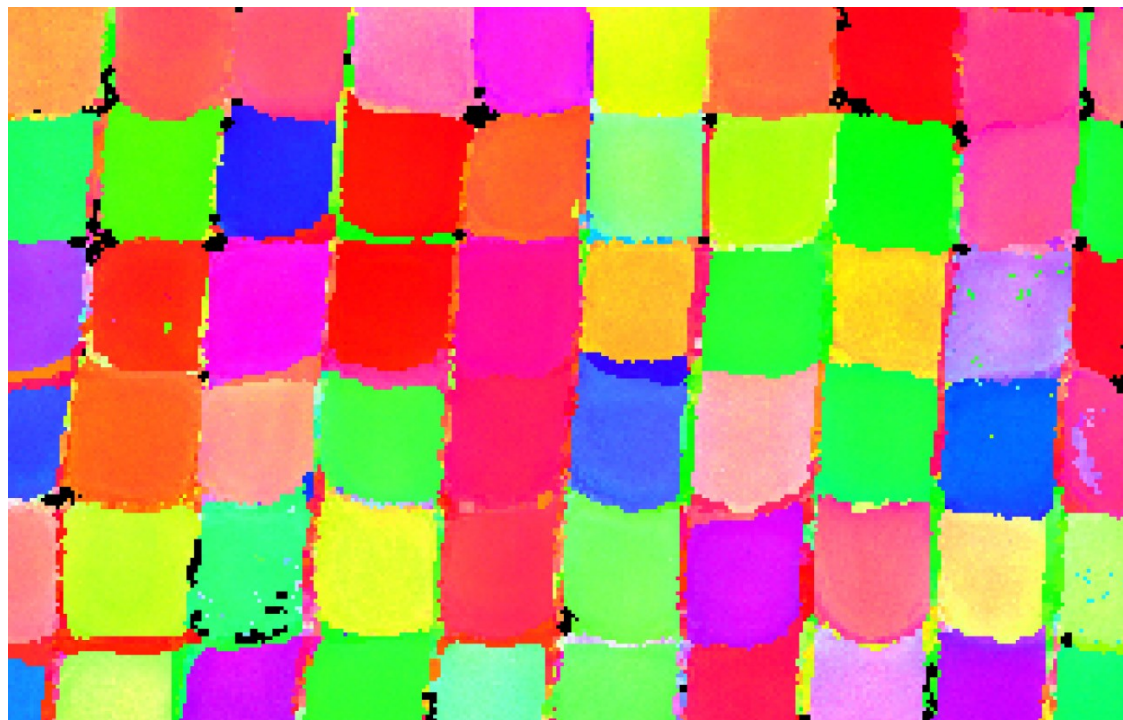
E-Mail franklin920221@gmail.com

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500 μ m

作品名稱 棋盤

作品內容

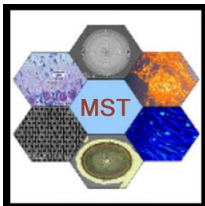
3D 列印鈦鎳合金沿列印方向拍攝之 EBSD 照片，紛亂的組織就像繽紛的棋盤

作者姓名 陳洋、呂念虎、陳志軒

學校單位 國立台灣大學 機械工程學系

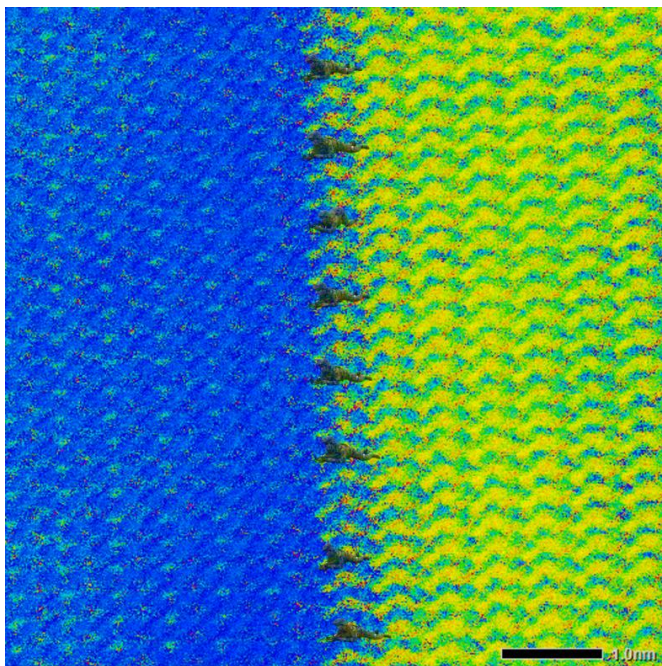
E-Mail r14522705@ntu.edu.tw
nhlu0109@ntu.edu.tw
chchen23@ntu.edu.tw

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作品名稱 伏伏前進

作品內容

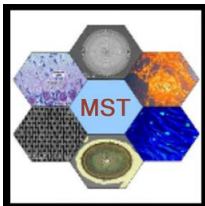
利用 STEM-DPC 去觀測 AlGaIn/GaN 的界面，因內建電場方向不同，使電子束在不同區域掃描時會往不同方向偏折，並用不同顏色的來表示，而在界面會形成藍黃條紋交錯出現的現象，藍黃配色像是烏克蘭國旗，而中間的界面彷彿是伏伏前進的士兵。

作者姓名： 郭柄豪

學校單位： 半導體研究中心

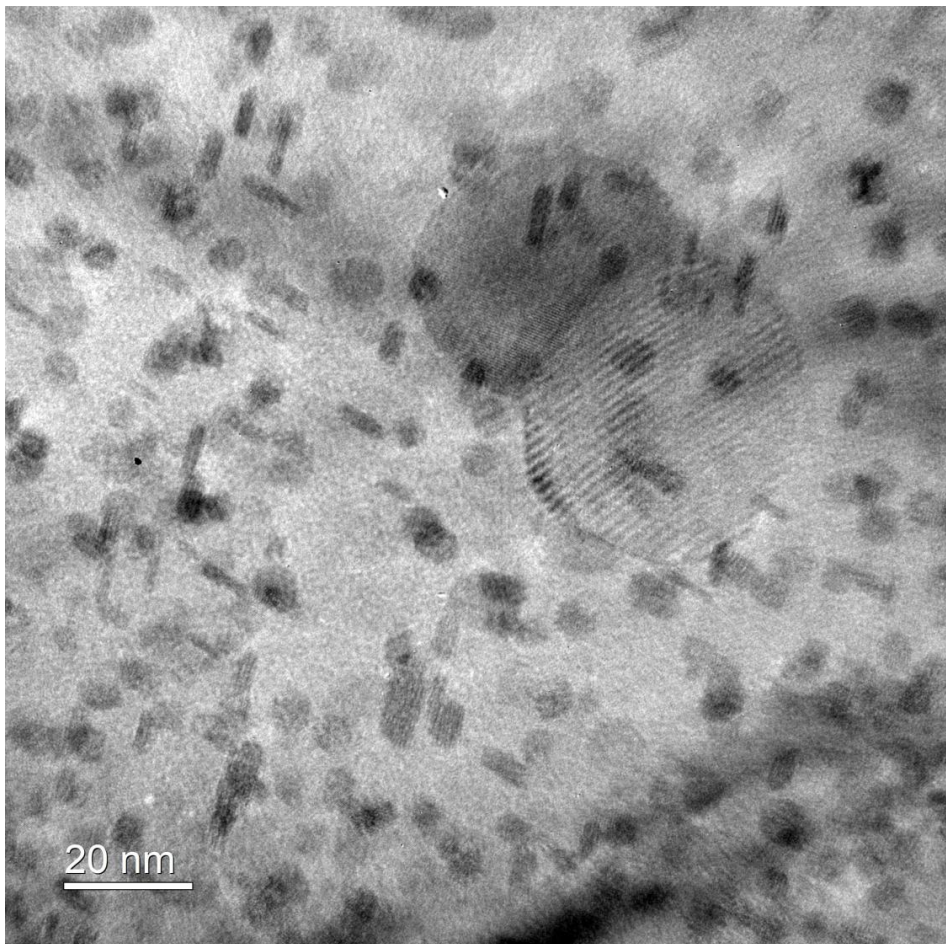
E-Mail: d102066001@gmail.com

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作品名稱: 奈米深處的靈魂吶喊 (7000 系鋁合金奈米析出物)

作品內容:

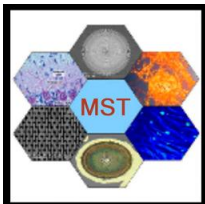
析出相交織出奈米臉孔，映照無數綠光倒影實驗至深夜的靈魂吶喊。

作者姓名: 楊唯翌* 陳冠廷* 陳丞 陳冠圻
鍾采甫*

學校單位:
國立陽明交通大學 材料科學與工程學系

E-Mail: l770305ouish@gmail.com

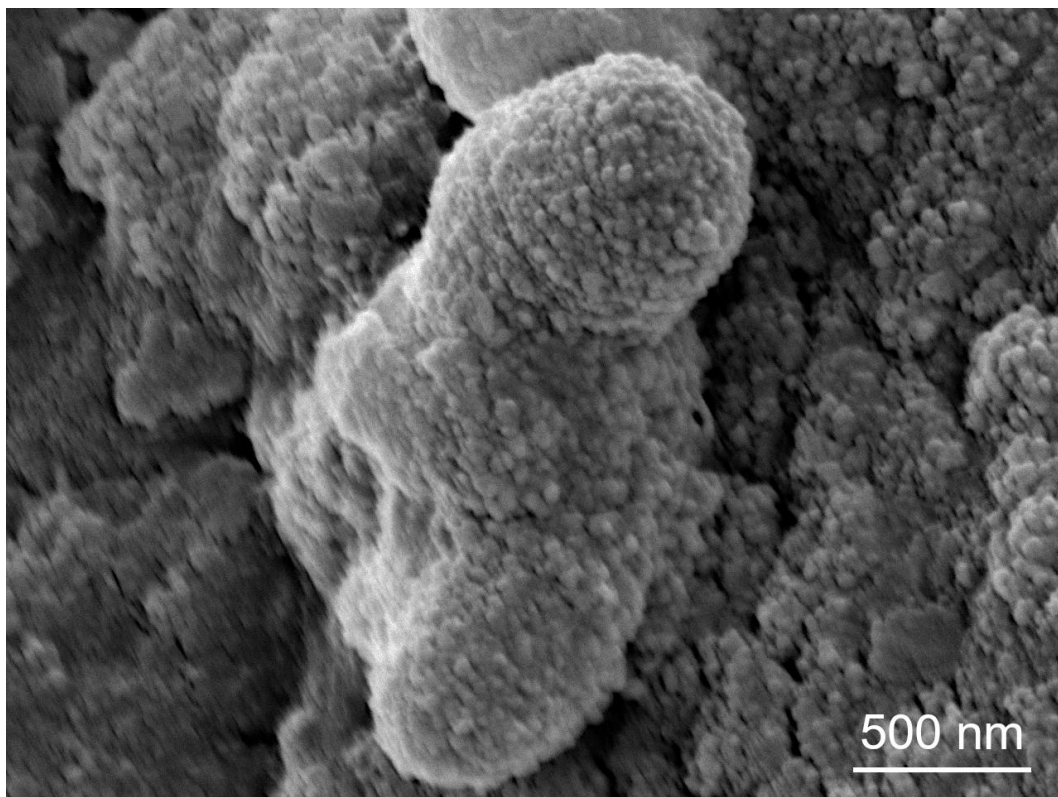
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作品名稱 安詳的鎂 鋅肝寶貝

作品內容

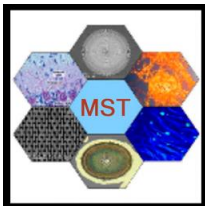
ZK60 之富鋅析出物如頭戴毛帽的嬰兒小手抓著奶瓶。

作者姓名 簡家凱 張喬芊

學校單位 國立台灣大學材料系

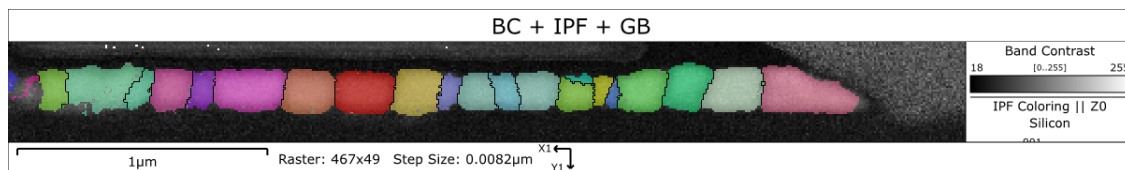
E-Mail r14527015@ntu.edu.tw

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作品名稱 砂毛毛蟲

作品內容

本影像為雷射結晶化多晶矽之 TKD 晶向圖。排列且延伸的晶粒形貌猶如一隻色彩繽紛的毛毛蟲穿梭於微觀世界，不同顏色代表不同晶體取向，展現雷射誘導晶粒成長過程中的結構演化與微觀之美。

作者姓名

許瓊姿、吳建霆、林昆霖

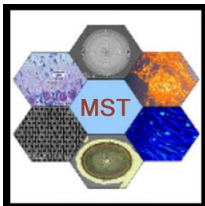
學校單位

國家實驗研究院台灣半導體研究中心

E-Mail

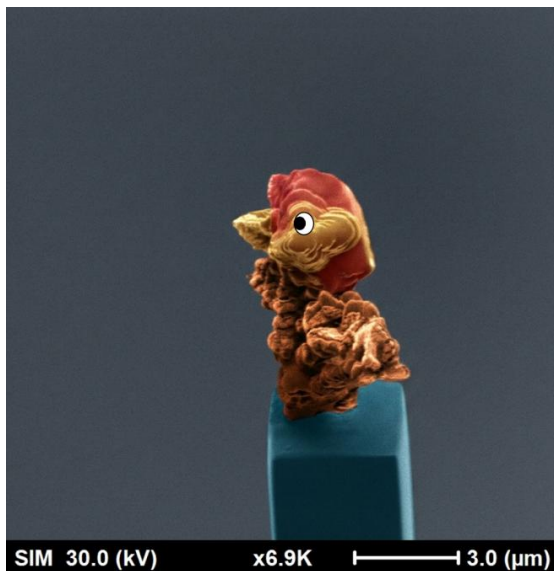
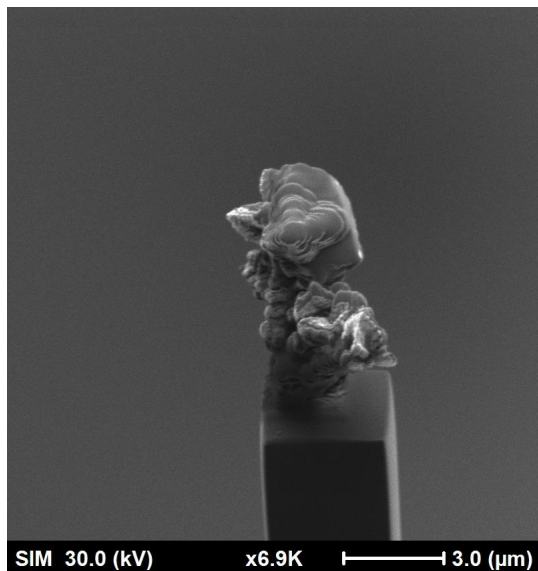
sct@nlar.org.tw

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作品名稱 咕雞鈷雞

作品內容

銅鈷樹枝狀晶在 FIB 影像下，其獨特層次構築出金雞意象。

作者姓名 何佳臻

學校單位 國立台灣大學

E-Mail 0530joanne@gmail.com

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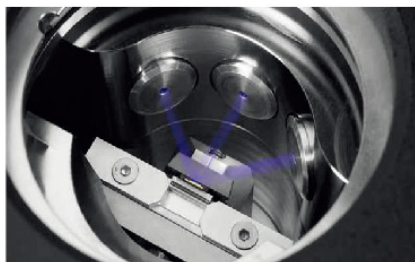
Leica EM TIC 3X 三離子束剖面拋光機 (CP)



無形變，無損傷的三離子束拋光

適用於任何材料，獲得一高品質且平整的剖面
以作為 OM / SEM / EDS / WDS / EBSD 觀察分析

馬鞍型三離子源集於一體



創新性的設計和操作

高效率，提高成本收益

- 可容納最大樣品尺寸為 50*50*10mm
- 可獲得高質量切割截面，區域尺寸可達 > 4*1mm
- 離子研磨速度高，Si材料300μm/h, 50μm 切割高度，可滿足實驗室高效率要求
- 可選用旋轉樣品載台進行平面拋光 (Top View)，可容納樣品尺寸為直徑 38mm

簡單易用，高精度

- 透過觸控螢幕進行簡單操控，不需要特別的操作技巧
- 樣品處理過程可即時監控，可以透過立體顯微鏡或 HD-TV CCD 觀察
- LED 照明，便於觀察樣品和位置校準
- 內置式真空系統，提供一個無振動的觀察視野
- 在製備好的平整切割截面上可再進行離子束蝕刻處理，增強樣品表面對比 (如晶界)
- 通過USB 即可進行參數和程序上的備份與載入



電顯試片前處理耗材及相關儀器

Sputter Coater

208HR High Resolution Sputter Coater for FE-SEM	108 auto Sputter Coater
easiGlow 91000 輝光放電機 (親水儀)	Targets for Sputter Coaters

Supplies / Accessories

Adhesives Conductive SEM Nonconductive	Adhesives Nonconductive Tabs/Tapes Adhesives Conductive Tabs/Tapes	Coring Punches with Plungers	Tweezers
TEM Grids	TEM Grid Storage Boxes	FIB Supplies	TEM Support Films



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台北業務部：TEL：02-29156277 FAX：02-29156221
電子信箱：pentad@pentad.com.tw 網址：www.pentad.com.tw



JSM-IT810
場發射式電子顯微鏡



JSM-IT810 是JEOL 全新旗艦型SEM機種，具備高解析的熱場發射式電子槍，全方位硬體設計，涵蓋多樣化的樣品需求，搭配整合式軟體，從樣品導航到報告輸出，提升分析產能

- In-lens Schottky 熱場發射式電子槍:提供充足穩定的電流
- 提供Semi In-lens(Model SIL) 及 Hybrid lens(model SHL/HL)兩系列共5種機型供選擇(SIL 及 SHL 系列均有Premium 及 Standard 兩種等級)
- Semi In-lens 系列提供高解析/高C/P 值選擇
- SEM Automatic Adjustment Package: 可定期做影像調整、倍率校正及EDS 能量標準來維持SEM性能與分析精確度
- Beam Deceleration 電子減速模式: 提升低電壓影像解析度
- Neo Action: 設定分析區域及條件，可自動拍照及EDS 分析



JSM-IT710HR
場發射式電子顯微鏡



JSM-IT710HR 是JEOL InTouchScope™ 系列的旗艦機種，具備高解析的場發射式電子槍，搭配全整合式軟體，從樣品導航到報告書出，全面提升分析產能。

- 提供300nA 大電流，滿足多元化的實驗需求
- 在高/低真空模式下，提供高解析的 SEI/BEI 影像
- 整合性的 EDS軟體
- 多點觸控與無線操控功能
- 根據樣品型態自動SEM 條件設定
- 多重動態影像及影片擷取功能
- ZeroMag 快速樣品導航功能
- Smile View Premium 影像銳化、拼接、重疊功能。



JSM-IT210
落地式鎢絲燈電子顯微鏡



標配高低真空模式JSM-IT210 是JEOL InTouchScope™ 系列的基礎機種，使用鎢燈絲熱游離式電子源，簡單好操作搭配全整合式軟體，具有高CP值從樣品導航到報告書出，全面提升分析產能。

- 輕鬆上手&高性價比
- ZeroMag 快速樣品導航功能
- SEI 偵測器&新型四區段BEI偵測器
- 電動X-Y移動樣品座
- Live EDS 能譜(Spectrum)與圖映(Mapping)分析
- Montage(拼圖)功能,大範圍自動拼接
- 3 分鐘快速樣品抽氣
- Smile View Lab 檔案報告管理系統



JCM-7000
桌上型電子顯微鏡



JCM-7000 是JEOL 桌上型電子顯微鏡機種，使用鎢燈絲熱游離式電子源，具有超簡易的使用體驗，顛覆你對操作電子顯微鏡的印象，搭配整合式元素分析儀全面提升分析產能。

- 標配高低真空模式
- ZeroMag 快速樣品導航功能
- SEI 偵測器&新型四區段BEI偵測器
- 電動X-Y移動樣品座
- Live EDS 能譜(Spectrum)與圖映(Mapping)分析
- Live 3D 動態3D量測圖
- Montage(拼圖)功能,大範圍自動拼接
- 3 分鐘快速樣品抽氣
- Smile View Lab 檔案報告管理系統



JEM-120i
120KV 穿透式電子顯微鏡



JEM-120i 是JEOL最新推出的120KV 穿透式電子顯微鏡

主要特色為:

1. 整體尺寸占地面積縮小了50%，體積更不到過去的1/3，而低於180cm 的高度，讓TEM 可以輕鬆適用於大部份的空間
2. 操作容易,強化版的控制系統與全自動孔徑(apertures)，在切換倍率時無須再手動切換孔徑。
3. 可擴充性,除了標配的多功能相機(Neo View Camera)外、可選配高畫素相機(Sight Sky Camera)/掃描穿透影像裝置(STEM)/能量分散式光譜儀(EDS)/冷凍觀察裝置(Cryo)及驗證的PyJEM 編程功能可編寫自動化流程