TROY TECHNICAL

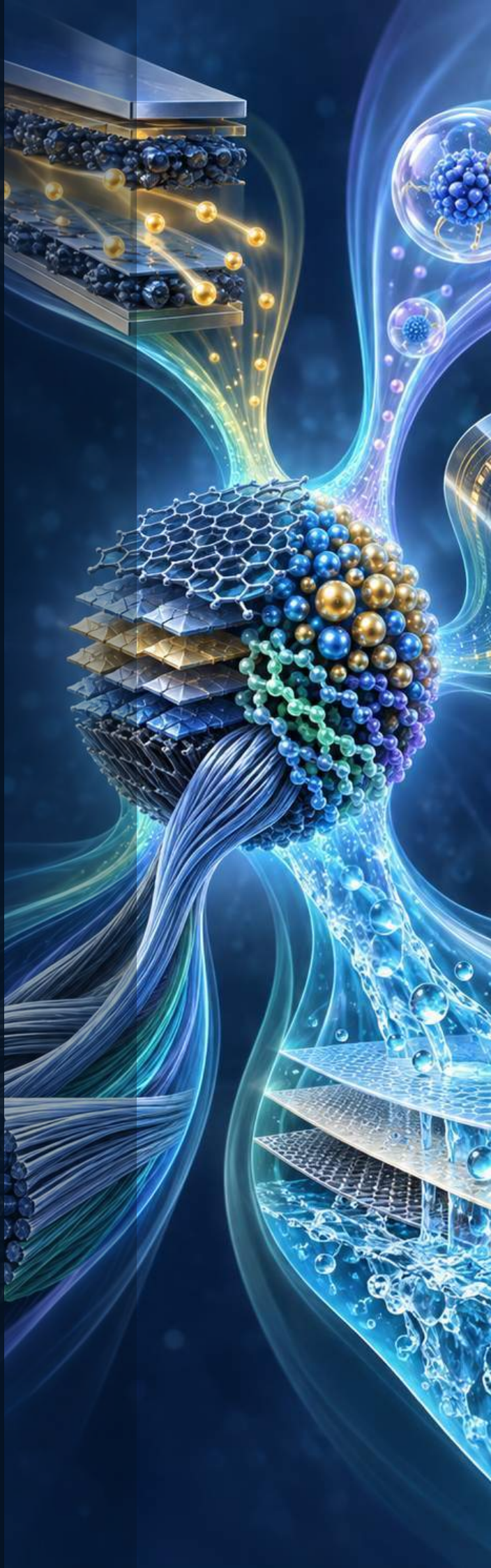
NANOTECHNOLOGY
WEEKLY REPORT

November 8 - November 14, 2026 | Issue 2026-W45

Translation from nanoscale property to reproducible, safe and scalable products

14	10
ANALYZED ARTICLES	PRIORITY THEMES

Issued 2026-11-14 | English edition | fixed approved cover artwork



Nanotechnology: the boundary moved from isolated claims to qualification evidence

14 English articles were reviewed independently from the Japanese edition. Ten themes are retained for management decisions.

SIGNAL 01 | NANO DESIGN

Graphene EMI Shielding Film: 400,000-Cycle Folding Durability

A joint research team from the Korea Institute of Industrial Technology (KITECH) and Hanyang University has developed a high-durability electromagnetic interference (EMI) shielding film that maintains performance after 400,000 folds.

SIGNAL 02 | SYNTHESIS

Mitsui Kinzoku and Kyoto University: MOF Glass for Hydrogen Production

Mitsui Kinzoku and Kyoto University have developed a proton-conducting Metal-Organic Framework (MOF) glass membrane capable of hydrogen production via water electrolysis at 170°C.

SIGNAL 03 | INTEGRATION

AR Waveguide Technology: POSTECH and Samsung's 1.5mm Lens Specs

Researchers from POSTECH and Samsung Research have developed an ultra-thin 1.5mm AR lens using metasurface waveguides to enable clear digital displays in bright outdoor environments.

SIGNAL 04 | APPLICATION

Korea University: Nano-plastic removal via ice crystal growth

A joint research team from Korea University and Myongji University developed a technique to remove up to 95% of nanoplastics from water using ice crystal growth and a bio-solvent.

DECISION

Focus this week's management attention on translation from nanoscale property to reproducible, safe and scalable products. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: prioritize applications with measurable system advantage and a credible qualification path.
2. Suppliers: prove dispersion, interface control, batch consistency, EHS and production economics.
3. Executives: track scale-up, metrology, toxicity, yield, interface stability and application-level value.

EVIDENCE DISCIPLINE

FACT states what the collected English source reports. BUSINESS READ and ACTION are editorial interpretations. UNKNOWN lists information that the source file does not establish. A linked article is not treated as independent confirmation of every claim.

Numbers and evidence anchors that require conditions

1.5mm
A12

SOURCE-BOUND CONDITION
Researchers from POSTECH and Samsung Research have developed an ultra-thin 1.5mm AR lens using metasurface waveguides to enable clear digital displays in bright outdoor environments.

95%
A05

SOURCE-BOUND CONDITION
A joint research team from Korea University and Myongji University developed a technique to remove up to 95% of nanoplastics from water using ice crystal growth and a bio-solvent.

109 nm
A03

SOURCE-BOUND CONDITION
Researchers have synthesized silica nanoparticles averaging 109 nm from end-of-life solar cell powder to enhance lithium-ion battery anodes.

94%
A04

SOURCE-BOUND CONDITION
Researchers from Huazhong University of Science and Technology and the National University of Singapore have developed a controllable oxygen doping method to reduce contact resistance in tungsten diselenide (WSe2) p-type.

158%
A01

SOURCE-BOUND CONDITION
The device demonstrates an SHG conversion efficiency of 158% W-1 and a 53% electrical modulation depth, enabling non-volatile control of optical responses.

HOW TO USE THESE NUMBERS
Each value is shown with the condition stated in the collected English article. Do not compare values across different test methods, device sizes, operating temperatures or commercial stages without normalizing those conditions.

Where the value chain moved

Each stage combines one leading theme and one supporting theme. The report treats handoffs as evidence transfers, not decorative arrows.

1

Nano design

P01/P06

A joint research team from the Korea Institute of Industrial Technology (KITECH) and Hanyang Universit y has developed a.

2

Synthesis

P02/P07

Mitsui Kinzoku and Kyoto University have developed a proton-co nducting Metal-Organi c Framework (MOF) glass membrane capable.

3

Integration

P03/P08

Researchers from POSTECH and Samsung Research have developed an ultra-thin 1.5mm AR lens using metasurface waveguides to.

4

Application

P04/P09

A joint research team from Korea University and Myongji University developed a technique to remove up to 95% of nanoplastics.

5

Scale & safety

P05/P10

Researchers have synthesized silica nanoparticles averaging 109 nm from end-of-life solar cell powder to enhance lithium-ion.

EVIDENCE REQUIRED AT EACH HANDOFF

Nano design to Synthesis	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale-up, metrology, toxicity, yield, interface stability and application-level value.
Synthesis to Integration	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale-up, metrology, toxicity, yield, interface stability and application-level value.
Integration to Application	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale-up, metrology, toxicity, yield, interface stability and application-level value.
Application to Scale & safety	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale-up, metrology, toxicity, yield, interface stability and application-level value.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented scale-up, metrology, toxicity, yield, interface stability and application-level value.

Priority map: maturity and next decision locus



P01	Graphene EMI Shielding Film: 400,000-Cycle Folding Durability System / adoption | cue: commercially
P02	Mitsui Kinzoku and Kyoto University: MOF Glass for Hydrogen Production Tech / process | cue: no system/business cue
P03	AR Waveguide Technology: POSTECH and Samsung's 1.5mm Lens Specs System / adoption | cue: commercial
P04	Korea University: Nano-plastic removal via ice crystal growth Tech / process | cue: no system/business cue
P05	Solar Panel Waste: Silica Nanoparticles for Battery Anodes Business / rules | cue: capacity
P06	WSe2 Transistors: Oxygen Doping Reduces Contact Resistance by 94% Tech / process | cue: no system/business cue
P07	NbOBr2 Ferroelectrics: Electrical Control of On-Chip SHG System / adoption | cue: integrated
P08	Apacer GraTherX: Copper-Graphene DDR5 Thermal Specs and Results Tech / process | cue: no system/business cue
P09	MOF Microfabrication: Tokyo University of Science 100nm Process System / adoption | cue: integration
P10	Korea University Photonics: 120,000x Light Amplification via Ultrathin Materials Tech / process | cue: no system/business cue

REPRODUCIBLE POSITIONING RULE

Horizontal position uses five discrete stages: Research, Prototype, Joint evaluation, Product adoption and Scale. The vertical bands classify the next decision locus: Tech / process, System / adoption, or Business / rules (including supply systems). Article-title cues take precedence; the overview is used only when the title is silent. These are categories, not impact ranks. Bubble diameter reflects the editorial score.

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P01 Graphene EMI Shielding Film: 400,000-Cycle Folding Durability

A08 | Nano design | Product adoption

2026-11-10

FACT

A joint research team from the Korea Institute of Industrial Technology (KITECH) and Hanyang University has developed a high-durability electromagnetic interference (EMI) shielding film that maintains performance after 400,000 folds. By utilizing commercially available materials to prevent graphene aggregation, the team established an eco-friendly water-based process compatible with existing mass-production lines.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 21/25 | MATURITY 4/5 | DECISION LOCUS: SYSTEM / ADOPTION

P02 Mitsui Kinzoku and Kyoto University: MOF Glass for Hydrogen Production

A11 | Synthesis | Product adoption

2026-11-10

FACT

Mitsui Kinzoku and Kyoto University have developed a proton-conducting Metal-Organic Framework (MOF) glass membrane capable of hydrogen production via water electrolysis at 170°C. This technology fills a critical material gap for electrolysis in the medium-temperature range of 150-250°C, enabling the utilization of industrial waste heat and steam.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P03 AR Waveguide Technology: POSTECH and Samsung's 1.5mm Lens Specs

A12 | Integration | Pilot

2026-11-12

FACT

Researchers from POSTECH and Samsung Research have developed an ultra-thin 1.5mm AR lens using metasurface waveguides to enable clear digital displays in bright outdoor environments. By precisely controlling light paths at the nanoscale, the team reduced light loss and color distortion, providing a technical foundation for commercial all-day AR glasses.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

P04 Korea University: Nano-plastic removal via ice crystal growth

A05 | Application | Pilot

2026-11-09

FACT

A joint research team from Korea University and Myongji University developed a technique to remove up to 95% of nanoplastics from water using ice crystal growth and a bio-solvent. By inducing particle aggregation during freezing, the team enabled the easy recovery of plastics as floating aggregates.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P05 Solar Panel Waste: Silica Nanoparticles for Battery Anodes

A03 | Scale & safety | Product adoption

2026-11-09

FACT

Researchers have synthesized silica nanoparticles averaging 109 nm from end-of-life solar cell powder to enhance lithium-ion battery anodes. Blending these particles into graphite anodes increased capacity to 370.34 mAh/g after 100 cycles, demonstrating a viable upcycling path for PV waste.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

P06 WSe2 Transistors: Oxygen Doping Reduces Contact Resistance by 94%

A04 | Nano design | Pilot

2026-11-12

FACT

Researchers from Huazhong University of Science and Technology and the National University of Singapore have developed a controllable oxygen doping method to reduce contact resistance in tungsten diselenide (WSe2) p-type transistors by approximately 94%. This breakthrough enables ballistic transport in 16 nm channel devices, positioning 2D semiconductors as a viable successor to silicon for sub-1 nm chip architectures.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P07 NbOBr2 Ferroelectrics: Electrical Control of On-Chip SHG

A01 | Synthesis | Pilot

2026-11-09

FACT

Researchers have integrated ferroelectric NbOBr2 with a silicon nitride microring resonator to achieve electrically reconfigurable second-harmonic generation (SHG) on a photonic chip. The device demonstrates an SHG conversion efficiency of 158% W-1 and a 53% electrical modulation depth, enabling non-volatile control of optical responses.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

P08 Apacer GraTherX: Copper-Graphene DDR5 Thermal Specs and Results

A14 | Integration | Joint evaluation

2026-11-12

FACT

Apacer has developed GraTherX, a copper-graphene composite thermal solution that reduces industrial DDR5 memory temperatures by over 20°C in fanless environments. The technology achieves high thermal balance across the module, significantly improving mean time between failures for compact or sealed industrial systems.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 19/25 | MATURITY 3/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P09 MOF Microfabrication: Tokyo University of Science 100nm Process

A10 | Application | Pilot

2026-11-11

FACT

Researchers at Tokyo University of Science have developed a method to microfabricate Metal-Organic Frameworks (MOFs) with approximately 100nm precision at room temperature. By introducing ionic liquids into MOF pores to stabilize the structure, the team suppressed damage caused by electron beams and ion beams. This breakthrough enables the integration of high-functionality MOFs into nano-devices via dry etching.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

P10 Korea University Photonics: 120,000x Light Amplification via Ultrathin Materials

A07 | Scale & safety | Pilot

Prior release 2026-11-07

FACT

Researchers at Korea University have developed a technique to amplify light intensity by approximately 120,000 times compared to single-layer materials using an ultrathin material. By implementing a "critical coupling" condition with a metal mirror, the team successfully converted near-infrared light into visible blue light. This advancement enables the miniaturization of next-generation optical devices and quantum technology.

WHY IT MATTERS

The decision relevance is translation from nanoscale property to reproducible, safe and scalable products. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, prove dispersion, interface control, batch consistency, EHS and production economics.

ACTION

Within 30 days, prioritize applications with measurable system advantage and a credible qualification path; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: scale-up, metrology, toxicity, yield, interface stability and application-level value.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

Playbook and 0-5 year roadmap

STAKEHOLDER	NOW | 0-30 DAYS	NEXT | 1-12 MONTHS	LATER | 1-5 YEARS
Operating companies	prioritize applications with measurable system advantage and a credible qualification path	Run production-like qualification with explicit acceptance and stop criteria.	Build a portfolio and architecture that can absorb technology and supplier changes.
Materials, equipment and technology suppliers	prove dispersion, interface control, batch consistency, EHS and production economics	Create shared reliability, process-window and failure-analysis data with customers.	Standardize interfaces, traceability, lifecycle support and recovery services.
Trading, investment and legal teams	Map scale-up, metrology, toxicity, yield, interface stability and application-le vel value.	Contract for capacity, quality, change notice, liability, alternatives and exit.	Diversify regional, technical and customer concentration risk.

ROADMAP

NOW | 0-30 DAYS
Evidence ledger
Owner: Strategy + quality
Deliverable: claim, source, condition, owner

NOW | 0-30 DAYS
Risk screen
Owner: Procurement + legal
Deliverable: unknowns, alternatives, stop

NEXT | 1-12 MONTHS
Joint qualification
Owner: R&D + supplier
Deliverable: process window and failure data

NEXT | 1-12 MONTHS
Commercial gate
Owner: Business + finance
Deliverable: unit economics and capacity

LATER | 1-5 YEARS
Platform strategy
Owner: Executive team
Deliverable: portfolio and interface roadmap

LATER | 1-5 YEARS
Service layer
Owner: Operations + channel
Deliverable: monitoring, maintenance and recovery

GO / NO-GO GATES

GATE	OWNER	REQUIRED EVIDENCE	NO-GO CONDITION
G1 Evidence	**Quality**	Source, test conditions and reproducibility	No traceable evidence
G2 Integration	**R&D**	Interface, process window and failure analysis	Cannot meet system conditions
G3 Commercial	**Business**	Capacity, total cost, contract and alternatives	Economics or supply cannot be supported
G4 Lifecycle	**Operations**	Monitoring, maintenance, change notice and exit	No accountable operating plan

ANALYZED ARTICLES | ITEMS 01-14

Every title and URL is displayed in full. URLs wrap without shortening and remain clickable. A verified-reference label means the translated HTML did not retain its original source URL.

ID	FULL ARTICLE TITLE	FULL SOURCE / VERIFIED REFERENCE URL - CLICKABLE
A01	NbOBr2 Ferroelectrics: Electrical Control of On-Chip SHG	https://doi.org/10.1038/s41565-026-02331-w
A02	Ti3C2Tx MXene: Delocalized Faradaic Processes and Proton Transport	https://doi.org/10.1038/s41467-026-79237-7
A03	Solar Panel Waste: Silica Nanoparticles for Battery Anodes	https://www.pv-magazine.com/2026/11/09/solar-panel-waste-yields-silica-nanoparticles-for-battery-anodes/
A04	WSe2 Transistors: Oxygen Doping Reduces Contact Resistance by 94%	https://news.qq.com/rain/a/20261112A096Z000
A05	Korea University: Nano-plastic removal via ice crystal growth	https://www.fnnews.com/news/202611091428352910
A06	DGIST Permanent Magnets: Reducing Heavy Rare Earth Use by 80%	https://news.bbsi.co.kr/news/articleView.html?idxno=4117708
A07	Korea University Photonics: 120,000x Light Amplification via Ultrathin Materials	https://www.pointdaily.co.kr/news/articleView.html?idxno=325164
A08	Graphene EMI Shielding Film: 400,000-Cycle Folding Durability	https://www.mtnews.net/news/articleView.html?idxno=26492
A09	NanoTerasu X-ray Ptychography: 7.4nm Resolution via Tender X-rays	https://www.nikkei.com/article/DGXZRSP715163_S6A111C2000000/
A10	MOF Microfabrication: Tokyo University of Science 100nm Process	https://www.nikkei.com/article/DGXZRSP715097_R11C26A1000000/
A11	Mitsui Kinzoku and Kyoto University: MOF Glass for Hydrogen Production	https://response.jp/article/2026/11/10/418829.html
A12	AR Waveguide Technology: POSTECH and Samsung's 1.5mm Lens Specs	https://www.dailian.co.kr/news/view/1712591/%EA%B5%AD%EB%82%B4-%EC%97%B0%EA%B5%AC%EC%A7%84-%EB%91%90%EA%BB%98-15%E3%8E%9C-AR-%EB%A0%8C%EC%A6%88-2026
A13	Landau-Zener-Majorana Transitions: Graphene Quantum Jumps Captured	https://sciencedaily.com/releases/2026/11/261112025523.htm
A14	Apacer GraTherX: Copper-Graphene DDR5 Thermal Specs and Results	https://www.graphene-info.com/apacer-s-copper-graphene-layer-cuts-ddr5-memory-temperatures-more-20-c-without

Nanotechnology — Selected Articles

Date: 2026-11-15

Articles: 14

Table of Contents

#01 NbOBr2 Ferroelectrics: Electrical Control of On-Chip SHG

#02 Ti3C2Tx MXene: Delocalized Faradaic Processes and Proton Transport

#03 Solar Panel Waste: Silica Nanoparticles for Battery Anodes

#04 WSe2 Transistors: Oxygen Doping Reduces Contact Resistance by 94%

#05 Korea University: Nano-plastic removal via ice crystal growth

#06 DGIST Permanent Magnets: Reducing Heavy Rare Earth Use by 80%

#07 Korea University Photonics: 120,000x Light Amplification via Ultrathin Materials

#08 Graphene EMI Shielding Film: 400,000-Cycle Folding Durability

#09 NanoTerasu X-ray Ptychography: 7.4nm Resolution via Tender X-rays

#10 MOF Microfabrication: Tokyo University of Science 100nm Process

#11 Mitsui Kinzoku and Kyoto University: MOF Glass for Hydrogen Production

#12 AR Waveguide Technology: POSTECH and Samsung's 1.5mm Lens Specs

#13 Landau-Zener-Majorana Transitions: Graphene Quantum Jumps Captured

#14 Apacer GraTherX: Copper-Graphene DDR5 Thermal Specs and Results

#01 NbOBr2 Ferroelectrics: Electrical Control of On-Chip SHG

Published November 09, 2026 Nature Nanotechnology



OVERVIEW

Researchers have integrated ferroelectric NbOBr2 with a silicon nitride microring resonator to achieve electrically reconfigurable second-harmonic generation (SHG) on a photonic chip. The device demonstrates an SHG conversion efficiency of 158% W^{-1} and a 53% electrical modulation depth, enabling non-volatile control of optical responses.

IN DEPTH

Key Findings

The integration of ferroelectric NbOBr2 films into a silicon nitride microring resonator has enabled the realization of electrically reconfigurable second-harmonic generation (SHG) on a photonic chip. The device achieves an SHG conversion efficiency of 158% W^{-1} under continuous-wave excitation and a 53% electrical modulation depth. Furthermore, the system supports non-volatile control, as polarization states can be programmed over multiple levels and retained after switching.

Technical Details

The device utilizes NbOBr2 films with thicknesses ranging from 20 nm to 40 nm. The material combines strong second-order susceptibility, resulting from intrinsic inversion-symmetry breaking, with in-plane ferroelectric polarisation that is electrically switchable. Control is achieved by modulating the Schottky barrier at the NbOBr2–metal interface, which in turn regulates carrier injection, dispersion, and free carrier absorption to tune the cavity-enhanced nonlinear response.

Background and Context

Niobium oxide dihalide films are known for SHG efficiency that scales with thickness due to weak interlayer electronic coupling. However, their application in integrated nonlinear photonics has previously been limited by a lack of robust electrical tuneability. This research addresses that gap by leveraging the ferroelectric properties of NbOBr2 to provide a mechanism for active electrical reconfiguration.

Significance and Outlook

The ability to program and retain polarization states allows for the non-volatile manipulation of optical responses on-chip. To demonstrate the practical utility of this technology, the researchers used the fundamental and frequency-converted outputs as complementary channels to perform dual-channel edge detection. This development provides a pathway for more flexible and efficient integrated nonlinear photonic devices.

Source: https://doi.org/10.1038/s41565-026-02331-w

#02 Ti3C2Tx MXene: Delocalized Faradaic Processes and Proton Transport

Published November 09, 2026 Nature Communications



OVERVIEW

Researchers have demonstrated that electrochemical reactions on isolated Ti3C2Tx MXene flakes occur across areas far exceeding the immediate contact point of the probe. This delocalization is mediated by thin interfacial water layers, providing fundamental insights into long-range proton diffusion and hydrogen storage on monolayer flakes.

IN DEPTH

Key Findings

Scanning X-ray microscopy (SXM) and scanning electrochemical cell microscopy (SECCM) have revealed that Faradaic processes on Ti3C2Tx MXene flakes are delocalized. For reactions including electrochemical oxidation and the hydrogen evolution reaction, the reactions extend well beyond the MXene flake area in direct contact with the droplet cell. Additionally, the study provides evidence of hydrogen storage on monolayer MXene flakes.

Technical Details

The researchers used SECCM to probe localized regions of monolayer MXene flakes with a probe radius of approximately 300 nm. They observed anomalously high capacitance values when normalized to the probe contact area, exceeding those of state-of-the-art devices. However, when normalized to the total flake area, the capacitance aligned with existing benchmarks. This discrepancy indicates a highly efficient, long-range proton diffusion pathway across the MXene surface. This mechanism is supported by the presence of a thin electrolyte film—approximately 5 nm in thickness—that forms a tenuous ionic bridge, drawing water from the droplet toward the material under reaction conditions.

Background and Context

MXenes are 2D transition metal carbides and nitrides valued for their high conductivity, hydrophilicity, and ultrafast intercalation kinetics. While O-terminated Ti3C2Tx shows superior performance for H+ intercalation due to confined water molecules in interlayers, it is prone to spontaneous oxidation to TiO2. Previous macroscale studies noted that planar electrodes sometimes exhibited higher gravimetric capacitances than macroporous ones, contradicting the assumption that increasing accessible surface area is the primary driver of capacitance. This suggested that lateral 2D proton transport along the MXene surface plays a critical role.

Significance and Outlook

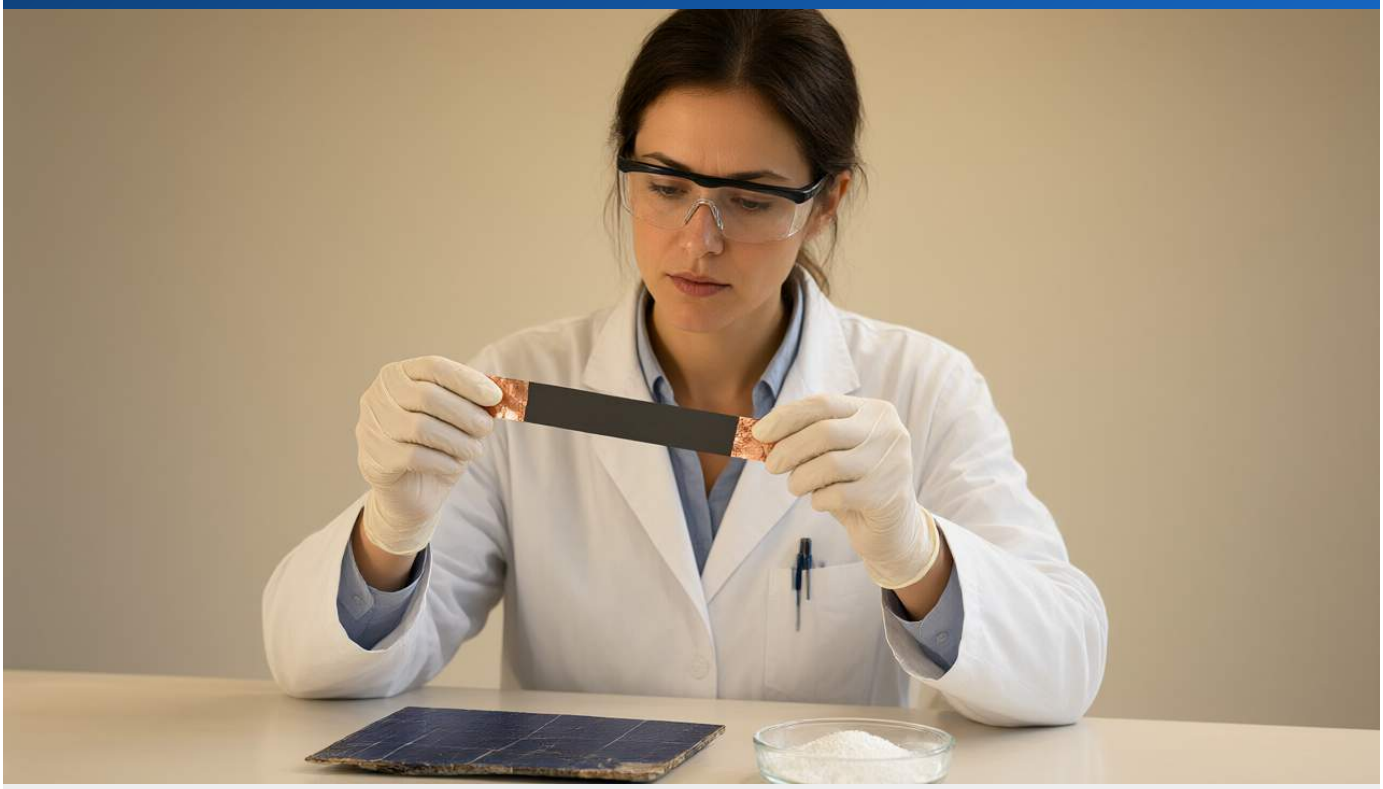
By decoupling intercalation from redox pseudocapacitance at the single-flake level, this work clarifies the role of interfacial water in mediating electrochemical connectivity over micron-scale distances. These insights address a major bottleneck in the scale-up of MXene-based energy storage devices by explaining the intrinsic electrochemical behavior and the influence of surface terminations on stability and performance.

Source: https://doi.org/10.1038/s41467-026-79237-7

Collected: November 14, 2026 | Automated Research System (AI)

#03 Solar Panel Waste: Silica Nanoparticles for Battery Anodes

Published November 09, 2026 pv magazine International USA



OVERVIEW

Researchers have synthesized silica nanoparticles averaging 109 nm from end-of-life solar cell powder to enhance lithium-ion battery anodes. Blending these particles into graphite anodes increased capacity to 370.34 mAh/g after 100 cycles, demonstrating a viable upcycling path for PV waste.

IN DEPTH

Key Findings

The integration of solar-waste-derived silica nanoparticles into graphite anodes significantly improves battery performance. In laboratory coin half-cells, an anode composed of 95% graphite and 5% silica by weight delivered a capacity of 370.34 mAh/g after 100 cycles at 0.1 A/g, compared to 308.24 mAh/g for pure graphite. The blended anode also showed a first-cycle Coulombic efficiency of 86.17%, surpassing the 79.14% achieved by graphite alone. At a higher current of 1.0 A/g, the blended anode retained 24.6% of its capacity, roughly double the 12.5% retention of pure graphite.

Technical Details

The production process begins by reacting silicon-containing powder from end-of-life panels with water and sodium hydroxide to create a sodium silicate solution. This solution serves as the precursor for a modified Stöber process, where silica particles are grown in an alkaline mixture of alcohol and ammonia. Unlike previous acid precipitation methods that often result in clumped particles, this alkaline route produces spherical particles without the need for polymer additives or surfactants.

The resulting nanoparticles averaged 109 nm in diameter, slightly larger than the 97 nm particles produced from commercial sodium silicate under identical conditions. Elemental analysis indicated the presence of sodium (approximately 4%) and aluminum (less than 1%), which the researchers attributed to panel waste and precursor residue; however, these levels did not noticeably affect performance.

Background & Context

The study, published in the International Journal of Electrochemical Science, was funded by the Korea Environment Industry & Technology Institute and the National Research Foundation of Korea. This research aligns with South Korea's extended producer responsibility rules for PV modules implemented in 2023, which saw 688 metric tons recycled in the first year. Other similar efforts include 2023 research in Australia and 2024 work by Gyeongsang National University to recover high-purity silicon powder for silicon oxide compounds.

Significance & Outlook

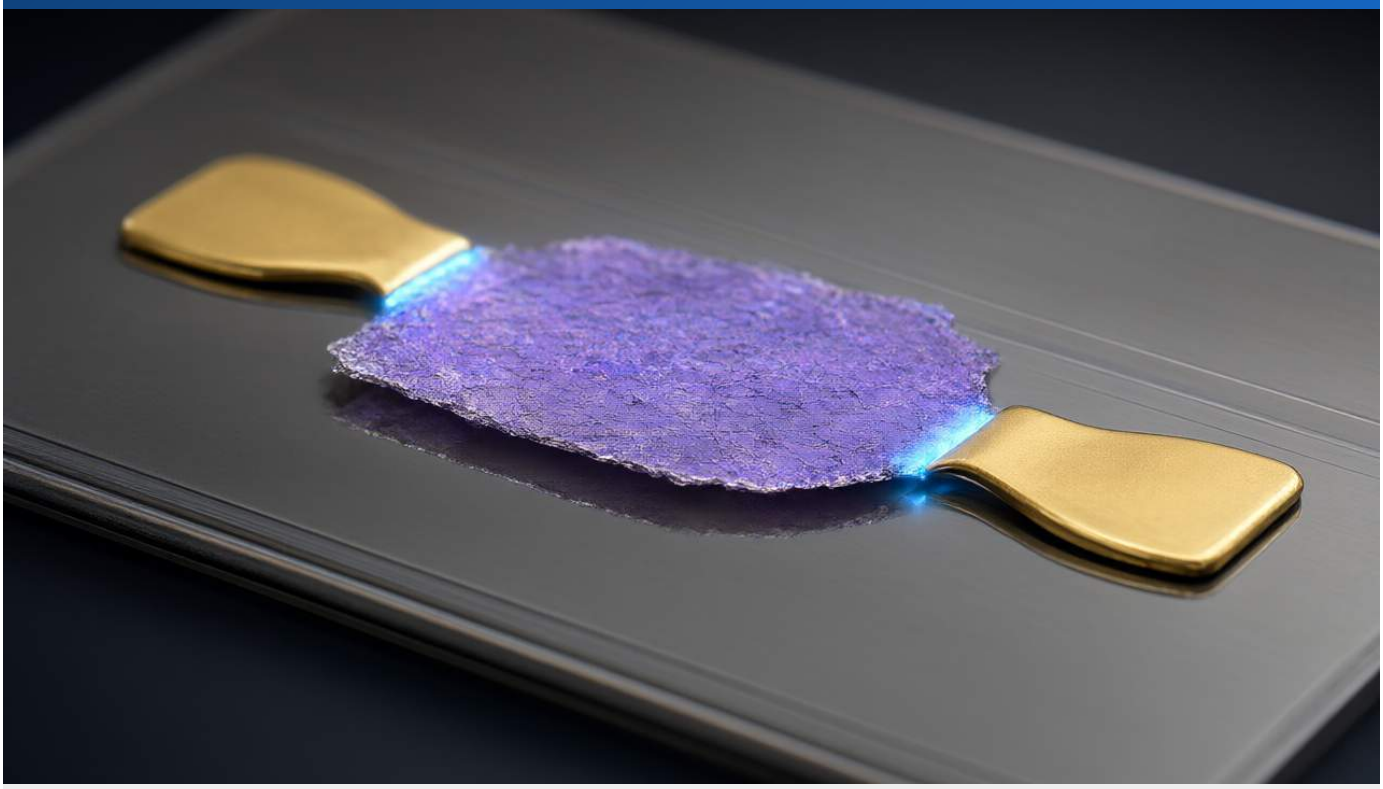
While the current study tested silica as-is, the researchers noted that converting these nanoparticles to silicon could further increase lithium storage capacity. Future work will focus on the reduction of nanoparticles to silicon for use as silicon anode materials.

Source: https://www.pv-magazine.com/2026/11/09/solar-panel-waste-yields-silica-nanoparticles-for-battery-anodes/

Collected: November 14, 2026 | Automated Research System (AI)

#04 WSe2 Transistors: Oxygen Doping Reduces Contact Resistance by 94%

Published November 12, 2026　腾讯新闻（DeepTech深科技）　China



OVERVIEW

Researchers from Huazhong University of Science and Technology and the National University of Singapore have developed a controllable oxygen doping method to reduce contact resistance in tungsten diselenide (WSe2) p-type transistors by approximately 94%. This breakthrough enables ballistic transport in 16 nm channel devices, positioning 2D semiconductors as a viable successor to silicon for sub-1 nm chip architectures.

IN DEPTH

Key Findings

A joint research team has successfully reduced the contact resistance of WSe2 transistors from 1,869 ohm-micrometers to 104 ohm-micrometers, representing a reduction of approximately 94%. Additionally, the hole mobility of the material increased from 55 $cm^2V^{-1}s^{-1}$ to 218.3 $cm^2V^{-1}s^{-1}$. These improvements were achieved through a novel oxygen doping process that repairs selenium vacancies and optimizes the metal-semiconductor interface.

Technical Details

The team utilized oxygen atoms to fill selenium vacancies within the WSe2 structure, forming stable chemical bonds that smooth the electronic structure of the interface. The researchers compared two process sequences and found that "post-doping"—applying oxygen annealing after the fabrication of metal electrodes—was significantly more effective. This method allows oxygen to penetrate through microscopic gaps in the metal, creating a near-perfect Ohmic contact while avoiding damage to the material that can occur during pre-doping.

To further optimize performance, the team implemented a "full-contact" structure combining top and edge contacts to maximize the contact area and minimize energy loss. In a device with a channel length of 16 nm, the transistor achieved a saturation current of 1,635 microamps per micrometer and a ballistic transport ratio of 81% at room temperature.

Background & Context

As silicon reaches its physical limits regarding leakage and heat generation, 2D semiconductor materials—which are only one atom thick—have emerged as candidates for next-generation chips. While n-type transistors have progressed, p-type transistors using WSe2 have been hindered by high contact resistance and selenium vacancies, which act as obstacles to hole movement.

Significance & Outlook

The results demonstrate that 2D p-type transistors can outperform previous silicon-based devices in specific metrics, clearing a major hurdle for sub-1 nm chip development. However, the researchers note that transitioning from silica substrates to high-k dielectric insulating layers and achieving large-scale, uniform material growth in factory environments remain the primary challenges for commercialization.

Source: https://news.qq.com/rain/a/20261112A096Z000

Collected: November 14, 2026 | Automated Research System (AI)

#05 Korea University: Nano-plastic removal via ice crystal growth

Published November 09, 2026 파이낸셜뉴스 (뉴스1) South Korea



OVERVIEW

A joint research team from Korea University and Myongji University developed a technique to remove up to 95% of nanoplastics from water using ice crystal growth and a bio-solvent. By inducing particle aggregation during freezing, the team enabled the easy recovery of plastics as floating aggregates.

IN DEPTH

Key Findings

Researchers from Korea University and Myongji University have developed a separation technology that removes 90% to 95% of nanoplastic particles from water through a single freeze-thaw cycle. The process utilizes the growth of ice crystals and a plant-derived bio-solvent to aggregate particles that are otherwise stable and dispersed in water.

Technical Details

The technology leverages the physical process of ice crystal growth. As water freezes, nanoplastic particles and a bio-solvent are pushed into the narrow spaces between growing ice crystals, increasing their local concentration. This proximity promotes the aggregation of the particles.

- **Bio-solvent:** The plant-derived solvent 'd-limonene' was found to be particularly effective in promoting nanoplastic aggregation in sub-zero environments.
- **Experimental Results:** The team tested three types of 100-nanometer (㎚) polystyrene nanoplastics with different surface characteristics.
- **Recovery Method:** The aggregated particles grew into micrometer (㎛) sized clumps that remained aggregated after thawing. Because these aggregates combined with the bio-solvent have a lower density than water, they float to the surface, allowing for simple removal and recovery.

Background & Context

Nanoplastics are difficult to remove because their small size and stability in water prevent them from settling naturally. Previous removal methods relied on coagulants, adsorbents, or separation membranes. However, these traditional methods often required additional chemical substances or specialized separation materials, and their efficiency varied depending on the surface characteristics of the particles.

Significance & Outlook

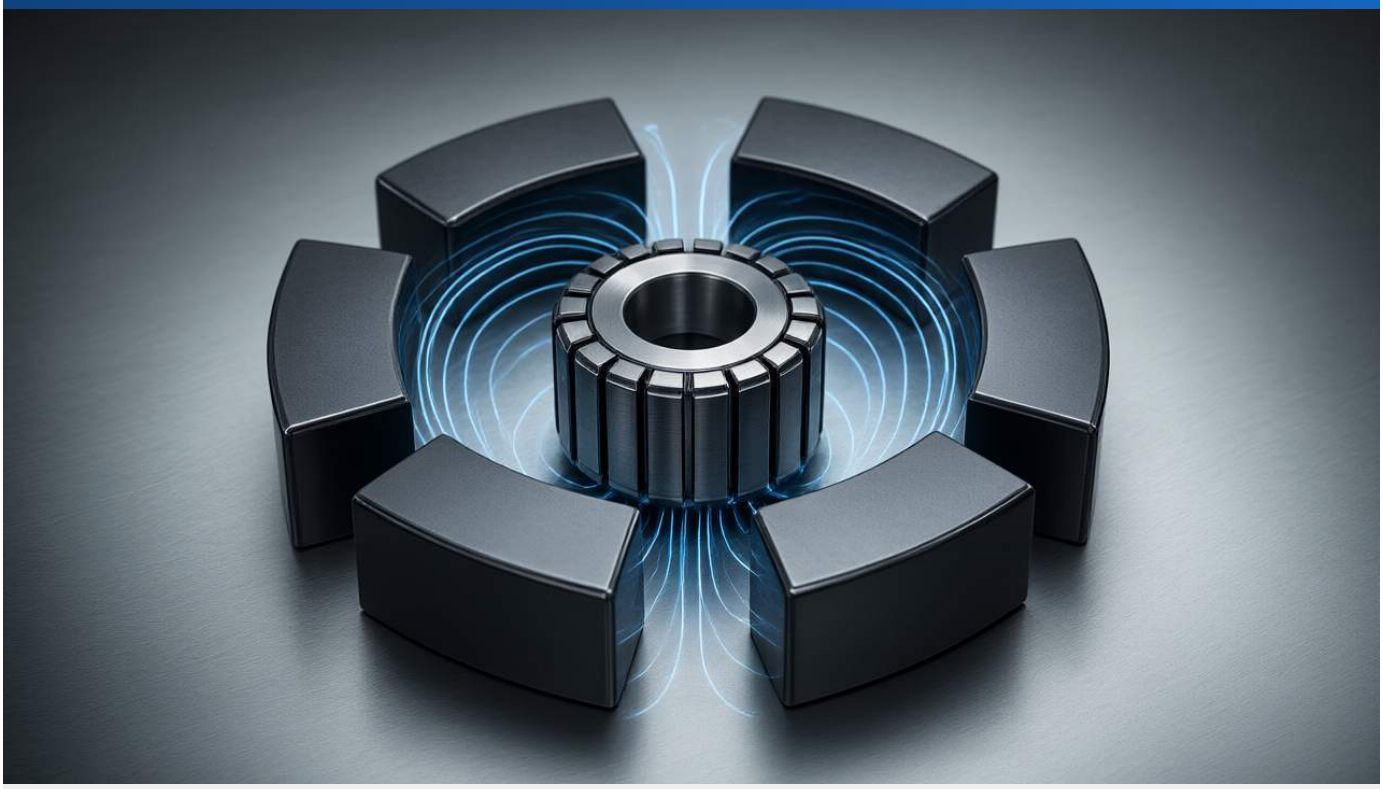
This method provides a new approach to nanoplastic separation that does not depend on chemical coagulants or solid adsorbents. The research was supported by the Engineering Research Center (ERC) project of the National Research Foundation of Korea and was published online on the 14th of last month in the *Chemical Engineering Journal*. Future work will focus on verifying performance in actual water environments and improving cooling energy efficiency and the recovery and reuse of the bio-solvent.

Source: https://www.fnnews.com/news/202611091428352910

Collected: November 14, 2026 | Automated Research System (AI)

#06 DGIST Permanent Magnets: Reducing Heavy Rare Earth Use by 80%

Published November 10, 2026 BBS NEWS (불교방송) South Korea



OVERVIEW

Researchers at DGIST have developed a material design technology that reduces the consumption of expensive heavy rare earth elements in high-performance permanent magnets by 80%. By optimizing the diffusion process to prevent material clustering, the team achieved high-temperature stability without sacrificing magnetic performance.

IN DEPTH

Key Findings

A research team led by Jung-min Kim and Dong-hwan Kim at the DGIST Nanotechnology Research Department has developed a material design technology that significantly reduces the waste of heavy rare earth elements used in high-performance permanent magnets. The team successfully reduced the amount of dysprosium, a representative heavy rare earth element, by 80% compared to existing methods while maintaining equivalent magnetic performance.

Technical Details

The research focused on neodymium permanent magnets, which are essential for electric vehicle (EV) drive motors and wind turbines. To maintain magnetic strength at high temperatures, these magnets require the addition of expensive heavy rare earth elements. However, the team identified a critical inefficiency in existing processes: heavy rare earth elements failed to disperse evenly within the magnet, instead clustering near the surface, leading to resource waste.

To resolve this, the researchers precisely analyzed the cause of this overconsumption and redesigned the composition of the diffusion material applied to the surface. This new design takes into account the ratio of light rare earth elements contained in the magnet base material. This approach suppresses the clustering phenomenon and induces the formation of a thin, uniform shell on the particle surfaces.

Background & Context

The development addresses the high cost and inefficiency associated with the heavy rare earth elements necessary for the stability of neodymium magnets in high-temperature environments. The findings of this study have been published in the *Chemical Engineering Journal*, a global academic journal specializing in materials and chemical engineering.

Significance & Outlook

According to senior researcher Jung-min Kim, this research provides a material design strategy to drastically reduce the use of expensive heavy rare earths by precisely controlling their movement and distribution. The team intends to expand the application of this technology to light rare earth-based processes to improve the efficient use of rare earth resources and strengthen technical competitiveness for next-generation high-performance permanent magnets.

Source: https://news.bbsi.co.kr/news/articleView.html?idxno=4117708

Collected: November 14, 2026 | Automated Research System (AI)

#07 Korea University Photonics: 120,000x Light Amplification via Ultrathin Materials

Published November 07, 2026 포인트데일리 South Korea



OVERVIEW

Researchers at Korea University have developed a technique to amplify light intensity by approximately 120,000 times compared to single-layer materials using an ultrathin material. By implementing a "critical coupling" condition with a metal mirror, the team successfully converted near-infrared light into visible blue light. This advancement enables the miniaturization of next-generation optical devices and quantum technology.

IN DEPTH

Key Findings

A research team led by Professors Park Kyu-hwan and Kong Su-hyun at Korea University has succeeded in amplifying the intensity of second-harmonic generation (SHG) by approximately 120,000 times relative to single-layer materials. The team achieved this by utilizing an ultrathin material—roughly 1/1000th the thickness of a human hair—to trap light within the material layer.

Technical Details

The core of the technology lies in utilizing the optical properties of metal mirrors to trap light without requiring complex processing. The researchers focused on the phase change that occurs when light reflects off metal. By implementing "critical coupling" to minimize the reflection of incident light, the team maximized the interaction between the light and the material.

- **Material and Structure:** The experiment utilized a molybdenum disulfide material with a thickness of approximately 55 nanometers (nm), topped with a semi-transparent metal mirror.
- **Design Standard:** The team established a design criterion to determine the optimal resonator structure based solely on the material's refractive index and absorption characteristics, replacing the previous need to find specific structures for each individual material.
- **Frequency Conversion:** The system converts near-infrared light with a wavelength of 910nm into blue visible light with a wavelength of 455nm.

Background & Context

Traditionally, creating resonators for light amplification required complex fabrication processes and material-specific structural searches. The developed method differentiates itself by allowing the implementation of the resonator through a simple layering process of thin films.

Significance & Outlook

This frequency conversion technology is expected to be applied across various high-tech fields, including quantum technology and next-generation optical devices. Because the enhancement of light interaction is achieved through ultrathin materials without complex optical structures, the technology is projected to improve manufacturing efficiency and enable the miniaturization of related optical components.

The findings were published in the October 24 issue of the journal *Nature Communications* under the title "Critically coupled zeroth-order resonance for ultrathin nonlinear photonics."

Source: https://www.pointdaily.co.kr/news/articleView.html?idxno=325164

Collected: November 14, 2026 | Automated Research System (AI)

#08 Graphene EMI Shielding Film: 400,000-Cycle Folding Durability

Published November 10, 2026 기계신문 South Korea



OVERVIEW

A joint research team from the Korea Institute of Industrial Technology (KITECH) and Hanyang University has developed a high-durability electromagnetic interference (EMI) shielding film that maintains performance after 400,000 folds. By utilizing commercially available materials to prevent graphene aggregation, the team established an eco-friendly water-based process compatible with existing mass-production lines.

IN DEPTH

Key Findings

The developed EMI shielding film, approximately 0.1 mm thick, reduces electromagnetic energy to 1/100,000 of its original level. In folding tests with a curvature radius of 3 mm, the film maintained 99.4% of its shielding performance and 97.9% of its electrical conductivity after 400,000 repetitions, showing no visible external damage. Additionally, the material retained over 92.5% of its initial performance under harsh conditions, including high temperature, high humidity, artificial sweat, and rapid temperature fluctuations.

Technical Details

The research team solved the common issue of graphene aggregation—which typically degrades performance—by identifying the core molecular structure required for uniform dispersion. Instead of expensive specialty dispersants or chemical treatments that impair electrical properties, the team used triethylamine, a commercially available general-purpose substance. Graphene solutions using this additive showed no precipitation even after six months.

The film is produced via an eco-friendly water-based process that composites the uniformly dispersed graphene with:

- Flexible plastic materials for overall flexibility.
- Plant-derived cellulose nanofibers to reinforce bonding between graphene layers.
- Carbon nanotubes to maximize electrical conductivity.

These components create a brick-like structural arrangement that prevents cracking during repeated bending.

Background and Context

Graphene is highly valued for displays, future mobility, aerospace, and medical devices due to its lightweight nature and superior electrical conductivity. However, its tendency to clump has historically limited mass production. Previous solutions relied on complex synthesis or costly additives, creating barriers to industrial application.

Significance and Outlook

Because the process uses a water-based system and common materials, it can be integrated into existing roll-to-roll coating and film production lines without requiring equipment changes. This significantly lowers the barrier to mass production. The technology is positioned as a key material for next-generation electronic devices and automotive parts, particularly for solving heat and EMI interference issues in high-density, high-flexibility applications such as foldable displays.

Source: https://www.mtnews.net/news/articleView.html?idxno=26492

Collected: November 14, 2026 | Automated Research System (AI)

#09 NanoTerasu X-ray Ptychography: 7.4nm Resolution via Tender X-rays

Published November 12, 2026　日本経済新聞（東北大学プレスリリース）　Japan



OVERVIEW

Researchers at Tohoku University have achieved a spatial resolution of 7.4nm using tender X-ray ptychography at the NanoTerasu facility. By utilizing a 400mA current operation, the team successfully visualized the fine structure of gold nanocubes. This advancement enables high-resolution imaging of semiconductor devices and battery or catalyst materials.

IN DEPTH

Key Findings

A research team from Tohoku University has achieved a projection spatial resolution of 7.4nm, breaking the 10nm barrier using tender X-ray ptychography. The study utilized the BL10U beamline at the 3GeV high-brightness synchrotron radiation facility, NanoTerasu. The researchers successfully demonstrated this resolution by clearly visualizing the fine structure of gold nanocubes.

Technical Details

The experiment was conducted under 400mA operation, a current level NanoTerasu reached in November 2025. The technical setup employed 4.5keV tender X-rays combined with the following hardware:

- Advanced Kirkpatrick-Baez total reflection focusing mirrors
- CITIUS high-speed integrating X-ray image detectors

The team performed image reconstruction by integrating diffraction data acquired across multiple detector positions.

Background and Context

X-ray ptychography is recognized as a high-resolution, non-destructive observation method. While high-resolution imaging below 10nm had previously been realized using soft and hard X-rays, achieving similar resolution in the intermediate "tender X-ray" region had remained difficult. This research, led by graduate student Yuhei Sasaki, Associate Professor Shi Ishiguro, and Professor Yukio Takahashi, addresses this gap.

Significance and Outlook

The ability to achieve sub-10nm resolution with tender X-rays is expected to expand the analysis of materials that rely on specific absorption edges, such as phosphorus and sulfur. Potential applications include:

- High-resolution element and chemical state imaging for battery and catalyst materials.
- Detailed structural analysis of semiconductor devices.

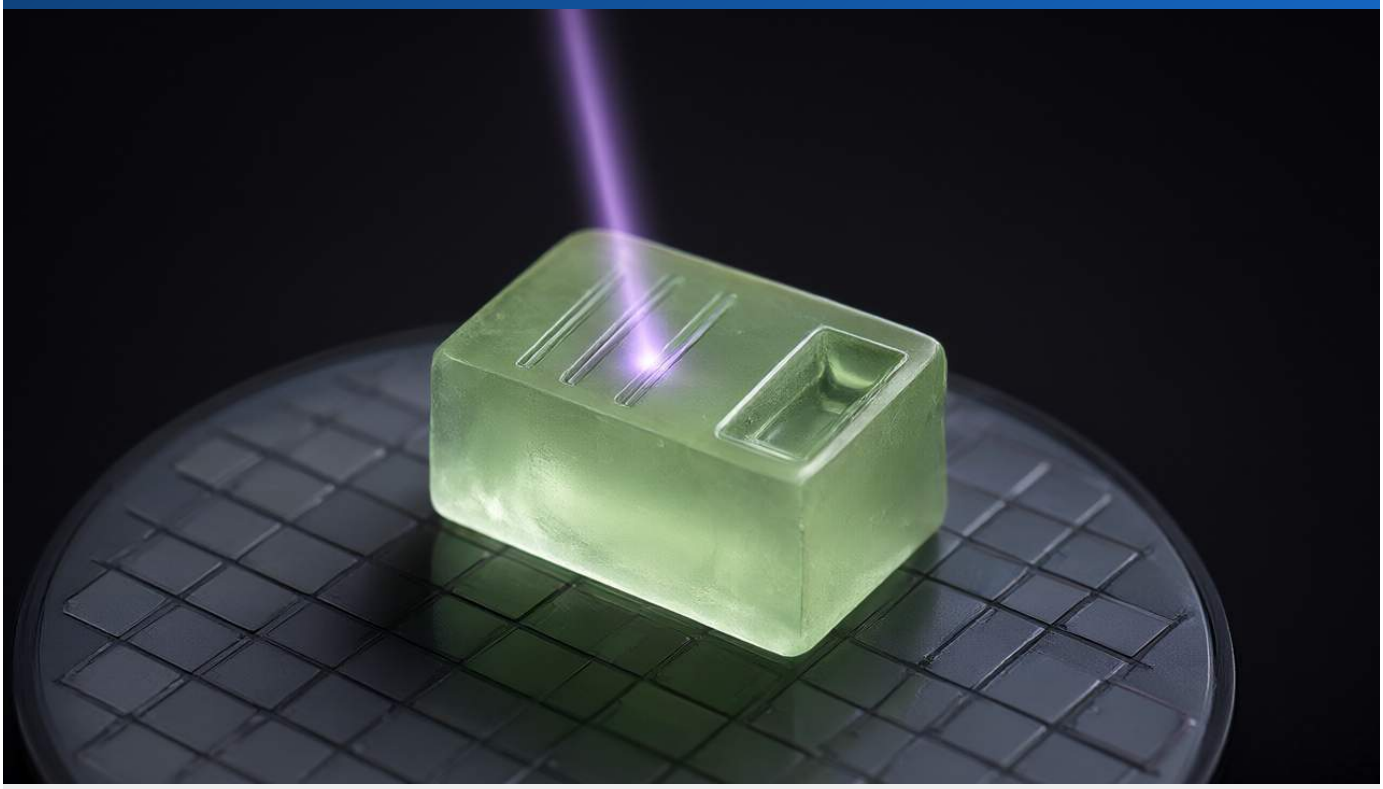
The findings of this study were published in the Journal of Synchrotron Radiation on November 12, 2026.

Source: https://www.nikkei.com/article/DGXZRSP715163_S6A111C2000000/

Collected: November 14, 2026 | Automated Research System (AI)

#10 MOF Microfabrication: Tokyo University of Science 100nm Process

Published November 11, 2026　日本経済新聞（東京理科大学プレスリリース）　Japan



OVERVIEW

Researchers at Tokyo University of Science have developed a method to microfabricate Metal-Organic Frameworks (MOFs) with approximately 100nm precision at room temperature. By introducing ionic liquids into MOF pores to stabilize the structure, the team suppressed damage caused by electron beams and ion beams. This breakthrough enables the integration of high-functionality MOFs into nano-devices via dry etching.

IN DEPTH

Key Findings

A research group led by Assistant Professor Yumeng Zheng and Professor Kentaro Kinoshita at the Tokyo University of Science has successfully achieved high-precision microfabrication of Metal-Organic Frameworks (MOFs). By utilizing ionic liquids to protect the material, the team performed dry etching at room temperature with a precision of approximately 100nm.

Technical Details

The primary challenge in MOF fabrication is the material's vulnerability to electron beams and ion beams, which typically cause the structure to decompose or sustain damage. To resolve this, the researchers introduced ionic liquids into the nanopores of the MOF to stabilize the framework. Key technical observations include:

- **Damage Suppression:** The introduction of ionic liquids significantly inhibited structural degradation during beam exposure.
- **Material Variability:** The research revealed that fabrication resistance varies depending on the specific type of ionic liquid used.
- **Degradation Mechanism:** The study suggests that beam-induced damage is linked to the reduction of copper ions from Cu2+ to Cu+ or Cu0, as well as the cleavage of Cu-O bonds.

Background and Context

MOFs are functional materials characterized by high specific surface areas and nanopores, making them highly promising for applications in sensors, catalysts, and gas separation and adsorption. However, their fragility under beam irradiation has historically hindered their application in device manufacturing, as standard microfabrication processes often destroy the material's integrity.

Significance and Outlook

This simplified method of protecting MOFs with ionic liquids enables dry etching processes that were previously considered difficult. The ability to process these materials without structural collapse provides a pathway for incorporating MOFs into high-performance nano-devices. The findings were published online in the journal Communications Materials on November 10, 2026.

Source: https://www.nikkei.com/article/DGXZRSP715097_R11C26A1000000/

Collected: November 14, 2026 | Automated Research System (AI)

#11 Mitsui Kinzoku and Kyoto University: MOF Glass for Hydrogen Production

Published November 10, 2026　レスポンス（Response.jp）　Japan



OVERVIEW

Mitsui Kinzoku and Kyoto University have developed a proton-conducting Metal-Organic Framework (MOF) glass membrane capable of hydrogen production via water electrolysis at 170°C. This technology fills a critical material gap for electrolysis in the medium-temperature range of 150–250°C, enabling the utilization of industrial waste heat and steam.

IN DEPTH

Key Findings

Mitsui Kinzoku and a research group led by Professor Satoshi Horige of the Graduate School of Science at Kyoto University have successfully produced hydrogen through water electrolysis using 170°C steam. This achievement was made possible by the development of a new proton-conducting MOF (Metal-Organic Framework) glass membrane designed to function in medium-temperature environments.

Technical Details

The research focuses on MOF glass, a material derived from Metal-Organic Frameworks. MOFs are porous materials composed of metal ions and organic molecules. The researchers utilized MOF glass due to its specific characteristics, which include:

- The ability to incorporate molecules with various functions.
- Suitability for molding and processing.

Background and Context

Water electrolysis is a primary method for hydrogen production to support a decarbonized society. However, a technical gap existed for the temperature range between 150°C and 250°C. This specific range is highly valuable because it aligns with the temperature of waste heat and steam typically generated in industrial plants. Prior to this development, there were no electrolyte materials suitable for water electrolysis within this medium-temperature window.

Significance and Outlook

By developing a membrane that functions at 170°C, the research group has provided a potential pathway to integrate hydrogen production directly with industrial waste heat recovery. This allows for more efficient energy use by leveraging existing thermal outputs from factories to drive the electrolysis process.

Source: https://response.jp/article/2026/11/10/418829.html

#12 AR Waveguide Technology: POSTECH and Samsung's 1.5mm Lens Specs

Published November 12, 2026 데일리안 South Korea



OVERVIEW

Researchers from POSTECH and Samsung Research have developed an ultra-thin 1.5mm AR lens using metasurface waveguides to enable clear digital displays in bright outdoor environments. By precisely controlling light paths at the nanoscale, the team reduced light loss and color distortion, providing a technical foundation for commercial all-day AR glasses.

IN DEPTH

Key Findings

A research team led by Professor Junseok Noh of POSTECH, in collaboration with Samsung Research, has developed an ultra-thin augmented reality (AR) lens with a total thickness of 1.5mm. The technology achieves a diagonal field of view (FOV) of 30 degrees and an eye box of 8mm by 8mm at a distance of 15mm from the waveguide. Performance tests showed a white light luminance efficiency averaging 1938 nits/lm, with a maximum of 4225 nits/lm.

Technical Details

The system utilizes metasurface waveguides to address light loss and color distortion common in traditional AR optics. The team implemented the following technical specifications:

- **Nanostructure Design:** Nano-structures smaller than the wavelength of light were placed on the waveguide surface, with shapes and intervals adjusted based on position.
- **Layered Architecture:** To achieve full-color imagery, the team combined two layers—one primarily for blue and green light, and another for red and green light.
- **Material:** The metasurfaces were fabricated using silicon nitride (SiNx), with 29 different nano-structure regions designed per layer.
- **Luminance Efficiency:** Average luminance efficiency was measured at 1897 nits/lm for red, 1977 nits/lm for green, and 2170 nits/lm for blue.

Background & Context

Conventional AR glasses often struggle to balance thickness, brightness, and the viewing range. Light typically leaks out as it changes direction within the waveguide, leading to dim images, especially when expanding the range of eye movement. This research, published in *Nature* on November 12, 2026, uses ray tracing and electromagnetic analysis to ensure more light reaches the eye.

Significance & Outlook

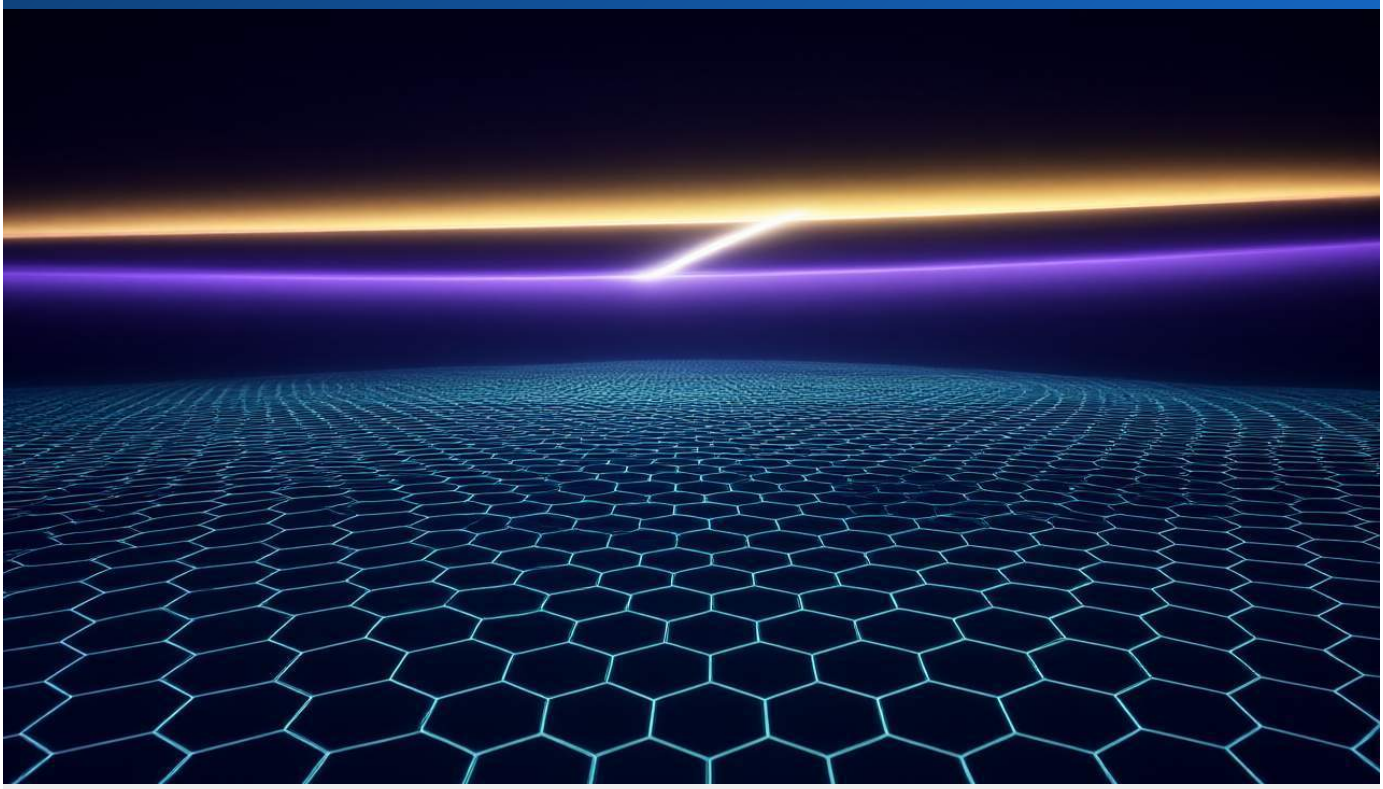
This development enables the use of AR glasses in bright outdoor settings and reduces display power consumption by increasing light delivery efficiency. Future goals include reducing the two-layer waveguide to a single layer, establishing mass-production processes, and eliminating "rainbow" blurring effects caused by external light. The technology is expected to be applied to AI-based smart glasses and daily-use AR devices for navigation and work information.

Source: https://www.dailian.co.kr/news/view/1712591/%EA%B5%AD%EB%82%B4-%EC%97%B0%EA%B5%AC%EC%A7%84-%EB%91%90%EA%BB%98-15%E3%8E%9C-AR-%EB%A0%8C%EC%A6%88-2026

Collected: November 14, 2026 | Automated Research System (AI)

#13 Landau-Zener-Majorana Transitions: Graphene Quantum Jumps Captured

Published November 13, 2026 ScienceDaily（Forschungszentrum Juelich） Germany



OVERVIEW

Researchers have directly observed electrons leaping across forbidden energy gaps in graphene using a photoemission momentum microscope. This discovery demonstrates that electrons can transition between energy states with up to 100 percent probability under intense electric fields, providing a foundation for light-controlled electronics.

IN DEPTH

Key Findings

Physicists from the University of Regensburg, Philipps-Universität Marburg, and Forschungszentrum Jülich have captured electrons performing "quantum jumps" across forbidden energy gaps in graphene. The study reveals that when exposed to intense pulses of light, electrons can switch between energy bands with a transition probability reaching 100 percent. This phenomenon, known as Landau-Zener-Majorana transitions, allows electrons to bypass intervening energy states that are normally off-limits.

Technical Details

The team utilized a photoemission momentum microscope to track electron behavior in real time. Unlike traditional microscopes that image a material's surface, this instrument measures electron energies and movement to map their distribution across different energy states. The experimental setup combined advanced laser technology with electron microscopy to capture movements on timescales too short for conventional imaging.

The success of the experiment relied on ultra-pure, one-atom-thick graphene samples manufactured at Forschungszentrum Jülich. Specifically, the use of "rotated" graphene ensured that quantum dynamics emerged clearly without being obscured by atomic-level impurities.

Background & Context

In semiconductors, electrons are typically restricted to specific energy bands, separated by forbidden energy gaps where stable states cannot exist. While quantum tunneling involves particles passing through a physical barrier, Landau-Zener-Majorana transitions are driven by the speed at which electrons approach the gap under the influence of a powerful electric field. This allows them to move between states even when separated by a substantial energy gap.

Significance & Outlook

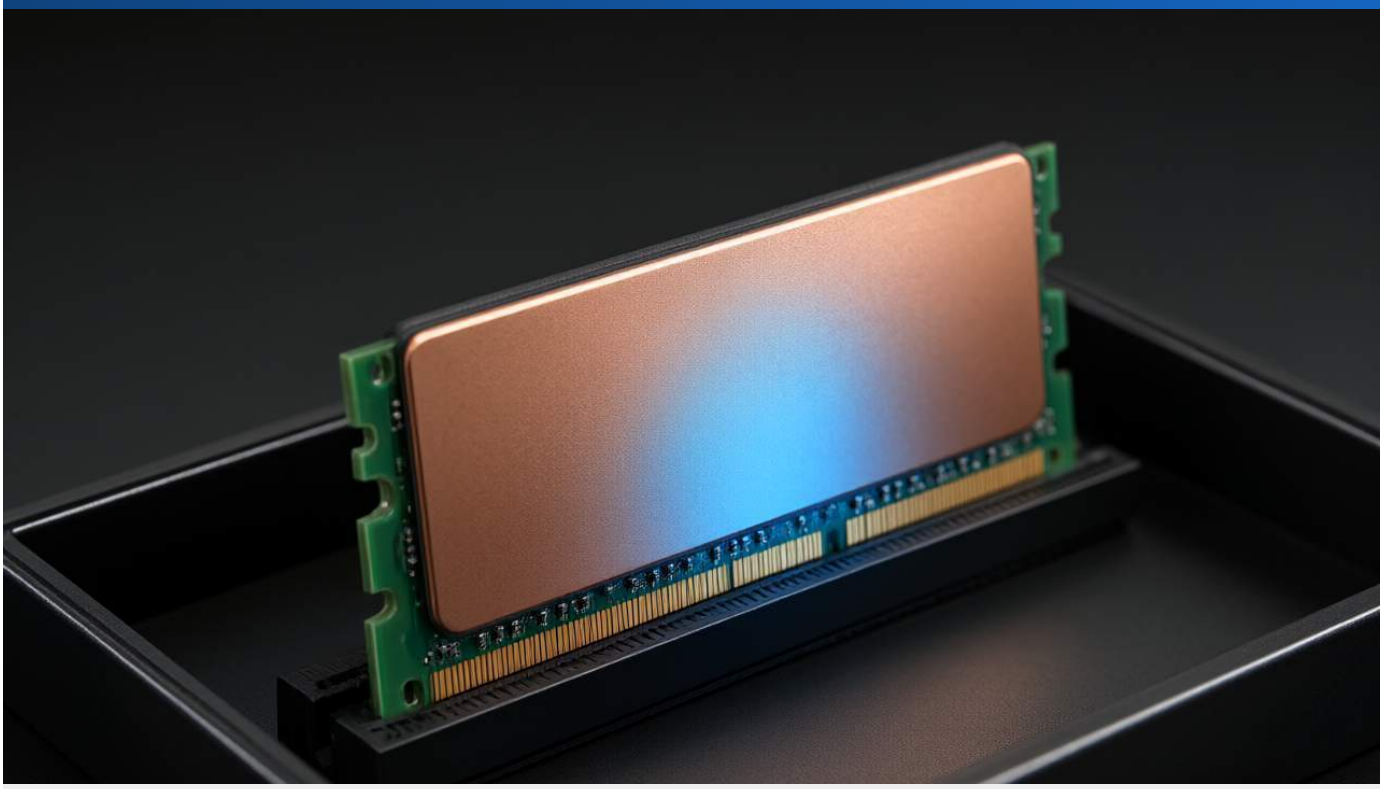
This imaging technique allows scientists to observe how interactions with a material's crystal lattice gradually disrupt orderly electron motion. Understanding these disruptions is critical for developing precise control over electron behavior. The findings suggest a path toward future electronic technologies that utilize the rapid oscillations of light to direct electrons, rather than relying entirely on conventional electronic methods.

Source: https://sciencedaily.com/releases/2026/11/261112025523.htm

Collected: November 14, 2026 | Automated Research System (AI)

#14 Apacer GraTherX: Copper-Graphene DDR5 Thermal Specs and Results

Published November 12, 2026 Graphene-Info Taiwan



OVERVIEW

Apacer has developed GraTherX, a copper-graphene composite thermal solution that reduces industrial DDR5 memory temperatures by over 20°C in fanless environments. The technology achieves high thermal balance across the module, significantly improving mean time between failures for compact or sealed industrial systems.

IN DEPTH

Key Findings

Apacer's GraTherX technology reduces DDR5 memory module temperatures by more than 20°C in systems lacking active cooling. In internal testing under natural convection and high load, a module's temperature dropped from 82.7°C to 59.3°C, representing a reduction of 23.4°C. Apacer further reports a 2.7-fold improvement in mean time between failures and a 60% reduction in the failure-in-time rate, though these figures have not been independently verified.

Technical Details

GraTherX utilizes a two-sided copper-graphene composite layer that cools both faces of the memory module. The design adds approximately 0.17 mm per side, allowing it to be integrated without redesigning existing DDR5 modules. To prevent short circuits caused by the proximity of the conductive layer to memory chips and traces, an insulating layer is incorporated. The solution is compatible with both ECC and non-ECC industrial modules.

A critical performance metric is the "thermal-balanced" nature of the design; Apacer reports a front-to-rear temperature difference of less than 0.8°C across the module. This minimizes uneven heating, which is a primary factor in shortening module lifespan.

Background and Context

Introduced in June 2026 and showcased at electronica 2026 in Munich, GraTherX leverages the high thermal conductivity of graphene. This approach aligns with existing research indicating that coating copper with graphene substantially improves heat conduction. Similar graphene-based cooling applications have appeared in other electronics, such as Acer’s Predator Triton 14 AI laptop and various multilayer graphene tapes used for insulation and cooling.

Significance and Outlook

The technology targets industrial applications where active fan cooling is impractical or impossible. Primary target sectors include:

- Industrial PCs and embedded platforms

- Edge AI hardware
- Smart surveillance systems
- In-vehicle computing
- Compact or sealed enclosures

Source: https://www.graphene-info.com/apacer-s-copper-graphene-layer-cuts-ddr5-memory-temperatures-more-20-c-without

Collected: November 14, 2026 | Automated Research System (AI)