TROY TECHNICAL

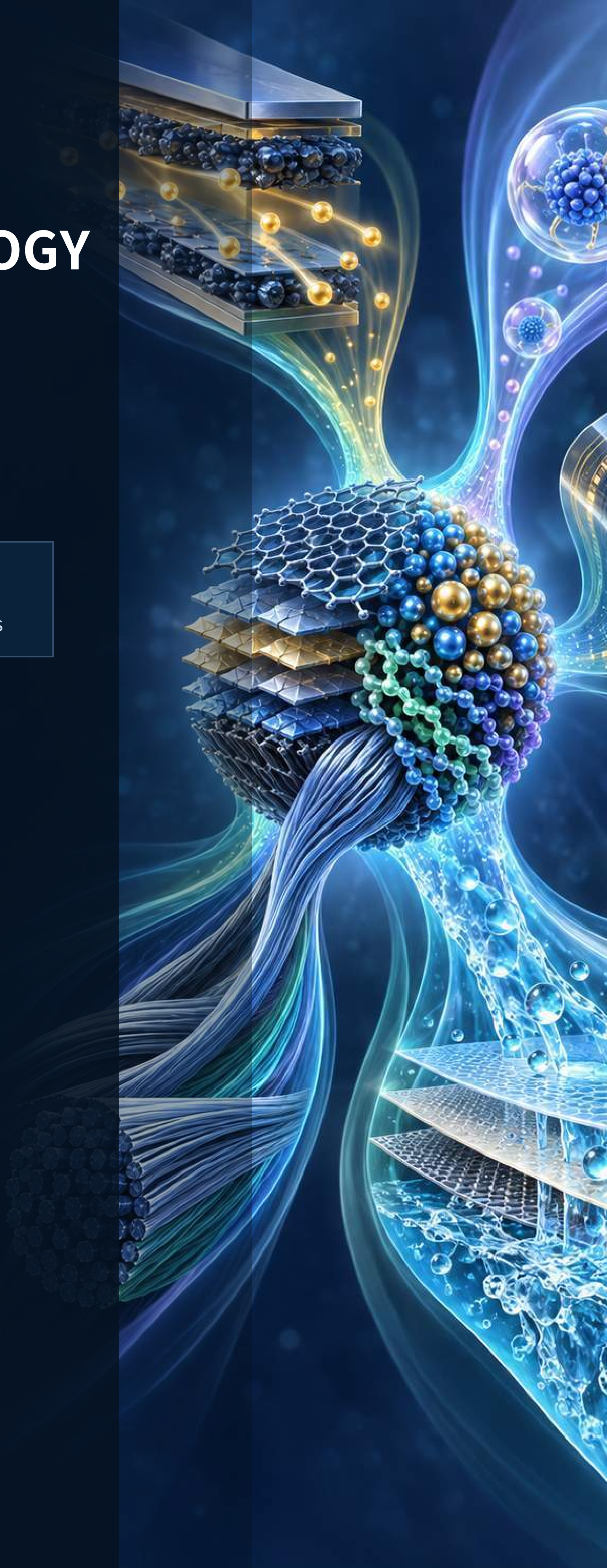
NANOTECHNOLOGY
WEEKLY REPORT

September 12 - September 18, 2026 | Issue 2026-W37

Translation from nanoscale property to reproducible, safe and scalable products

15	10
ANALYZED ARTICLES	PRIORITY THEMES

Issued 2026-09-18 | English edition | fixed approved cover artwork



Nanotechnology: the boundary moved from isolated claims to qualification evidence

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

SIGNAL 01 | NANO DESIGN

UDC Awarded Nearly $5 Million NSF CREST Grant to Advance Nanotechnology Research and

The University of the District of Columbia (UDC) has secured a renewal of its CREST grant, amounting to nearly $5 million from the National Science Foundation (NSF), to further advance nanotechnology research and education.

SIGNAL 02 | SYNTHESIS

COVID-19 Pandemic Exposes Nanomedicine's 'Missing Link': Thousands of Studies Yield Only Three Systemic

The COVID-19 pandemic revealed a critical gap in antiviral nanotechnology: despite thousands of promising basic research studies, only three systemic clinical trials have been conducted, with no regulatory approvals.

SIGNAL 03 | INTEGRATION

Materials Science-2026 Conference to Explore Nanomaterial Applications in Defense, Aerospace, and Mechanical Engineering

The "Material Science-2026" conference, scheduled for September 14-15 in Rome, Italy, will address advanced materials across defense, aerospace, and mechanical engineering sectors.

SIGNAL 04 | APPLICATION

International Team Achieves 17% Efficiency in Semi-Transparent Perovskite Solar Cells Using Sputter-Resistant ALD

An international research team has developed a semi-transparent perovskite solar cell boasting 17% efficiency, built upon a sputter-resistant aluminum oxide (AlOx) layer deposited via atomic layer deposition (ALD).

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.

Five numbers or evidence anchors that require conditions

$5 million
A03

SOURCE-BOUND CONDITION
The University of the District of Columbia (UDC) has secured a renewal of its CREST grant, amounting to nearly $5 million from the National Science Foundation (NSF), to further advance nanotechnology research and.

17%
A01

SOURCE-BOUND CONDITION
An international research team has developed a semi-transparent perovskite solar cell boasting 17% efficiency, built upon a sputter-resistant aluminum oxide (AlOx) layer deposited via atomic layer deposition (ALD).

$459.5 billion
A04

SOURCE-BOUND CONDITION
The nano-biotechnology market is forecast to surpass $459.5 billion by 2035, driven by significant progress in healthcare and life sciences, as highlighted in a market research report.

600 times
A10

SOURCE-BOUND CONDITION
This innovative coating achieved a calculated corrosion rate of 0.0000372 millimeters per year in electrochemical tests, over 600 times slower than unprotected steel.

80%
A12

SOURCE-BOUND CONDITION
Advances in nanofabrication and cavity quantum electrodynamics have enabled III-V quantum dots (QDs) to achieve photon collection efficiencies exceeding 80%.

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	2	3	4	5
Nano design	**Synthesis**	**Integration**	**Application**	**Scale & safety**
P01/P06	P02/P07	P03/P08	P04/P09	P05/P10
The University of the District of Columbia (UDC) has secured a renewal of its CREST grant, amounting to nearly $5 million.	The COVID-19 pandemic revealed a critical gap in antiviral nanotechnology: despite thousands of promising basic research.	The "Material Science-2026" conference, scheduled for September 14-15 in Rome, Italy, will address advanced materials across.	An international research team has developed a semi-transparent perovskite solar cell boasting 17% efficiency, built upon a.	The nano-biotechnology market is forecast to surpass $459.5 billion by 2035, driven by significant progress in healthcare and.

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 business impact

P01	UDC Awarded Nearly $5 Million NSF CREST Grant to Advance Nanotechnology Research and
P02	COVID-19 Pandemic Exposes Nanomedicine's 'Missing Link': Thousands of Studies Yield Only Three Systemic
P03	Materials Science-2026 Conference to Explore Nanomaterial Applications in Defense, Aerospace, and Mechanical Engineering
P04	International Team Achieves 17% Efficiency in Semi-Transparent Perovskite Solar Cells Using Sputter-Resistant ALD
P05	Nano-biotechnology Market Projected to Exceed $459.5 Billion by 2035, Fueled by Healthcare and
P06	Clarivate Names David L. Allara and Ralph G. Nuzzo Citation Laureates for Pioneering
P07	University of Queensland Develops Smart Nanocoating Slowing Steel Rust Corrosion Over 600-Fold to
P08	Morphotonics Unveils Display-Centric Nanoimprint Solution to Overcome AR Waveguide Cost and Production Bottlenecks
P09	Nanofabrication Boosts III-V Quantum Dot Photon Collection Efficiency Beyond 80% for Quantum Technologies
P10	Nanocellulose Dramatically Boosts Electrospun Membrane Performance for Sustainable Water Treatment

REPRODUCIBLE POSITIONING RULE

Horizontal position uses five discrete stages: Research, Prototype, Joint evaluation, Product adoption and Scale. Vertical position uses three impact levels: single use, multiple customers and multiple supply tiers. Bubble diameter reflects the editorial score inherited from the weekly selection rubric.

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

P01 UDC Awarded Nearly $5 Million NSF CREST Grant to Advance Nanotechnology Research and

A03 | Nano design | Research

Date not stated

FACT

The University of the District of Columbia (UDC) has secured a renewal of its CREST grant, amounting to nearly $5 million from the National Science Foundation (NSF), to further advance nanotechnology research and education. This significant funding will support research across four interconnected areas: molecular spintronics, powder-based electrochemical additive manufacturing, nano/microscale thermal management, and molecular catalysis.

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 1/5 | IMPACT 2/3

P02 COVID-19 Pandemic Exposes Nanomedicine's 'Missing Link': Thousands of Studies Yield Only Three Systemic

A05 | Synthesis | Joint evaluation

Date not stated

FACT

The COVID-19 pandemic revealed a critical gap in antiviral nanotechnology: despite thousands of promising basic research studies, only three systemic clinical trials have been conducted, with no regulatory approvals. Decades of research have not translated into widespread clinical application due to manufacturing complexities, stringent regulatory requirements, high development costs, and insufficient investment.

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 3/5 | IMPACT 2/3

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

P03

Materials Science-2026 Conference to Explore Nanomaterial Applications in Defense, Aerospace, and Mechanical Engineering

A16 | Integration | Joint evaluation

Date not stated

FACT

The "Material Science-2026" conference, scheduled for September 14-15 in Rome, Italy, will address advanced materials across defense, aerospace, and mechanical engineering sectors. Key themes include advancements in nanomaterial science and nanotechnology, composite materials for aerospace and automotive, and high-performance ceramics.

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 3/5 | IMPACT 2/3

P04

International Team Achieves 17% Efficiency in Semi-Transparent Perovskite Solar Cells Using Sputter-Resistant ALD

A01 | Application | Pilot

Date not stated

FACT

An international research team has developed a semi-transparent perovskite solar cell boasting 17% efficiency, built upon a sputter-resistant aluminum oxide (AlOx) layer deposited via atomic layer deposition (ALD). This innovative AlOx layer effectively suppresses interfacial charge recombination and enhances the protection of the perovskite, significantly improving both efficiency and operational stability.

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 | IMPACT 1/3

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

P05

Nano-biotechnology Market Projected to Exceed $459.5 Billion by 2035, Fueled by Healthcare and

A04 | Scale & safety | Research

Date not stated

FACT

The nano-biotechnology market is forecast to surpass $459.5 billion by 2035, driven by significant progress in healthcare and life sciences, as highlighted in a market research report. Nanoscale systems like nanoparticles, liposomes, and polymeric nanocarriers are key to this growth, enabling controlled drug release and localized delivery of therapeutic molecules. Government-backed research initiatives and private investments are further accelerating this market expansion.

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 1/5 | IMPACT 2/3

P06

Clarivate Names David L. Allara and Ralph G. Nuzzo Citation Laureates for Pioneering

A15 | Nano design | Pilot

Date not stated

FACT

Clarivate has announced David L. Allara and Ralph G. Nuzzo of Pennsylvania State University as Citation Laureates for their transformative work in self-assembled nanomaterials, specifically self-assembled monolayers (SAMs). This recognition highlights their foundational contributions to controlling matter at the nanoscale, impacting diverse fields from electronics to biosensors. The Citation Laureates program identifies highly-cited researchers whose breakthroughs are deemed potential Nobel Prize recipients.

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 20/25 | MATURITY 2/5 | IMPACT 2/3

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

P07 University of Queensland Develops Smart Nanocoating Slowing Steel Rust Corrosion Over 600-Fold to

A10 | Synthesis | Pilot

Date not stated

FACT

Researchers at the University of Queensland developed a smart nanocoating using pH-sensitive nanocontainers storing benzotriazole (BTA) corrosion inhibitor within an aqueous polyurethane matrix. This innovative coating achieved a calculated corrosion rate of 0.0000372 millimeters per year in electrochemical tests, over 600 times slower than unprotected steel.

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 20/25 | MATURITY 2/5 | IMPACT 1/3

P08 Morphotonics Unveils Display-Centric Nanoimprint Solution to Overcome AR Waveguide Cost and Production Bottlenecks

A14 | Integration | Product adoption

Date not stated

FACT

Dutch nanoimprint lithography firm Morphotonics announced at CIOE 2026 that the key to unlocking low-cost, high-volume production of AR glasses waveguides lies not in semiconductor, but in display industry technology. Their nanoimprint lithography leverages large-area, high-throughput processes to reduce manufacturing costs and accelerate mass adoption of AR waveguides. This approach offers a highly efficient alternative to current expensive and complex production methods.

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 20/25 | MATURITY 4/5 | IMPACT 2/3

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

P09

Nanofabrication Boosts III-V Quantum Dot Photon Collection Efficiency Beyond 80% for Quantum Technologies

A12 | Application | Research

Date not stated

FACT

Advances in nanofabrication and cavity quantum electrodynamics have enabled III-V quantum dots (QDs) to achieve photon collection efficiencies exceeding 80%. These 20-nanometer scale nanostructures function as two-level quantum systems capable of emitting single photons on demand. This breakthrough extends beyond fundamental quantum research, with early applications anticipated in bioimaging, accelerating the practical implementation of quantum technologies.

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 1/5 | IMPACT 2/3

P10

Nanocellulose Dramatically Boosts Electrospun Membrane Performance for Sustainable Water Treatment

A07 | Scale & safety | Research

Date not stated

FACT

Incorporating renewable cellulose nanomaterials significantly enhances the mechanical strength, hydrophilicity, permeability, fouling resistance, and pollutant removal capabilities of electrospun membranes for water treatment. A review in npj Materials Sustainability highlights nanocellulose's potential to improve sustainability across various water treatment designs.

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 1/5 | IMPACT 1/3

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 01-16

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	International Team Achieves 17% Efficiency in Semi-Transparent Perovskite Solar Cells Using Sputter-Resistant ALD Aluminum Oxide Layer, Enabling 26% in Tandem Cells	https://www.pv-magazine.com/2026/09/17/scientists-build-17-efficient-semi-transparent-perovskite-solar-cell-based-on-sputter-resistant-aluminum-oxide-layer/
A02	JSON Schemas Released to Standardize ALD/ALE Processes in Materials Science, Accelerating Semiconductor Process Development	https://papers.cool/arxiv/2609.12139
A03	UDC Awarded Nearly $5 Million NSF CREST Grant to Advance Nanotechnology Research and Education	https://www.udc.edu/news/2026/09/nsf-awards-udc-nearly-5-million-to-advance-nanotechnology-research-and-education?image
A04	Nano-biotechnology Market Projected to Exceed $459.5 Billion by 2035, Fueled by Healthcare and Life Sciences Advances	https://industrytoday.co.uk/pr_and_marketing/nano-biotechnology-market-to-cross-usd-4595-billion-by-2035-driven-by-advances-in-healthcare-and-life-sciences
A05	COVID-19 Pandemic Exposes Nanomedicine's 'Missing Link': Thousands of Studies Yield Only Three Systemic Clinical Trials	https://www.trialsitenews.com/a/covid-19-exposed-nanomedicines-missing-link-thousands-of-studies-just-three-systemic-trials-19ac3f12
A06	Smart Materials and Nanomedicines Play Critical Role in Personalized Cancer Diagnosis and Therapy	https://s3-euw1-ap-pe-df-pch-content-store-p.s3.eu-west-1.amazonaws.com/9780429157271/bd16c979-ad19-4b6b-ab08-acc71410d329/chapters/chap5.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAQFVOSJ57TJK3L5FC%2F20260917%2Feu-west-1%2Fs3%2Faws4_request&X-Amz-Date=20260917T191137Z&X-Amz-Expires=172800&X-Amz-Signature=04d87a39e01c17152cf0f4dab1375f4c0c18baa040751d6feccb4974d6aaae90&X-Amz-SignedHeaders=host&response-content-disposition=attachment%3B%20filename%3D%2210.1201_b19977-5_chapterpdf.pdf%22
A07	Nanocellulose Dramatically Boosts Electrospun Membrane Performance for Sustainable Water Treatment	https://www.azonano.com/news.aspx?newsID=41825
A08	Targeted Nanoparticles Enhance Anti-Cancer Immune Responses, Reprogramming Macrophages via mRNA Technology with Over 60% Reduction in Immunosuppressive Cells	https://www.news-medical.net/news/20260911/Targeted-nanoparticles-strengthen-anti-cancer-immune-responses-in-tumors.aspx
A09	MXene Nanomaterials Achieve 98.3% Capacitance Retention in Supercapacitors and 100 mA cm-2 Bifunctional Electrocatalysis for Hydrogen Production	https://bioengineer.org/mxenes-emerge-as-frontier-nanomaterials-powering-supercapacitors-and-clean-hydrogen-production/
A10	University of Queensland Develops Smart Nanocoating Slowing Steel Rust Corrosion Over 600-Fold to 0.0000372 mm/year	https://www.thebrighterside.news/post/smart-nanocoating-slows-rust-corrosion-by-more-than-600-times/
A11	Medical College of Wisconsin Pioneers Multi-Functional Nano Drug Delivery Systems for Glaucoma, Atherosclerosis, and Triple-Negative Breast Cancer	https://www.mcw.edu/mcwknowledge/mcw-stories/nano-drug-delivery-systems-treat-diseases-at-their-source
A12	Nanofabrication Boosts III-V Quantum Dot Photon Collection Efficiency Beyond 80% for Quantum Technologies	https://quantumzeitgeist.com/iii-v-quantum-dot-80-percent/
A14	Morphotonics Unveils Display-Centric Nanoimprint Solution to Overcome AR Waveguide Cost and Production Bottlenecks	https://www.digitimes.com/news/a20260909VL234/ar-display-expo-manufacturing-nanoimprint.html
A15	Clarivate Names David L. Allara and Ralph G. Nuzzo Citation Laureates for Pioneering Work in Self-Assembled Nanomaterials	https://www.prnewswire.com/news-releases/clarivate-reveals-citation-laureates-2026-recognizing-transformative-scientific-breakthroughs-302880553.html
A16	Materials Science-2026 Conference to Explore Nanomaterial Applications in Defense, Aerospace, and Mechanical Engineering	https://materialscience.materialsconferences.com/events-list/materials-in-defence-aerospace-and-mechanical-engineering

Nanotechnology — Selected Articles

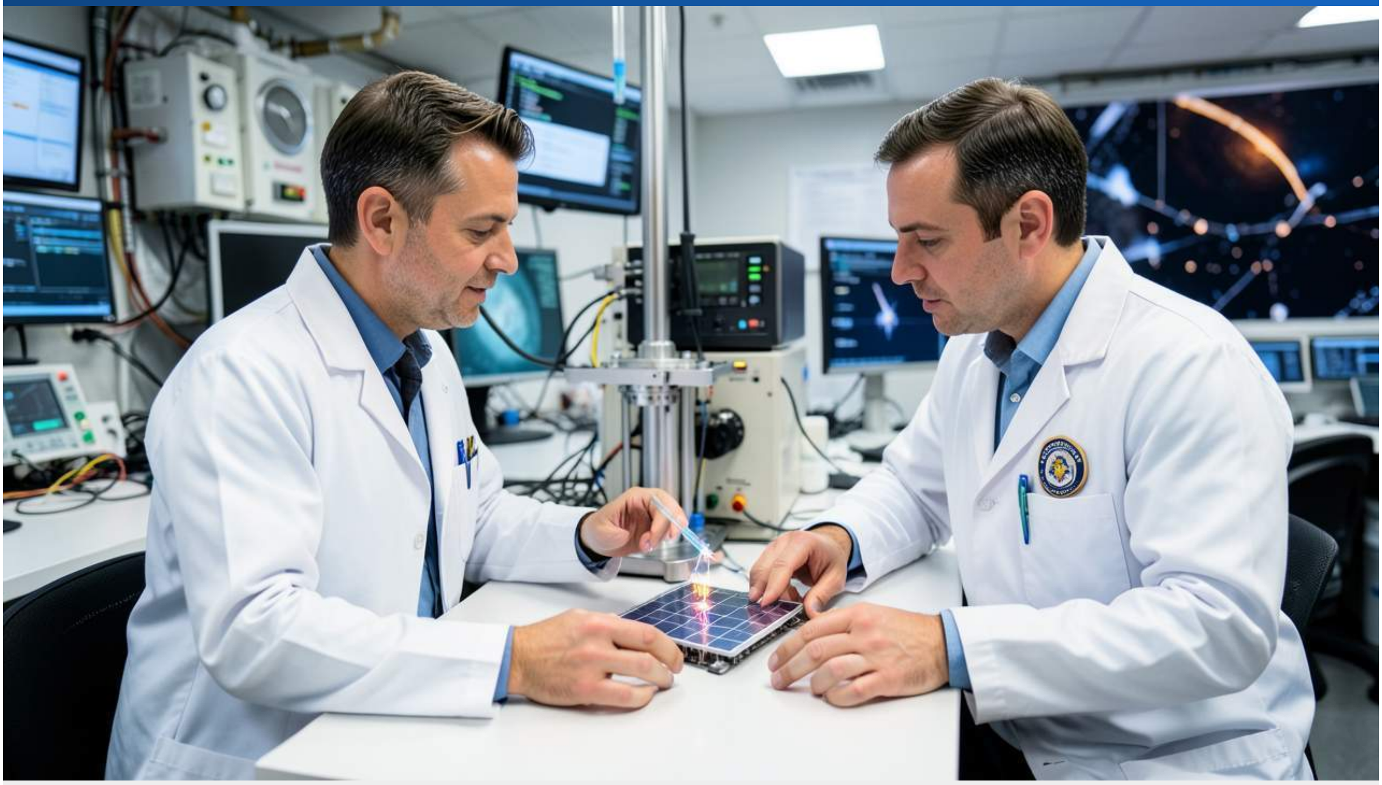
Date: 2026-09-20

Articles: 14

Table of Contents

#01 International Team Achieves 17% Efficiency in Semi-Transparent Perovskite Solar Cells Using Sputter-Resistant ALD Aluminum Oxide Layer, Enabling 26% in Tandem Cells

Published September 17, 2026 pv magazine Global Unknown



OVERVIEW

An international research team has developed a semi-transparent perovskite solar cell boasting 17% efficiency, built upon a sputter-resistant aluminum oxide (AlOx) layer deposited via atomic layer deposition (ALD). This innovative AlOx layer effectively suppresses interfacial charge recombination and enhances the protection of the perovskite, significantly improving both efficiency and operational stability. The technology has further enabled perovskite-silicon tandem cells to achieve a remarkable 26% efficiency, pushing beyond the 17% achieved by conventional semi-transparent cells.

IN DEPTH

Key Findings

An international research consortium has successfully developed a semi-transparent perovskite solar cell with a 17% power conversion efficiency by integrating a highly sputter-resistant aluminum oxide (AlOx) layer, deposited using atomic layer deposition (ALD). This breakthrough addresses critical performance and stability challenges inherent in previous semi-transparent perovskite designs. When applied in a perovskite-silicon tandem cell configuration, this technology demonstrated a superior efficiency of 26%, marking a significant advance toward the commercial viability of next-generation solar energy solutions.

Technical / Clinical Details

The newly developed perovskite solar cell incorporates an ALD-deposited AlOx layer between the transparent electrode and the perovskite active layer, resolving several key technical hurdles. Specifically, this AlOx layer effectively mitigates interfacial charge recombination, thereby boosting power conversion efficiency. Beyond its electronic function, the AlOx layer serves as a robust barrier, safeguarding the perovskite material from degradation induced by atmospheric moisture, oxygen, and potential damage during manufacturing processes like sputtering. The precise nanometer-scale control over the AlOx layer’s thickness optimizes both optical transparency and protective efficacy, crucial for maintaining the device's high performance over time. The inherent semi-transparent properties of these cells open avenues for multifunctional applications such such as building-integrated photovoltaics (BIPV) and agricultural solar installations.

Background & Context

Perovskite solar cells have garnered considerable attention as a promising next-generation photovoltaic technology due to their high efficiency potential and low manufacturing costs. However, particularly for semi-transparent variants, achieving a balance between high efficiency and long-term stability has remained a formidable challenge, hindering their widespread adoption. Prior research struggled to simultaneously meet the conflicting demands of improved transparency for the electrodes and enhanced durability for the perovskite layer. The introduction of the ALD AlOx layer provides an effective solution to these issues, contributing significantly to performance enhancements, especially in tandem structures. When combined with silicon solar cells, perovskites efficiently absorb short-wavelength light, while silicon captures longer wavelengths, enabling a higher overall conversion efficiency than either material could achieve alone.

Strategic Significance & Outlook

This sputter-resistant ALD AlOx-based perovskite solar cell technology opens new possibilities for flexible devices and smart window applications. The simultaneous achievement of high efficiency and high stability is expected to accelerate the adoption of perovskite technology in the BIPV market. Furthermore, leveraging ALD, a well-established technique in semiconductor manufacturing, offers advantages in terms of scalability for mass production and cost reduction. Future efforts will focus on further enhancing efficiency and conducting long-term outdoor field tests to validate the durability and reliability of these devices under real-world conditions. These advancements are instrumental in establishing perovskite solar cells as a mainstream energy source for the future, contributing to more sustainable and integrated energy systems worldwide.

Source: https://www.pv-magazine.com/2026/09/17/scientists-build-17-efficient-semi-transparent-perovskite-solar-cell-based-on-sputter-resistant-aluminum-oxide-layer/

#02 JSON Schemas Released to Standardize ALD/ALE Processes in Materials Science, Accelerating Semiconductor Process Development

Published September 10, 2026 Cool Papers Unknown

OVERVIEW

Four domain-expert-reviewed JSON schemas have been published to standardize experimental and simulation processes for Atomic Layer Deposition (ALD) and Atomic Layer Etching (ALE) in materials science. These schemas structure materials, process conditions, configurations, and measured/predicted results, facilitating the comparability and machine-actionable reuse of scientific literature. This standardization is expected to significantly accelerate process development, particularly in the semiconductor industry.

IN DEPTH

Key Findings

In the field of materials science, four domain-expert-reviewed JSON schemas have been released to describe experimental and simulation processes for Atomic Layer Deposition (ALD) and Atomic Layer Etching (ALE). This standardized data description method aims to help researchers structure and easily share their experimental and simulation data. This initiative is expected to enhance the comparability of scientific literature, promote data-driven research including machine learning applications, and significantly shorten the development cycle for new materials and processes, especially within the semiconductor industry.

Technical / Clinical Details

The published JSON schemas comprehensively define the main components that constitute ALD and ALE processes, such as the precursor materials used, reaction temperature, pressure, number of cycles, substrate type, deposition/etching rates, and characterization results of the films. Each schema focuses on the following four key aspects:

- **Materials:** Identifiers, purity, and delivery methods for all chemicals used (precursors, reaction gases, carrier gases).
- **Process Conditions:** Temperature, pressure, flow rates, pulse times, and cycle sequences within the reaction chamber.
- **Configuration:** Experimental setup, reactor type, and substrate preparation status.
- **Results:** Measured film thickness, composition, crystal structure, electrical properties, and simulated predicted values.

These schemas enable the efficient exchange and integration of ALD/ALE data generated by different research groups and institutions in a common format. This will facilitate data mining and machine learning algorithms for optimizing new processes and predicting material properties more easily than ever before.

Background & Context

ALD and ALE are critical technologies that enable precise film formation and patterning at the nanoscale, widely utilized in semiconductor device manufacturing, microelectronics, and nanotechnology. These processes are essential for determining the performance of next-generation transistors, memories, sensors, and quantum computing devices. However, the diverse ways in which different research groups report experimental data have made it difficult to compare and database results. This data fragmentation has hindered research progress. Standardization via JSON schemas removes these information sharing barriers and provides a clear framework to accelerate data-driven innovation in line with open science principles.

Strategic Significance & Outlook

The introduction of JSON schemas for ALD/ALE process descriptions will significantly improve the efficiency of materials development in the semiconductor industry. Researchers will be able to more quickly explore and optimize new processes using standardized datasets. This will promote the development of informatics research using artificial intelligence (AI) and machine learning models, reducing the number of experimental trials in the laboratory and cutting development costs and time. In the future, widespread adoption of these schemas as industry standards is expected to further accelerate global collaborative research, leading to faster market introduction of higher-performance and more innovative nanodevices. This is a crucial step in advancing the digital transformation of materials science and contributing to the establishment of a robust data ecosystem.

Source: https://papers.cool/arxiv/2609.12139

#03 UDC Awarded Nearly $5 Million NSF CREST Grant to Advance Nanotechnology Research and Education

Published September 11, 2026 University of the District of Columbia USA

OVERVIEW

The University of the District of Columbia (UDC) has secured a renewal of its CREST grant, amounting to nearly $5 million from the National Science Foundation (NSF), to further advance nanotechnology research and education. This significant funding will support research across four interconnected areas: molecular spintronics, powder-based electrochemical additive manufacturing, nano/microscale thermal management, and molecular catalysis. The grant aims to drive innovation in next-generation computing, advanced manufacturing, efficient thermal management, and sustainable energy systems.

IN DEPTH

Key Findings

The University of the District of Columbia (UDC) has received a renewed CREST (Centers for Research Excellence in Science and Technology) grant from the National Science Foundation (NSF), totaling approximately $5 million. This substantial funding will enable UDC to continue vigorously promoting its research and educational programs in nanotechnology. This significant financial support strengthens UDC's foundation for conducting cutting-edge nanoscience research and fostering the next generation of scientists and engineers from diverse backgrounds. Breakthroughs are particularly anticipated in areas critical to future technologies.

Technical / Clinical Details

The renewed CREST grant focuses on four interconnected research areas that form the core of UDC's nanotechnology initiatives:

- **Molecular Spintronics:** Development of next-generation computing technologies that utilize not only electron charge but also spin. This aims to enhance data storage capacity and dramatically accelerate processing speeds.
- **Powder-based Electrochemical Additive Manufacturing:** An advanced additive manufacturing technique that uses metal and ceramic powders to produce components with highly precise three-dimensional structures. It is applied to manufacturing complex nano-devices and customized materials.
- **Nano/Microscale Thermal Management:** Efficient heat dissipation technologies to solve overheating issues in miniaturizing electronic devices. This explores new cooling solutions using thermoelectric materials and nanostructures.
- **Molecular Catalysis:** Development of nanoscale catalysts to promote efficient chemical reactions. This is applied to sustainable energy conversion and environmental remediation processes.

These research efforts will be conducted through an interdisciplinary approach, with experts from each field collaborating. Students will gain practical research skills and specialized knowledge by directly participating in these cutting-edge projects.

Background & Context

Nanotechnology is a foundational technology that drives innovation across all scientific and technological fields, including materials science, electronics, medicine, and energy. The U.S. government emphasizes investment in nanotechnology research to maintain international competitiveness and develop talent that will lead future industries. The NSF's CREST program specifically supports Minority-Serving Institutions (MSIs) and Historically Black Colleges and Universities (HBCUs) to enhance diversity and inclusivity in Science, Technology, Engineering, and Mathematics (STEM) fields. Grants to institutions like UDC are crucial for these institutions to conduct excellent research and provide high-quality STEM education to economically disadvantaged and minority students.Strategic Significance & Outlook

This grant to UDC holds immense significance for shaping future industries such as next-generation computing, advanced manufacturing, and sustainable energy systems. Molecular spintronics will contribute to the advancement of quantum computing, while electrochemical additive manufacturing will enable rapid prototyping and production of customized nano-devices. Nano/microscale thermal management will support the proliferation of high-performance devices like AI chips and 5G communication equipment, and molecular catalysis will contribute to the progress of clean energy technologies and CO_2 reduction techniques. Through this research, UDC is expected to not only generate new intellectual property but also produce highly skilled STEM talent, contributing to the strengthening of U.S. scientific and technological capabilities. This investment is an essential component in solidifying U.S. leadership in the field of nanotechnology.

Source: https://www.udc.edu/news/2026/09/nsf-awards-udc-nearly-5-million-to-advance-nanotechnology-research-and-education?image

#04 COVID-19 Pandemic Exposes Nanomedicine's 'Missing Link': Thousands of Studies Yield Only Three Systemic Clinical Trials

Published September 16, 2026 TrialSite News USA

OVERVIEW

The COVID-19 pandemic revealed a critical gap in antiviral nanotechnology: despite thousands of promising basic research studies, only three systemic clinical trials have been conducted, with no regulatory approvals. Decades of research have not translated into widespread clinical application due to manufacturing complexities, stringent regulatory requirements, high development costs, and insufficient investment. This significant translational bottleneck demands strategic solutions for nanomedicine to realize its full therapeutic potential.

IN DEPTH

Key Findings

The COVID-19 pandemic starkly illuminated a severe gap in the clinical translation of antiviral nanotechnology. Despite thousands of promising basic research studies, only three systemic clinical trials have been conducted to date, and no nanomedicine has received regulatory approval in this space. This represents a "missing link" in nanomedicine, highlighting structural challenges in bridging fundamental research findings to practical therapeutic applications.

Technical / Clinical Details

Nanotechnology, with its potential for precise targeting and controlled pharmacokinetics, holds immense promise for antiviral therapies. Theoretically, nanoparticles can efficiently deliver antiviral drugs to infected cells, minimizing side effects while enhancing therapeutic efficacy. However, these theoretical advantages have rarely been fully validated in clinical trials. The reported challenges are multifaceted:

- **Manufacturing Complexity:** Producing nanoparticles with uniform size, shape, and surface characteristics at scale and cost-effectively is extremely challenging. Quality control and scale-up require sophisticated technologies and facilities.
- **Regulatory Demands:** Due to their novelty, nanomedicines require unique safety assessments and pharmacokinetic profiling distinct from traditional drugs, making the approval process longer and more complex.
- **Development Costs:** Transitioning from preclinical research to clinical trials demands substantial funding, and the intricate nature of nanomedicines further inflates these costs.
- **Investment Shortfall:** These high hurdles contribute to pharmaceutical companies and investors hesitating to make risky investments in nanomedicine clinical development.

While lipid nanoparticles (LNPs) for mRNA vaccines were a notable exception in the COVID-19 response, the progress of systemic nanomedicines as antiviral therapeutics has lagged significantly.

Background & Context

Although nanomedicine has been researched for decades, its commercialization and clinical application have not advanced as anticipated. Particularly in infectious diseases, the failure to achieve rapid development and approval of nanomedicines even during a public health crisis like COVID-19 underscored the magnitude of its translational barriers. This review points to insufficient collaboration among academia, industry, and regulatory bodies, suggesting the need for a more integrated approach.

Strategic Significance & Outlook

For nanomedicines to unlock their true potential, strategies are needed to standardize manufacturing processes, clarify regulatory guidelines, and attract larger investments from early stages. The establishment of new incentives and ecosystems is crucial to accelerate the translation of basic research findings into clinical practice. This will pave the way for nanomedicines to offer more effective solutions against future pandemics and intractable diseases. Researchers, engineers, and investors must focus on innovative approaches and collaborate to overcome these challenges.

Source: https://www.trialsitenews.com/a/covid-19-exposed-nanomedicines-missing-link-thousands-of-studies-just-three-systemic-trials-19ac3f12

#05 Smart Materials and Nanomedicines Play Critical Role in Personalized Cancer Diagnosis and Therapy

Published September 17, 2026 AWS (referencing a chapter from a scientific publication) USA

OVERVIEW

Smart materials, particularly nanomedicines, are reported to play a pivotal role in personalized cancer diagnosis and treatment. Targeted nanomedicines, designed to recognize and bind to molecular markers on cancer cell surfaces via receptors, offer enhanced drug delivery efficiency, prolonged circulation time, protection from biodegradation, and controlled drug release. These innovative nanotechnologies significantly advance personalized medicine, paving the way for more effective cancer therapies with reduced side effects.

IN DEPTH

Key Findings

Smart materials, especially nanomedicines, are highlighted for their critical role in cancer diagnosis and therapy. These materials function as "targeted nanomedicines" by specifically recognizing and binding to molecular targets on cancer cell surfaces, leading to more efficient and selective drug delivery. This approach has the potential to improve the therapeutic index of drugs and significantly reduce side effects compared to conventional chemotherapy.

Technical / Clinical Details

Targeted nanomedicines are engineered to overcome several challenges in cancer treatment. Their primary advantages include:

- **Enhanced Drug Delivery Efficiency:** Nanoparticles increase accumulation in tumor tissues (EPR effect) and promote intracellular uptake of therapeutic agents.
- **Prolonged Circulation Time:** Nanoparticles protect drugs from degradation and clearance in the body, increasing their stability in the bloodstream.
- **Protection from Biodegradation:** Encapsulation prevents rapid inactivation of drugs within the body.
- **Controlled Drug Release:** They can incorporate smart mechanisms that release drugs in response to specific stimuli (e.g., pH, temperature, enzymes).

These features are achieved by conjugating ligands (such as antibodies, peptides, or aptamers) to the surface of nanoparticles. These ligands bind to cancer-specific receptors (e.g., HER2, EGFR, folate receptor), delivering the drug directly to target cells. This strategy minimizes damage to healthy cells while achieving high drug concentrations in cancer cells, maximizing therapeutic efficacy and reducing adverse effects. The responsive functionalities of smart materials also open avenues for "theranostics," integrating both diagnosis (imaging agent delivery) and therapy (drug delivery).

Background & Context

Traditional cancer treatments, particularly chemotherapy, have faced significant challenges due to non-specific drug distribution leading to unavoidable systemic side effects. With the advent of personalized medicine, there is a growing demand for more precise therapies tailored to individual patient genetic profiles and tumor characteristics. Nanotechnology has emerged as an indispensable tool for realizing this precision medicine, promising innovation at every stage of cancer care, from diagnosis to treatment and monitoring. Research and development investments in this field are robust, with strengthening collaborations between academia and industry.

Strategic Significance & Outlook

Research and development in smart materials and nanomedicines are projected to accelerate. Next-generation nanomedicines will likely evolve to possess more complex bioresponsiveness, multi-functionality, and biocompatibility. For instance, the integration with novel therapeutic modalities, such as nanoparticles combined with immunotherapy or nanocarriers loaded with gene editing tools, is highly probable. These advancements are expected to fundamentally transform the cancer treatment paradigm, providing more effective, personalized, and patient-friendly therapeutic options, thereby significantly improving the prognosis and quality of life for cancer patients.

Source: https://s3-euw1-ap-pe-df-pch-content-store-p.s3.eu-west-1.amazonaws.com/9780429157271/bd16c979-ad19-4b6b-ab08-acc71410d329/chapters/chap5.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAQFVOSJ57TJK3L5FC%2F20260917%2Feu-west-1%2Fs3%2Faws4_request&X-Amz-Date=20260917T191137Z&X-Amz-Expires=172800&X-Amz-Signature=04d87a39e01c17152cf0f4dab1375f4c0c18baa040751d6feccb4974d6aaae90&X-Amz-SignedHeaders=host&response-content-disposition=attachment%3B%20filename%3D%2210.1201_b19977-5_chapterpdf.pdf%22

#06 Nanocellulose Dramatically Boosts Electrospun Membrane Performance for Sustainable Water Treatment

Published September 11, 2026 AZoNano UK

OVERVIEW

Incorporating renewable cellulose nanomaterials significantly enhances the mechanical strength, hydrophilicity, permeability, fouling resistance, and pollutant removal capabilities of electrospun membranes for water treatment. A review in npj Materials Sustainability highlights nanocellulose's potential to improve sustainability across various water treatment designs. Specifically, adding just 0.5 wt.% of cellulose nanocrystals to polyethersulfone electrospun membranes increased water flux by approximately 73%, from 136 to 235 L m-2 h-1, while also improving membrane wettability. This technology promises more efficient and environmentally friendly water purification solutions.

IN DEPTH

Key Findings

The integration of renewable cellulose nanomaterials into electrospun membranes dramatically enhances the performance of water treatment membranes, improving mechanical strength, hydrophilicity, permeability, fouling resistance, and pollutant removal capabilities. A review published in npj Materials Sustainability underscores the significant contribution of this breakthrough to the advancement of sustainable water treatment technologies.

Technical/Clinical Details

Nanocellulose, including cellulose nanocrystals (CNCs) and cellulose nanofibrils (CNFs), is an ideal material for enhancing water treatment membranes due to its unique properties. Key technical improvements highlighted in the review include:

- **Enhanced Mechanical Strength:** The incorporation of nanocellulose increases the physical durability of membranes, leading to extended lifespan and stable operation under harsh conditions.
- **Increased Hydrophilicity:** Cellulose's inherent hydrophilicity improves the membrane surface's affinity for water, facilitating water molecule passage. This significantly boosts water flux (permeability). For instance, adding just 0.5 wt.% of cellulose nanocrystals to polyethersulfone electrospun membranes resulted in an approximate 73% increase in water flux, from 136 to 235 L m-2 h-1, alongside improved membrane wettability.
- **Improved Fouling Resistance:** Enhanced hydrophilicity inhibits the adhesion of organic matter and microorganisms to the membrane surface, thereby reducing fouling, cleaning frequency, and maintenance costs.
- **Strengthened Pollutant Removal Capacity:** The high surface area and functional groups of nanocellulose improve the adsorption and filtration efficiency of various pollutants, such as heavy metal ions, organic dyes, and bacteria.

These characteristics, especially when combined with electrospinning technology, enable the fabrication of composite membranes with highly porous and uniform structures, leading to high-performance water treatment systems.

Background & Context

The escalating global water scarcity and pollution crisis demand the urgent development of effective and sustainable water treatment technologies. Existing membrane technologies often face issues like fouling, low permeability, and limited mechanical strength, resulting in high operational costs and environmental burdens. Utilizing nanotechnology, particularly renewable biomass-derived nanocellulose, offers a promising solution to overcome these challenges and provide more environmentally friendly options. This approach aligns well with the United Nations Sustainable Development Goals (SDGs).

Strategic Significance & Outlook

Nanocellulose-based water treatment membranes are expected to find widespread applications in industrial wastewater treatment, potable water production, and desalination. If low-cost, high-performance membrane development progresses, it will significantly contribute to the widespread adoption of water treatment technologies and cost reduction. Future prospects include the evolution of these membranes into smart membranes with sensing and self-healing capabilities, potentially integrating into more advanced water quality management systems. This technology represents a crucial step toward addressing global water challenges.

Source: https://www.azonano.com/news.aspx?newsID=41825

#07 Targeted Nanoparticles Enhance Anti-Cancer Immune Responses, Reprogramming Macrophages via mRNA Technology with Over 60% Reduction in Immunosuppressive Cells

Published September 11, 2026 News-Medical Australia

OVERVIEW

Researchers at the University of Adelaide have developed a groundbreaking method using lipid nanoparticles (LNPs) with mRNA technology to reprogram immune cells within tumors, thereby strengthening the body's anti-cancer immune response. This approach specifically targets tumor-associated macrophages (TAMs), demonstrating in animal models a reduction of immunosuppressive macrophages by over 60% and a fourfold increase in CXCL9, a crucial chemical signal that attracts cancer-fighting T cells to tumors. This significant advance holds the potential to substantially boost the efficacy of existing immunotherapies and improve prognoses for cancer patients.

IN DEPTH

Key Findings

A research team at the University of Adelaide has developed a novel therapeutic approach utilizing lipid nanoparticles (LNPs) incorporating mRNA technology, similar to that used in COVID-19 vaccines, to reprogram tumor-associated macrophages (TAMs) and significantly enhance anti-tumor immune responses. In animal studies, these nanoparticles successfully reduced the percentage of immunosuppressive macrophages by over 60% and increased levels of CXCL9, a critical chemical signal that attracts anti-cancer T cells to tumors, by fourfold.

Technical/Clinical Details

The core of this research lies in the targeted delivery of mRNA via nanoparticles. Key technical details include:

- **Application of mRNA Technology:** Leveraging the proven efficacy of mRNA technology from COVID-19 vaccines, the researchers applied it to cancer immunotherapy. mRNA encapsulated within LNPs induces specific gene expression to modulate the function of TAMs.
- **Targeting Tumor-Associated Macrophages (TAMs):** TAMs are known to play an immunosuppressive role within the tumor microenvironment. This new nanoparticle system specifically targets TAMs, suppressing their immunosuppressive functions to activate anti-tumor immune responses.
- **Reduction of Immunosuppressive Macrophages:** In animal models, the nanoparticle therapy successfully reduced the number of immunosuppressive macrophages within tumors by over 60%. This effectively disarms the immunosuppressive tumor microenvironment, enabling effector immune cells like T cells to become more active.
- **Increased CXCL9 Expression:** Concurrently, the treatment led to a fourfold increase in the levels of CXCL9, a chemokine crucial for recruiting cytotoxic T lymphocytes (CTLs) to the tumor site, thereby promoting robust anti-tumor immune responses.

This approach holds significant potential for synergistic improvements in therapeutic efficacy when combined with existing immunotherapies, such as immune checkpoint inhibitors.

Background & Context

While cancer immunotherapy has shown remarkable therapeutic effects in many cancer types recently, it is not effective for all patients, especially in solid tumors with immunosuppressive tumor microenvironments where its efficacy is limited. TAMs within the tumor microenvironment have been identified as key factors that inhibit T cell activation and promote tumor growth through the expression of immune checkpoint molecules and cytokine secretion. Therefore, therapeutic strategies targeting TAMs are gaining attention as a crucial approach to enhance the effectiveness of immunotherapy.

Strategic Significance & Outlook

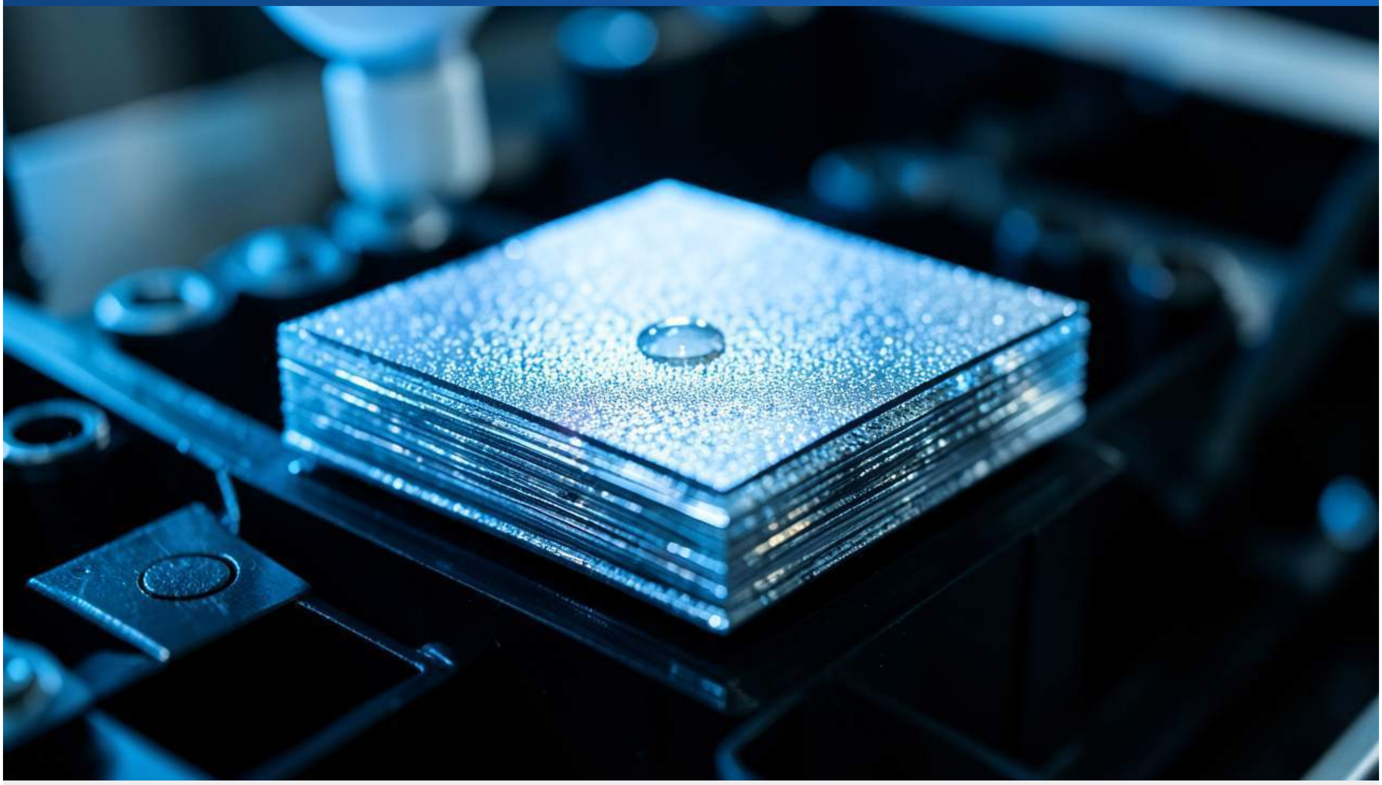
The research findings from the University of Adelaide represent a new frontier in cancer immunotherapy and are expected to contribute to improved treatment outcomes for various cancer types in the future. The immediate focus will be on further evaluating the safety profile of this technology, validating its efficacy in diverse preclinical models, and ultimately transitioning to human clinical trials. This nanoparticle-based mRNA delivery system also holds promise for advancing personalized medicine, offering effective treatment options for refractory cancers and significantly improving patient prognoses.

Source: https://www.news-medical.net/news/20260911/Targeted-nanoparticles-strengthen-anti-cancer-immune-responses-in-tumors.aspx

Collected: September 18, 2026 | Automated Research System (Gemini API)

#08 MXene Nanomaterials Achieve 98.3% Capacitance Retention in Supercapacitors and 100 mA cm-2 Bifunctional Electrocatalysis for Hydrogen Production

Published September 12, 2026 Bioengineer.org Unknown



OVERVIEW

MXene-based nanomaterials are emerging as frontier materials for both high-performance supercapacitors and clean hydrogen production. A MXene/PANI hybrid, synthesized through composite engineering, demonstrated exceptional capacitance retention of 98.3% after 10,000 cycles, with capacities of approximately 503 F g-1 and 1682 F cm-3. Furthermore, a Ni3Se4-NiSe2-Co3O4 heterostructure on MXene functions as an efficient bifunctional electrocatalyst, achieving 100 mA cm-2 at a cell voltage of 1.64 V with 100 hours of stable operation.

IN DEPTH

Key Findings

MXene nanomaterials are rapidly gaining prominence as frontier materials for both high-performance supercapacitors and clean hydrogen production, exhibiting exceptional dual-functionality. Notably, a MXene/polyaniline (PANI) hybrid composite engineered for supercapacitors maintained an outstanding 98.3% capacitance retention after 10,000 cycles, achieving high specific and volumetric capacitances of approximately 503 F g-1 and 1682 F cm-3, respectively. Concurrently, a Ni_3Se_4-$NiSe_2$-Co_3O_4 heterostructure constructed on MXene demonstrated highly efficient bifunctional electrocatalytic activity, reaching 100 mA cm-2 at a cell voltage of 1.64 V with remarkable stability over 100 hours for hydrogen production.

Technical / Clinical Details

For supercapacitor applications, the MXene/PANI hybrid capitalizes on the high electrical conductivity of MXene and the significant pseudocapacitance of PANI, leading to a synergistic enhancement in energy storage performance. The long-term reliability is evidenced by the impressive 98.3% capacitance retention over 10,000 cycles, indicating minimal degradation of the electrode material. In hydrogen production, the Ni_3Se_4-$NiSe_2$-Co_3O_4 heterostructure on MXene demonstrates robust catalytic activity for both oxygen evolution reaction (OER) and hydrogen evolution reaction (HER). The 100-hour stable operation and a current density of 100 mA cm-2 at 1.64 V underscore its potential for practical water electrolysis systems, surpassing many conventional catalysts.

Background & Context

The global demand for sustainable energy solutions is driving intense research into advanced materials for energy storage and conversion. Supercapacitors, known for their rapid charge-discharge capabilities and long cycle life, are vital for applications ranging from electric vehicles to grid-scale energy storage and portable electronics. Simultaneously, clean hydrogen production via water electrolysis is crucial for decarbonizing various sectors and establishing a future hydrogen economy. MXenes, a class of two-dimensional transition metal carbides, nitrides, or carbonitrides, are highly promising due to their unique properties, including high surface area, excellent electrical conductivity, and tunable surface chemistry, which make them ideal for these demanding applications.

Strategic Significance & Outlook

This dual functionality of MXene-based materials opens new avenues for integrated energy system design. Enhanced supercapacitor performance can extend the range of electric vehicles and improve the lifespan of electronic devices, while highly efficient catalysts for hydrogen production will accelerate the transition to a clean energy economy. Future research will focus on scaling up the synthesis of these MXene-based materials, further optimizing their composite structures, and rigorously evaluating their long-term stability and cost-effectiveness in real-world conditions. The exploration of novel MXene compositions and their integration into advanced devices will play a central role in the development of next-generation energy technologies.

Source: https://bioengineer.org/mxenes-emerge-as-frontier-nanomaterials-powering-supercapacitors-and-clean-hydrogen-production/

Collected: September 18, 2026 | Automated Research System (Gemini API)

#09 University of Queensland Develops Smart Nanocoating Slowing Steel Rust Corrosion Over 600-Fold to 0.0000372 mm/year

Published September 17, 2026 The Brighter Side of News (University of Queensland) Australia

OVERVIEW

Researchers at the University of Queensland developed a smart nanocoating using pH-sensitive nanocontainers storing benzotriazole (BTA) corrosion inhibitor within an aqueous polyurethane matrix. This innovative coating achieved a calculated corrosion rate of 0.0000372 millimeters per year in electrochemical tests, over 600 times slower than unprotected steel. The breakthrough demonstrates a new direction for significantly enhancing long-term material protection by combining a physical barrier with an active, responsive mechanism triggered at the onset of corrosion.

IN DEPTH

Key Findings

Researchers at the University of Queensland have engineered a smart nanocoating that drastically slows down rust corrosion in steel by over 600 times compared to unprotected steel. This innovative coating, which embeds pH-sensitive nanocontainers filled with benzotriazole (BTA) corrosion inhibitor within an aqueous polyurethane matrix, achieved an impressive calculated corrosion rate of just 0.0000372 millimeters per year in electrochemical assessments.

Technical / Clinical Details

The developed smart nanocoating utilizes an aqueous polyurethane (WPU) base, in which pH-sensitive nanocontainers encapsulate the benzotriazole (BTA) corrosion inhibitor. These nanocontainers are engineered to respond to pH changes (typically acidification) that occur when corrosion initiates on the metal surface, triggering the release of the BTA inhibitor. Upon release, BTA forms a protective layer on the steel surface, effectively stifling further corrosion reactions. Electrochemical tests, such as electrochemical impedance spectroscopy (EIS), demonstrated that this coating exhibited extremely low corrosion current densities, reducing the annual corrosion rate from approximately 0.0225 millimeters for unprotected steel to a mere 0.0000372 millimeters. This result unequivocally highlights a protective efficacy far superior to that of conventional passive barrier coatings.

Background & Context

Metal corrosion represents a formidable economic challenge, incurring trillions of dollars in losses annually across critical sectors like infrastructure, transportation, and manufacturing. Traditional anti-corrosion coatings primarily function as physical barriers, but their protective capability is compromised when scratches or micro-defects occur, leading to localized corrosion. Research into self-healing or active anti-corrosion coatings has thus become a crucial avenue for addressing these vulnerabilities. The University of Queensland's research provides a transformative approach by integrating 'smart' functionality—autonomous inhibitor release at the initial stages of corrosion—thereby dramatically extending the lifespan of metal structures beyond simple barrier protection.

Strategic Significance & Outlook

This smart nanocoating technology holds the potential to revolutionize corrosion protection for steel components in harsh environments, including bridges, ships, automobiles, aircraft, and offshore structures. It promises substantial reductions in maintenance costs and resource consumption associated with corrosion, contributing to a more sustainable society. Future research will likely focus on enhancing the durability of the nanocontainers, exploring a broader range of corrosion inhibitors beyond BTA, scaling up coating production, and evaluating its applicability to various metal substrates. This active corrosion prevention strategy has the potential to redefine the standard for future material protection technologies globally.

Source: https://www.thebrighterside.news/post/smart-nanocoating-slows-rust-corrosion-by-more-than-600-times/

Collected: September 18, 2026 | Automated Research System (Gemini API)

#10 Medical College of Wisconsin Pioneers Multi-Functional Nano Drug Delivery Systems for Glaucoma, Atherosclerosis, and Triple-Negative Breast Cancer

Published September 10, 2026 Medical College of Wisconsin USA

OVERVIEW

A collaborative team from the Medical College of Wisconsin and Marquette University has developed innovative nano drug delivery systems targeting glaucoma, atherosclerosis, and triple-negative breast cancer. These systems demonstrate enhanced drug targeting and delivery to disease sites, offering improved therapeutic efficacy. Specifically, solid drug nanoparticles are designed for deep optic nerve delivery in glaucoma, dendrimers for efficient plaque degradation in atherosclerosis, and a novel system capable of crossing the blood-brain barrier for triple-negative breast cancer. The research aims for future clinical trials and commercialization.

IN DEPTH

Key Findings

A joint research team from the Medical College of Wisconsin (MCW) and Marquette University has developed groundbreaking nano drug delivery systems designed to treat challenging diseases such as glaucoma, atherosclerosis, and aggressive triple-negative breast cancer. These systems precisely deliver therapeutic agents to the source of the disease, promising enhanced efficacy and reduced systemic side effects.

Technical / Clinical Details

For glaucoma treatment, the team engineered solid drug nanoparticles capable of penetrating deep into the optic nerve, a region often inaccessible to conventional eye drops. This targeted delivery mechanism is crucial for effective neuroprotection, addressing a significant limitation in current glaucoma therapies. In the context of atherosclerosis, the researchers utilized dendrimers—highly branched polymer nanoparticles—to specifically degrade arterial plaques. This approach offers a novel strategy to halt and potentially reverse the progression of this leading cause of cardiovascular disease.

Perhaps most significantly, a nano delivery system was developed for triple-negative breast cancer (TNBC), renowned for its aggressive nature and resistance to standard treatments. This innovative system demonstrates the ability to traverse the blood-brain barrier, opening new avenues for treating brain metastases, a common and devastating complication of TNBC. The ability to bypass this formidable biological barrier represents a major leap forward in addressing an unmet medical need for patients with this form of cancer.

Background & Context

Nanotechnology-based drug delivery systems (DDS) are transformative tools in medicine, enhancing drug stability, controlling biodistribution, and improving targeted delivery to specific cells or tissues. These benefits can significantly augment the effectiveness of existing drugs and enable entirely new therapeutic modalities. The precision offered by nanoparticles allows for maximizing therapeutic impact while minimizing off-target exposure and adverse events, a critical advantage in managing complex diseases. The MCW and Marquette University research aligns with global efforts to leverage nanotechnology for personalized and more effective medical interventions.

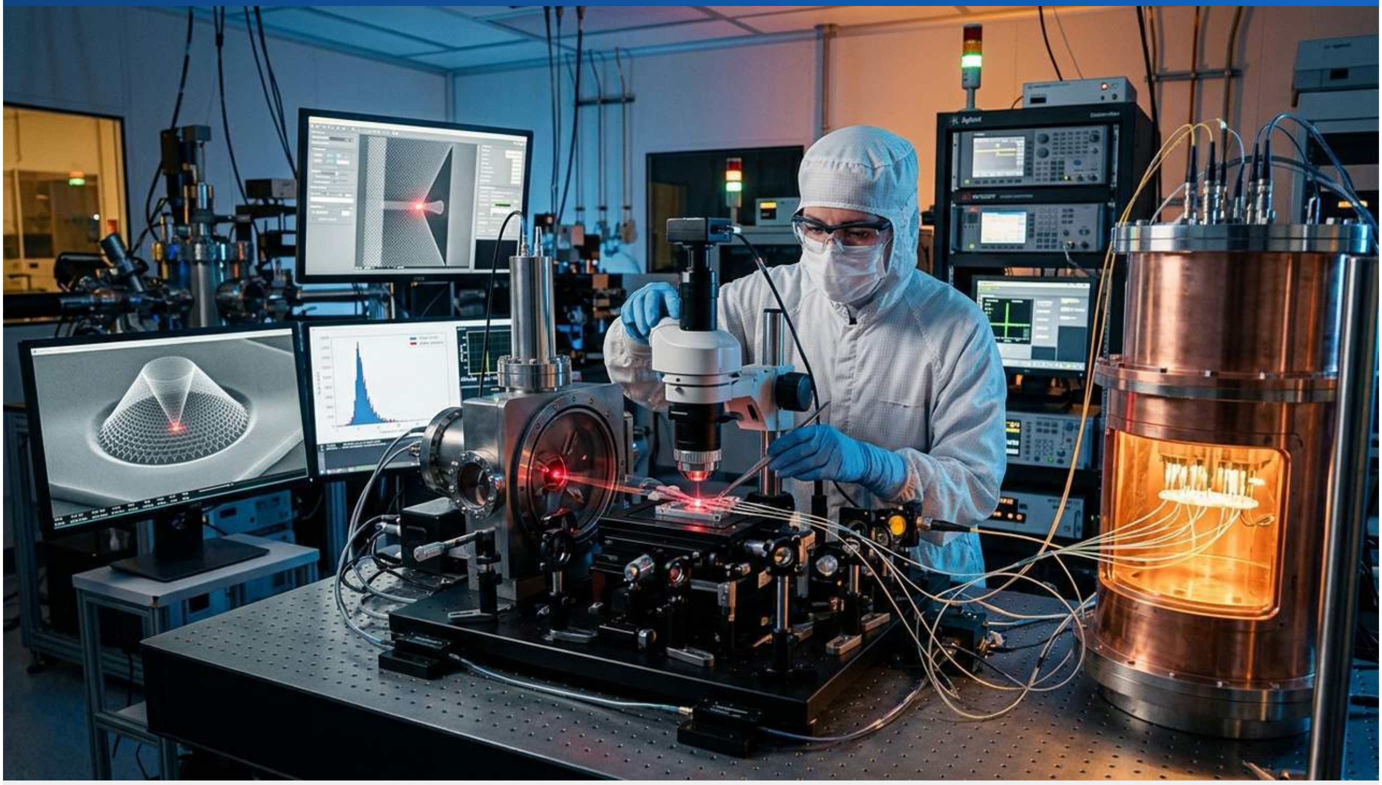
Strategic Significance & Outlook

The research team plans to further optimize these nano drug delivery systems, conducting extensive preclinical evaluations for safety and efficacy before advancing to human clinical trials. The TNBC delivery system, in particular, holds immense promise as a potentially game-changing therapeutic option for a patient population with limited choices. Successful commercialization of these technologies could revolutionize the treatment landscape for several intractable diseases, significantly improving patient outcomes and quality of life. This advancement underscores the growing potential of nanotechnology to deliver precise, effective solutions across diverse medical fields.

Source: https://www.mcw.edu/mcwknowledge/mcw-stories/nano-drug-delivery-systems-treat-diseases-at-their-source

#11 Nanofabrication Boosts III-V Quantum Dot Photon Collection Efficiency Beyond 80% for Quantum Technologies

Published September 16, 2026 Quantum Zeitgeist International



OVERVIEW

Advances in nanofabrication and cavity quantum electrodynamics have enabled III-V quantum dots (QDs) to achieve photon collection efficiencies exceeding 80%. These 20-nanometer scale nanostructures function as two-level quantum systems capable of emitting single photons on demand. This breakthrough extends beyond fundamental quantum research, with early applications anticipated in bioimaging, accelerating the practical implementation of quantum technologies.

IN DEPTH

Key Findings

III-V quantum dots (QDs) have achieved a remarkable photon collection efficiency exceeding 80%, thanks to significant advancements in nanofabrication techniques and cavity quantum electrodynamics (CQED). This breakthrough dramatically improves the performance of single-photon sources, promising substantial implications for quantum information science and precision bioimaging.

Technical / Clinical Details

At the heart of this technology are III-V semiconductor quantum dots, precisely structured at a minuscule scale of approximately 20 nanometers. These QDs operate as ideal two-level quantum systems, capable of emitting single photons on demand. Nanofabrication techniques enable the precise placement of these QDs and the creation of surrounding optical cavities. This strategic integration ensures that photons emitted by the QDs are efficiently captured within the cavity, drastically enhancing their collection probability.

By leveraging the principles of cavity quantum electrodynamics, the emission properties of the QDs are finely tuned, optimizing both the directionality and efficiency of photon emission. Specifically, maximizing the coupling strength between the QD and the cavity mode enhances the spontaneous emission rate while suppressing photon losses through undesired pathways. The achievement of over 80% photon collection efficiency is a direct result of these sophisticated design and control capabilities, significantly boosting the reliability and practicality of quantum light sources that were previously challenging to realize.

Background & Context

Single-photon sources are fundamental building blocks for various quantum technologies, including quantum cryptography, quantum computing, and quantum metrology. Developing high-efficiency and reliable single-photon sources has long been a primary challenge in quantum information science. Traditional single-photon sources often suffered from limitations such as low efficiency, the requirement for cryogenic temperatures, or difficulties in on-demand photon generation. Achieving over 80% collection efficiency with III-V QDs marks a critical step in overcoming these hurdles, substantially elevating the feasibility of commercial quantum applications.

Strategic Significance & Outlook

This III-V QD technology is poised to extend beyond fundamental quantum physics research into diverse practical applications. Its high-efficiency photon generation capability will particularly contribute to secure information transfer in quantum key distribution and the development of faster, more robust quantum computing processors. In the field of bioimaging, the enhanced detection sensitivity at the single-photon level could enable super-resolution imaging of biomolecules and deeper tissue optical diagnostics. Future key steps for broader adoption will include improving room-temperature operational stability and establishing scalable production technologies.

Source: https://quantumzeitgeist.com/iii-v-quantum-dot-80-percent/

#12 Morphotonics Unveils Display-Centric Nanoimprint Solution to Overcome AR Waveguide Cost and Production Bottlenecks

Published September 10, 2026 Vertex AI Search Netherlands

OVERVIEW

Dutch nanoimprint lithography firm Morphotonics announced at CIOE 2026 that the key to unlocking low-cost, high-volume production of AR glasses waveguides lies not in semiconductor, but in display industry technology. Their nanoimprint lithography leverages large-area, high-throughput processes to reduce manufacturing costs and accelerate mass adoption of AR waveguides. This approach offers a highly efficient alternative to current expensive and complex production methods.

IN DEPTH

Key Findings

Morphotonics, a Dutch nanoimprint lithography specialist, unveiled a groundbreaking strategy at the China International Optoelectronic Expo (CIOE) 2026, asserting that the bottleneck in cost-effective, high-volume production of Augmented Reality (AR) glasses waveguides can be overcome by drawing expertise from the display industry, rather than solely relying on semiconductor manufacturing. The company aims to leverage its nanoimprint lithography (NIL) technology to enable significantly lower production costs and faster scaling for AR waveguides, thereby accelerating the mass market penetration of AR devices.

Technical / Clinical Details

AR waveguides require the precise fabrication of intricate optical structures, such as gratings, on their surfaces to efficiently guide and project light into the user's eye. Traditional manufacturing methods often involve expensive and complex processes borrowed from the semiconductor industry, including advanced photolithography, which are ill-suited for the large-area, high-volume requirements of consumer AR. Morphotonics' NIL technology directly transfers nanoscale patterns from a master mold onto a waveguide substrate. This process, rooted in display manufacturing principles, is inherently capable of large-area patterning with high throughput and significantly lower capital expenditure compared to semiconductor fabs. For example, NIL systems can achieve sub-micron patterning at a fraction of the cost per unit compared to EUV or deep UV lithography, and process large substrates (e.g., Generation 8.5 display glass) that are much larger than typical semiconductor wafers, enabling parallel production of multiple waveguide units from a single substrate.

Background & Context

AR glasses are widely anticipated as the next major computing platform, yet their widespread adoption has been hampered by high price points and manufacturing complexities. A significant contributor to this cost is the production of high-performance waveguides, which are crucial for delivering immersive AR experiences. The prevailing approach has been to adapt semiconductor fabrication techniques, which are designed for small, ultra-precise logic chips, not for the larger, optically critical components needed in displays. Morphotonics' expertise in nanoimprint technology, particularly its heritage in the display industry for applications like anti-glare coatings and backlight units, provides a unique advantage. Their ability to manage large substrates and achieve uniform patterning across expansive areas positions them well to address the specific challenges of AR waveguide manufacturing, where yield and throughput on large panels are paramount.

Strategic Significance & Outlook

The success of Morphotonics' display-centric approach to AR waveguide manufacturing could dramatically reduce the overall cost of AR glasses, making them more accessible to a broader consumer base. This cost reduction would not only stimulate consumer adoption but also encourage greater investment and innovation in the AR ecosystem, enabling more companies to enter the market with diverse product offerings. Beyond consumer electronics, lower-cost AR waveguides could unlock new applications in industrial settings, healthcare, and education. Furthermore, nanoimprint technology holds promise for other emerging optical components, such as micro-LED displays and metasurface optics, suggesting a pivotal role in the future convergence of nanotechnology and display innovation. The move signals a potential shift away from direct adaptation of semiconductor processes towards more application-specific, high-volume manufacturing solutions for advanced optical components.

Source: https://www.digitimes.com/news/a20260909VL234/ar-display-expo-manufacturing-nanoimprint.html

#13 Clarivate Names David L. Allara and Ralph G. Nuzzo Citation Laureates for Pioneering Work in Self-Assembled Nanomaterials

Published September 17, 2026 PR Newswire (Clarivate) USA

OVERVIEW

Clarivate has announced David L. Allara and Ralph G. Nuzzo of Pennsylvania State University as Citation Laureates for their transformative work in self-assembled nanomaterials, specifically self-assembled monolayers (SAMs). This recognition highlights their foundational contributions to controlling matter at the nanoscale, impacting diverse fields from electronics to biosensors. The Citation Laureates program identifies highly-cited researchers whose breakthroughs are deemed potential Nobel Prize recipients.

IN DEPTH

Key Findings

Clarivate, a global leader in analytics, has unveiled its 2026 Citation Laureates, recognizing scientists whose highly cited research has made transformative breakthroughs and are considered potential Nobel Prize recipients. In the Chemistry category, Professors David L. Allara and Ralph G. Nuzzo from Pennsylvania State University have been honored for their pioneering work in the field of self-assembled nanomaterials, particularly self-assembled monolayers (SAMs). Their collective research has laid the fundamental groundwork for precisely controlling surface properties at the nanoscale, thereby impacting a vast array of scientific and technological applications.

Technical / Clinical Details

Professors Allara and Nuzzo are credited with establishing much of the scientific understanding and practical applications of self-assembled monolayers (SAMs), where organic molecules spontaneously arrange themselves into highly ordered, single-molecule thick films on substrate surfaces. Their research meticulously elucidated the mechanisms of SAM formation, characterized their structural properties, and demonstrated methodologies for their functionalization. For instance, they were instrumental in identifying the processes by which various alkanethiol derivatives form dense, well-ordered monolayers on gold and silver surfaces, and how the thickness, orientation, and surface energy of these films could be precisely controlled. This fundamental work enabled the bespoke tailoring of surface chemical and physical properties at the nanoscale, leading to applications such as enhanced sensitivity in biosensors, precise interface control in microelectronic devices, and the development of advanced corrosion-resistant coatings. Their early work, for instance, demonstrated the ability to create defect-free films spanning square centimeters, a crucial step for industrial adoption.

Background & Context

Self-assembled nanomaterials represent a cornerstone of bottom-up nanotechnology, offering a highly promising approach to fabricating functional materials through molecular-level self-construction. Since the concept of SAMs emerged in the 1980s, Professors Allara and Nuzzo have made seminal contributions to enhancing their structural integrity and chemical stability. Their research significantly advanced the understanding of self-assembly phenomena in nanoscience and engineering, profoundly influencing diverse fields including materials science, surface chemistry, biotechnology, and electronics. Without their foundational discoveries, the development of many contemporary nanodevices and sophisticated sensors would have been significantly hindered, or even impossible, underscoring the broad impact of their work.

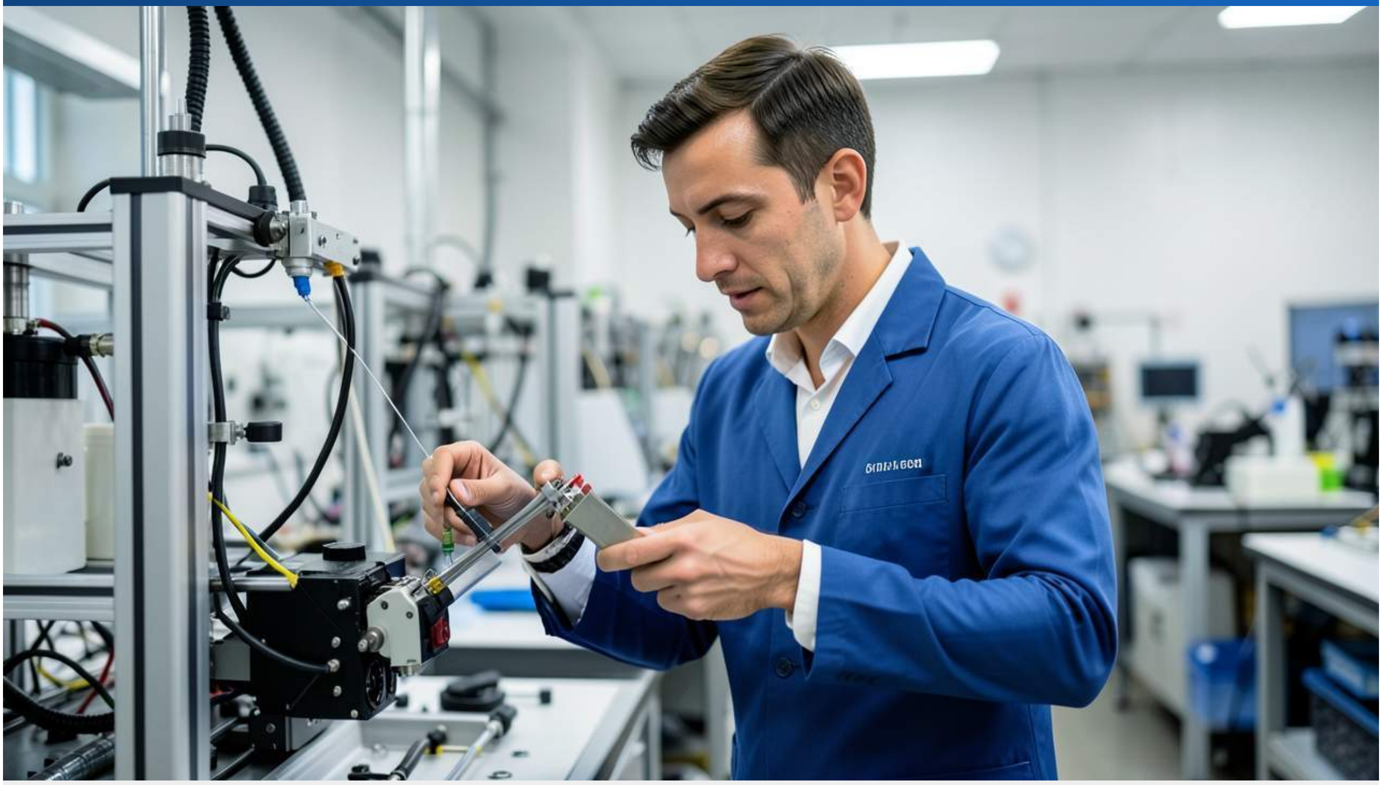
Strategic Significance & Outlook

The research by Professors Allara and Nuzzo on self-assembled nanomaterials continues to provide an indispensable foundation for the ongoing advancement of nanotechnology. SAMs are expected to unlock new possibilities in future applications such as molecular electronics, advanced functional coatings, precise drug delivery systems in personalized medicine, and efficiency improvements in renewable energy technologies, including solar cells. Clarivate's Citation Laureate award validates the sustained influence of their research and its high esteem within the scientific community. Their accomplishments are recognized as truly 'transformative scientific breakthroughs' that the Nobel Prize Committee is highly likely to consider, solidifying their legacy as pioneers who fundamentally shaped our ability to manipulate matter at the nanoscale for technological benefit.

Source: https://www.prnewswire.com/news-releases/clarivate-reveals-citation-laureates-2026-recognizing-transformative-scientific-breakthroughs-302880553.html

#14 Materials Science-2026 Conference to Explore Nanomaterial Applications in Defense, Aerospace, and Mechanical Engineering

Published September 14, 2026   Conferences.com   イタリア



OVERVIEW

The "Material Science-2026" conference, scheduled for September 14-15 in Rome, Italy, will address advanced materials across defense, aerospace, and mechanical engineering sectors. Key themes include advancements in nanomaterial science and nanotechnology, composite materials for aerospace and automotive, and high-performance ceramics. The conference will feature sessions dedicated to the latest applications of nanocomposites and other nanomaterials, poised to significantly influence future industrial trends and technological innovation.

IN DEPTH

Key Findings

The "Material Science-2026" conference, set to take place on September 14-15 in Rome, Italy, will serve as a pivotal platform for discussing the latest trends and future outlooks in materials science for defense, aerospace, and mechanical engineering. Central to the discussions will be advancements in nanomaterial science and nanotechnology, alongside composite materials tailored for aerospace and automotive applications, and high-performance ceramics.

Technical / Clinical Details

This international gathering will delve into how advanced materials, including high-performance nanocomposites, sophisticated ceramics, and specialized metal alloys, contribute to enhanced performance in extreme environments. In the aerospace sector, discussions will encompass the design and manufacturing of lighter, stronger, and more heat- and fatigue-resistant composite and nanostructured materials. Examples include research on integrating nanoparticles into carbon fiber reinforced plastics (CFRP) to improve interlaminar strength and impact resistance. For defense, themes will include the development of novel materials for ballistic protection and stealth technology, while mechanical engineering topics will cover wear- and corrosion-resistant surface coatings and nanomaterial applications in sensors. Cross-cutting themes such as material characterization, simulation techniques, and sustainable material development will also be addressed.

Background & Context

The defense, aerospace, and mechanical engineering sectors are perpetually driven by the demand to push the boundaries of material performance. The aerospace industry, in particular, requires lightweight yet highly durable materials to achieve fuel efficiency and ensure safety. The defense industry seeks more robust and functional materials for enhanced weapon systems and soldier protection. Nanotechnology offers transformative solutions to meet these demands. By designing and controlling materials at the nanoscale, unprecedented property enhancements and multi-functionality, previously unattainable with bulk materials, become possible. This conference plays a crucial role in bridging these technological challenges with emerging opportunities.

Strategic Significance & Outlook

The "Material Science-2026" conference will be a significant event showcasing how nanomaterials are shaping the future of these critical industrial sectors. The research findings and technological innovations presented are expected to directly influence the design of next-generation aircraft, spacecraft, defense systems, and various mechanical devices. Particularly, progress toward the practical implementation of nanocomposites and smart materials is anticipated to boost industrial competitiveness and create new market opportunities. Attendees will have the chance to foster collaboration among researchers and strengthen ties with industry, thereby accelerating the transition from fundamental research to practical application.

Source: https://materialscience.materialsconferences.com/events-list/materials-in-defence-aerospace-and-mechanical-engineering