TROY TECHNICAL

POLYMERS & RESINS

WEEKLY REPORT

November 14 - November 20, 2026 | Issue 2026-W46

Qualification evidence across formulation, processing, durability and circularity

12	10
ANALYZED ARTICLES	PRIORITY THEMES

Issued 2026-11-20 | English edition | fixed approved cover artwork



Polymers & Resins: the boundary moved from isolated claims to qualification evidence

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

SIGNAL 01 | MOLECULE & FORMULATION

SiO2/Al2O3 Hybrid Nanoparticles: Epoxy Anti-Corrosion Specs 2026

Researchers have developed an epoxy nanocomposite coating using GPMS-functionalised SiO2/Al2O3 hybrid nanoparticles that reduces corrosion current density on carbon steel by more than two orders of magnitude.

SIGNAL 02 | MATERIAL PRODUCTION

Polyolefin Upcycling: ETH Zurich's 2026 High-Strength Adhesive Tech

Researchers at ETH Zurich have developed a visible-light-driven grafting method to convert waste polyethylene (PE) and polypropylene (PP) into high-strength industrial adhesives.

SIGNAL 03 | PROCESSING

Fluorine-Free Laser Coating: Durable Protection for 7075 Alloy

Researchers have developed a fluorine-free superhydrophobic coating for 7075 aluminium alloy that achieves a water contact angle of 163.4° and a corrosion protection efficiency of 99.86%.

SIGNAL 04 | COMPONENT ADOPTION

PEEK Scaffolds: Gradient-Porosity TPMS Geometries for Bone Repair

Researchers evaluated five triply periodic minimal surface (TPMS) geometries in polyether ether ketone (PEEK) scaffolds, finding that Split P scaffolds provide the optimal balance of biomechanical and hydrodynamic performance.

DECISION

Focus this week's management attention on qualification evidence across formulation, processing, durability and circularity. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: select applications where performance data can justify qualification effort and switching cost.
2. Suppliers: provide process windows, reliability data, traceability and recovery economics with the material.
3. Executives: track scale, price, long-term reliability, regulation, recyclability and customer qualification.

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

40 days
A04

SOURCE-BOUND CONDITION
The system maintains a wet adhesion strength of 9.3 MPa after 40 days of salt-water immersion, significantly improving long-term durability in aggressive environments.

99.86%
A08

SOURCE-BOUND CONDITION
Researchers have developed a fluorine-free superhydrophobic coating for 7075 aluminium alloy that achieves a water contact angle of 163.4° and a corrosion protection efficiency of 99.86%.

76.4 %
A01

SOURCE-BOUND CONDITION
The material achieves a UL-94 V-0 classification and reduces total smoke production by up to 76.4 %, significantly enhancing safety for electromobility and energy storage.

95.2%
A02

SOURCE-BOUND CONDITION
Achieving a self-healing efficiency of 95.2%, the system provides robust corrosion protection for metal components in marine and industrial environments.

50 million
A10

SOURCE-BOUND CONDITION
The material achieves higher tensile strength than conventional hemp-based natural fibers, utilizing a waste resource of over 50 million tons annually.

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

Molecule & formulation

P01/P06

Researchers have developed an epoxy nanocomposite coating using GPMS-functionalised SiO2/Al2O3 hybrid nanoparticles that.

2

Material production

P02/P07

Researchers at ETH Zurich have developed a visible-light-driven grafting method to convert waste polyethylene (PE) and.

3

Processing

P03/P08

Researchers have developed a fluorine-free superhydrophobic coating for 7075 aluminium alloy that achieves a water contact.

4

Component adoption

P04/P09

Researchers evaluated five triply periodic minimal surface (TPMS) geometries in polyether ether ketone (PEEK) scaffolds.

5

Recovery & reuse

P05/P10

Researchers have developed a composite flame-retardant epoxy coating that delays the onset of lithium-ion battery thermal.

EVIDENCE REQUIRED AT EACH HANDOFF

Molecule & formulation to Material production	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale, price, long-term reliability, regulation, recyclability and customer qualification.
Material production to Processing	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale, price, long-term reliability, regulation, recyclability and customer qualification.
Processing to Component adoption	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale, price, long-term reliability, regulation, recyclability and customer qualification.
Component adoption to Recovery & reuse	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck scale, price, long-term reliability, regulation, recyclability and customer qualification.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented scale, price, long-term reliability, regulation, recyclability and customer qualification.

Priority map: maturity and next decision locus



P01	SiO2/Al2O3 Hybrid Nanoparticles: Epoxy Anti-Corrosion Specs 2026 System / adoption | cue: orders
P02	Polyolefin Upcycling: ETH Zurich's 2026 High-Strength Adhesive Tech Tech / process | cue: no system/business cue
P03	Fluorine-Free Laser Coating: Durable Protection for 7075 Alloy Tech / process | cue: no system/business cue
P04	PEEK Scaffolds: Gradient-Porosity TPMS Geometries for Bone Repair Tech / process | cue: no system/business cue
P05	Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s Tech / process | cue: no system/business cue
P06	Lotus-Inspired Coating: NIR-Triggered Self-Healing in 15 Seconds System / adoption | cue: system
P07	Nissan and Food Ribbon: Pineapple Leaf Fiber Exterior Parts Specs Tech / process | cue: no system/business cue
P08	CFRP Manufacturing: Kumoh Nat'l Inst't improves strength and toughness Tech / process | cue: no system/business cue
P09	Dual-Salt Polymer Electrolyte: Self-Healing Li-Metal Battery Specs Tech / process | cue: no system/business cue
P10	CsxWO3 Transparent Coating: Winter De-Icing and Summer Cooling 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 SiO2/Al2O3 Hybrid Nanoparticles: Epoxy Anti-Corrosion Specs 2026

A04 | Molecule & formulation | Product adoption

Prior release 2026-11-13

FACT

Researchers have developed an epoxy nanocomposite coating using GPMS-functionalised SiO2/Al2O3 hybrid nanoparticles that reduces corrosion current density on carbon steel by more than two orders of magnitude. The system maintains a wet adhesion strength of 9.3 MPa after 40 days of salt-water immersion, significantly improving long-term durability in aggressive environments.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: SYSTEM / ADOPTION

P02 Polyolefin Upcycling: ETH Zurich's 2026 High-Strength Adhesive Tech

A09 | Material production | Joint evaluation

2026-11-18

FACT

Researchers at ETH Zurich have developed a visible-light-driven grafting method to convert waste polyethylene (PE) and polypropylene (PP) into high-strength industrial adhesives. The process achieves lap-shear strengths up to 13.4 MPa on metal substrates, enabling the upcycling of low-value plastic waste into high-performance functional materials.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

EDITORIAL SCORE 20/25 | MATURITY 3/5 | DECISION LOCUS: TECH / PROCESS

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

P03 Fluorine-Free Laser Coating: Durable Protection for 7075 Alloy

A08 | Processing | Pilot

2026-11-18

FACT

Researchers have developed a fluorine-free superhydrophobic coating for 7075 aluminium alloy that achieves a water contact angle of 163.4° and a corrosion protection efficiency of 99.86%. By combining femtosecond laser texturing with organic-inorganic reinforcement, the coating significantly reduces ice adhesion to 34 kPa. This technology provides a sustainable alternative to fluorinated modifiers for aerospace, marine, and transport applications.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

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

P04 PEEK Scaffolds: Gradient-Porosity TPMS Geometries for Bone Repair

A06 | Component adoption | Pilot

Prior release 2026-11-13

FACT

Researchers evaluated five triply periodic minimal surface (TPMS) geometries in polyether ether ketone (PEEK) scaffolds, finding that Split P scaffolds provide the optimal balance of biomechanical and hydrodynamic performance. The study demonstrates that adjusting central porosity and geometry significantly impacts stiffness, stress concentration, and permeability for craniofacial bone defect repair.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

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

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

P05 Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s

A01 | Recovery & reuse | Product adoption

2026-11-19

FACT

Researchers have developed a composite flame-retardant epoxy coating that delays the onset of lithium-ion battery thermal runaway by 465 s and reduces adjacent cell peak temperatures by 272 °C. The material achieves a UL-94 V-0 classification and reduces total smoke production by up to 76.4 %, significantly enhancing safety for electromobility and energy storage.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

EDITORIAL SCORE 19/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

P06 Lotus-Inspired Coating: NIR-Triggered Self-Healing in 15 Seconds

A02 | Molecule & formulation | Joint evaluation

2026-11-17

FACT

Researchers have developed a shape-memory superhydrophobic epoxy coating that recovers from mechanical damage in 15 seconds under near-infrared (NIR) light. Achieving a self-healing efficiency of 95.2%, the system provides robust corrosion protection for metal components in marine and industrial environments.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

EDITORIAL SCORE 19/25 | MATURITY 3/5 | DECISION LOCUS: SYSTEM / ADOPTION

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

P07 Nissan and Food Ribbon: Pineapple Leaf Fiber Exterior Parts Specs

A10 | Material production | Pilot

2026-11-19

FACT

Nissan and Food Ribbon have developed the world's first automotive exterior parts using Natural Fiber Reinforced Plastics (NFRP) derived from pineapple leaf fibers. The material achieves higher tensile strength than conventional hemp-based natural fibers, utilizing a waste resource of over 50 million tons annually.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

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

P08 CFRP Manufacturing: Kumoh Nat'l Inst't improves strength and toughness

A11 | Processing | Pilot

2026-11-18

FACT

Researchers at Kumoh National Institute of Technology have developed a manufacturing technique that simultaneously improves the interlaminar fracture toughness and strength of Carbon Fiber Reinforced Plastics (CFRP). By applying a low-melting-point polyamide nanofiber web, the team increased interlaminar fracture toughness by up to 296% while enhancing flexural and shear strength.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

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

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

P09 Dual-Salt Polymer Electrolyte: Self-Healing Li-Metal Battery Specs

A12 | Component adoption | Pilot

2026-11-14

FACT

Researchers have developed a self-healing dual-salt polymer electrolyte for lithium metal batteries capable of operating at room temperature. The material achieves an ionic conductivity of 2.23 mS cm-1 and suppresses dendrite growth, enhancing both safety and cycle life.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

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

P10 CsxWO3 Transparent Coating: Winter De-Icing and Summer Cooling

A03 | Recovery & reuse | Pilot

2026-11-20

FACT

Researchers have developed a transparent solid slippery coating using a phenyl/methylsiloxane network and CsxWO3 nanoparticles that combines photothermal de-icing with summer thermal management. The coating achieves 86.5 °C under sunlight while maintaining over 83% visible transparency, providing an all-weather solution for outdoor optical components.

WHY IT MATTERS

The decision relevance is qualification evidence across formulation, processing, durability and circularity. 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, provide process windows, reliability data, traceability and recovery economics with the material.

ACTION

Within 30 days, select applications where performance data can justify qualification effort and switching cost; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: scale, price, long-term reliability, regulation, recyclability and customer qualification.

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	select applications where performance data can justify qualification effort and switching cost	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	provide process windows, reliability data, traceability and recovery economics with the material	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, price, long-term reliability, regulation, recyclability and customer qualification.	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 01-12

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	Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s	https://www.european-coatings.com/news/coatings-technologies/fire-safe-coating-delays-lithium-ion-battery-thermal-runaway/
A02	Lotus-Inspired Coating: NIR-Triggered Self-Healing in 15 Seconds	https://www.european-coatings.com/news/coatings-technologies/lotus-inspired-superhydrophobic-coating-self-heals-in-15-seconds/
A03	CsxWO3 Transparent Coating: Winter De-Icing and Summer Cooling	https://www.european-coatings.com/news/coatings-technologies/transparent-coating-delivers-winter-de-icing-and-summer-cooling/
A04	SiO2/Al2O3 Hybrid Nanoparticles: Epoxy Anti-Corrosion Specs 2026	https://www.european-coatings.com/news/coatings-technologies/hybrid-nanoparticles-boost-epoxy-anti-corrosion-and-wet-adhesion/
A05	MXene-B4C-Polyimide Nanocomposite: Proton and EMI Shielding Specs	https://doi.org/10.21203/rs.3.rs-10946351/v1
A06	PEEK Scaffolds: Gradient-Porosity TPMS Geometries for Bone Repair	https://doi.org/10.1097/scs.0000000000013589
A07	PA6 Crystallization: Bisurea Additives and Optical Clarity 2025	https://www.plasticsengineering.org/2026/11/supramolecular-additives-reshape-pa6-crystallization-012645/
A08	Fluorine-Free Laser Coating: Durable Protection for 7075 Alloy	https://www.european-coatings.com/news/coatings-technologies/fluorine-free-laser-coating-protects-aluminium-alloy-durably/
A09	Polyolefin Upcycling: ETH Zurich's 2026 High-Strength Adhesive Tech	https://finance.sina.com.cn/roll/2026-11-18/doc-inizeacc1573112.shtml
A10	Nissan and Food Ribbon: Pineapple Leaf Fiber Exterior Parts Specs	https://msrweb.jp/article/11863/
A11	CFRP Manufacturing: Kumoh Nat'l Inst't improves strength and toughness	https://www.mt.co.kr/policy/2026/11/18/2026111817440141754
A12	Dual-Salt Polymer Electrolyte: Self-Healing Li-Metal Battery Specs	https://elettronauti.it/articolo/un-elettrolita-autoriparante-a-doppio-sale-per-batterie-al-litio/

Polymers_Resins — Selected Articles

Date: 2026-11-21

Articles: 12

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#04 SiO_2/Al_2O_3 Hybrid Nanoparticles: Epoxy Anti-Corrosion Specs 2026

#05 MXene–B_4C–Polyimide Nanocomposite: Proton and EMI Shielding Specs

#06 PEEK Scaffolds: Gradient-Porosity TPMS Geometries for Bone Repair

#07 PA6 Crystallization: Bisurea Additives and Optical Clarity 2025

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#12 Dual-Salt Polymer Electrolyte: Self-Healing Li-Metal Battery Specs

#01 Composite Epoxy Coating: Delaying LIB Thermal Runaway by 465s

Published November 19, 2026 European Coatings



OVERVIEW

Researchers have developed a composite flame-retardant epoxy coating that delays the onset of lithium-ion battery thermal runaway by 465 s and reduces adjacent cell peak temperatures by 272 °C. The material achieves a UL-94 V-0 classification and reduces total smoke production by up to 76.4 %, significantly enhancing safety for electromobility and energy storage.

IN DEPTH

Key Findings

The developed composite coating, specifically the EP/20RMH@AP-Fe1/PEPA4 formulation, significantly improves the thermal safety of lithium-ion batteries (LIBs). In thermal runaway propagation tests, the coating delayed the onset of thermal runaway at the directly heated Position-1 battery by 465 s and lowered the peak temperature of the adjacent Position-2 battery by 272 °C compared to uncoated cells. Additionally, the coating achieved a UL-94 V-0 classification and a limiting oxygen index (LOI) of 28.0 %.

Technical Details

The coating utilizes an epoxy resin (EP) matrix integrated with two complementary flame retardants: a biomass-based supramolecular magnesium hydroxide rod-crystal (RMH@AP-Fe) and a cage-like small-molecular charring agent called pentaerythritol phosphate (PEPA). While RMH@AP-Fe provides good interfacial compatibility with the EP matrix, it lacks sufficient char-forming efficiency on its own. The combination of both agents creates a composite intumescent flame-retardant system (RMH@AP-Fe/PEPA) that enhances char quality and creates a continuous protective barrier during combustion.

Smoke suppression performance was a primary result of this formulation:

- Total smoke production decreased by 76.4 % compared to pure EP.
- Peak smoke production rate decreased by 48.1 % compared to pure EP.

Background & Context

Epoxy resins are widely used in new energy vehicle components, such as insulating parts and battery protection housings, due to their electrical insulation, adhesion, and mechanical strength. However, their carbon- and hydrogen-rich chemical structure typically leads to rapid flame spread and the emission of dense, toxic smoke during fire events.

Significance & Outlook

The reduction in smoke and toxic gas release is critical for battery fire scenarios, as it extends evacuation time and minimizes secondary hazards. By providing effective thermal insulation, ablation resistance, and fire retardancy, this composite coating offers a multifunctional strategy for improving the safety of energy storage systems and electromobility applications.

Source: https://www.european-coatings.com/news/coatings-technologies/fire-safe-coating-delays-lithium-ion-battery-thermal-runaway/

Collected: November 21, 2026 | Automated Research System (AI)

#02 Lotus-Inspired Coating: NIR-Triggered Self-Healing in 15 Seconds

Published November 17, 2026 European Coatings



OVERVIEW

Researchers have developed a shape-memory superhydrophobic epoxy coating that recovers from mechanical damage in 15 seconds under near-infrared (NIR) light. Achieving a self-healing efficiency of 95.2%, the system provides robust corrosion protection for metal components in marine and industrial environments.

IN DEPTH

Key Findings

A new superhydrophobic epoxy coating can recover from physical damage within 15 seconds when exposed to near-infrared laser irradiation. The system demonstrates a self-healing efficiency of 95.2%, as quantified by Bode plot integration from electrochemical impedance spectroscopy. This recovery mechanism remains stable over multiple healing cycles, preventing the irreversible accumulation of damage caused by weathering, impact, or abrasion.

Technical Details

The coating architecture is inspired by the microstructure of lotus leaves and consists of two primary components:

- **Micro-pillar Arrays:** Fabricated via a template method using shape-memory epoxy resin, these arrays create a robust framework that shields internal structures from wear.
- **Dual-scale ZIF-8 Particles:** Zeolitic imidazolate framework-8 particles are sprayed onto the micro-pillar array to provide the hierarchical roughness necessary for stable superhydrophobicity.

Unlike conventional sprayed or doped coatings, this design uses the micro-pillar array as a protective shield. This ensures that superhydrophobicity is preserved even if the micro-pillars suffer mechanical fracture.

Background & Context

Superhydrophobic coatings are highly valued for corrosion protection in industrial and marine settings. However, commercial adoption has been limited by high susceptibility to mechanical damage and poor long-term stability. The researchers addressed these weaknesses by combining a shape-memory matrix with a biomimetic structural design to ensure the coating can be restored on-demand.

Significance & Outlook

Electrochemical impedance spectroscopy confirmed that the coating maintains its barrier performance over 28 days of immersion testing. The strong bonding between the ZIF-8 particles and the micro-pillar scaffold, combined with the rapid photo-thermal recovery, allows for consistent superhydrophobic behavior even after multiple abrasion cycles. This strategy offers a viable route to overcoming the durability hurdles associated with protecting metal components in engineering service environments.

Source: https://www.european-coatings.com/news/coatings-technologies/lotus-inspired-superhydrophobic-coating-self-heals-in-15-seconds/

Collected: November 21, 2026 | Automated Research System (AI)

#03 Cs_xWO_3 Transparent Coating: Winter De-Icing and Summer Cooling

Published November 20, 2026 European Coatings



OVERVIEW

Researchers have developed a transparent solid slippery coating using a phenyl/methylsiloxane network and Cs_xWO_3 nanoparticles that combines photothermal de-icing with summer thermal management. The coating achieves 86.5 °C under sunlight while maintaining over 83% visible transparency, providing an all-weather solution for outdoor optical components.

IN DEPTH

Key Findings

The developed transparent coating achieves a surface temperature of 86.5 °C under 1 sun illumination, representing an apparent photothermal conversion efficiency of 42.6% while maintaining visible light transmittance above 83%. In winter conditions at –20 °C without illumination, the coating demonstrates an icing delay of 121 s and an ice adhesion strength of 56.8 kPa. Under 1 kW/m² simulated solar irradiation, the ice-melting time on the Cs_xWO_3-20/PSO coating is 46.4% shorter than on bare glass.

Technical Details

The coating is based on a phenyl/methylsiloxane cross-linked network combined with free polydimethylsiloxane (PDMS) segments, creating a liquid-lubricant-free solid slippery surface with a sliding angle of 16°. Cesium tungsten bronze (Cs_xWO_3) nanoparticles serve as a spectrally selective filler, providing strong absorption in the near-infrared region and relatively weak absorption in the visible range.

Beyond de-icing, the near-infrared-selective absorption of Cs_xWO_3 allows the coating to act as a solar heat shield. In tests using a model house, the coating reduced indoor temperatures by 19.9 °C. Durability tests show the hybrid structure maintains stable performance after 1,000 abrasion cycles and prolonged chemical exposure.

Background & Context

Ice accumulation on outdoor optical windows is a critical challenge for UAV optoelectronic pods, automotive autonomous driving sensors, and building-integrated photovoltaic (BIPV) facades. Previous passive solutions, such as superhydrophobic surfaces and slippery liquid-infused porous surfaces (SLIPS), often fail due to lubricant depletion or wetting-state transitions. Conversely, active photothermal coatings using carbon-based materials or MXenes typically lack the necessary optical clarity for these applications.

Significance & Outlook

This material is one of the few reported transparent anti-icing coatings to simultaneously integrate liquid-lubricant-free solid slipperiness, low ice adhesion, near-infrared-selective photothermal de-icing, and summer thermal management. It offers a durable, all-weather solution for protecting and managing the temperature of transparent outdoor optical components.

Source: https://www.european-coatings.com/news/coatings-technologies/transparent-coating-delivers-winter-de-icing-and-summer-cooling/

Collected: November 21, 2026 | Automated Research System (AI)

#04 SiO_2/Al_2O_3 Hybrid Nanoparticles: Epoxy Anti-Corrosion Specs 2026

Published November 13, 2026 European Coatings



OVERVIEW

Researchers have developed an epoxy nanocomposite coating using GPMS-functionalised SiO_2/Al_2O_3 hybrid nanoparticles that reduces corrosion current density on carbon steel by more than two orders of magnitude. The system maintains a wet adhesion strength of 9.3 MPa after 40 days of salt-water immersion, significantly improving long-term durability in aggressive environments.

IN DEPTH

Key Findings

The hybrid coating containing 1 wt.% SiO_2 and 1 wt.% Al_2O_3 (1S1A) demonstrated a dramatic increase in corrosion resistance compared to neat epoxy and single-filler systems. Potentiodynamic polarisation measurements showed a reduction in corrosion current density (Icorr) from 0.1425 to 0.0005 μA/cm². Additionally, water uptake was limited to 5.09% after 40 days of immersion in a 3.5 wt.% NaCl solution, the lowest recorded level for this study.

Technical Details

To prevent nanoparticle agglomeration and ensure polymer compatibility, both silica (SiO_2) and alumina (Al_2O_3) nanoparticles were chemically modified with 3-glycidoxypropyltrimethoxysilane (GPMS). The success of this covalent grafting was verified using thermogravimetric analysis (TGA) and Fourier-transform infrared spectroscopy (FTIR). This epoxide-functional silane layer facilitates the covalent integration of fillers into the epoxy network during the curing process.

Regarding wet adhesion, the 1S1A coating retained a pull-off strength of 9.3 MPa after 40 days of immersion, representing a loss of only 24.39% ± 0.68%. In contrast, neat epoxy coatings lost 54.55% ± 1.13% of their adhesion strength under the same conditions.

Background & Context

Standard neat epoxy coatings are prone to curing-induced micropores. These defects allow the diffusion of chloride ions, oxygen, and water toward the substrate interface, which typically results in cathodic delamination, hydrolytic degradation, and under-film corrosion. The researchers targeted St-37 carbon steel for this study, utilizing a hybrid nanoparticle approach to address these vulnerabilities.

Significance & Outlook

The performance boost is attributed to a synergistic effect where SiO_2 provides pore-filling capabilities while Al_2O_3 provides covalent interfacial anchoring. This combination creates a dense, defect-free network that effectively restricts electrolyte ingress and suppresses delamination. These results indicate a viable path for enhancing the long-term stability of protective coatings in highly saline environments.

Source: https://www.european-coatings.com/news/coatings-technologies/hybrid-nanoparticles-boost-epoxy-anti-corrosion-and-wet-adhesion/

Collected: November 21, 2026 | Automated Research System (AI)

#05 MXene–B_4C–Polyimide Nanocomposite: Proton and EMI Shielding Specs

Published November 12, 2026　Research Square（プレプリント）



OVERVIEW

A lightweight MXene ($Ti_3C_2T_x$)–B_4C–polyimide nanocomposite achieves 100% proton attenuation and 54.7 dB EMI shielding in the X-band. This dual-function material reduces areal mass by approximately 81% compared to a 2.0 mm aluminum reference, offering a consolidated protection system for aerospace avionics.

IN DEPTH

Key Findings

The optimized nanocomposite, consisting of 20 wt% B_4C and 15 wt% MXene, provides 100% proton attenuation at a bulk thickness of 36 mm. This performance is approximately fivefold higher than an aerospace-grade aluminum reference. Simultaneously, the material delivers 54.7 dB of electromagnetic interference (EMI) shielding across the X-band (8.2–12.4 GHz) and maintains an electrical conductivity of 2.1×10^4 S/m.

Technical Details

The material system integrates surface-functionalized B_4C nanoparticles (~ 45 nm) and exfoliated MXene nanosheets into a polyimide matrix using solution casting and vacuum-assisted filtration. Design parameters were guided by SRIM/TRIM simulations, which indicated that a boron-rich composition of 31 at% could completely stop 50 MeV protons at approximately 36 mm thickness, with electronic stopping as the primary energy loss mechanism.

Physical and environmental testing confirmed the following specifications:

- **Mass Efficiency:** Areal mass reduction of ~ 81% relative to a 2.0 mm aluminum reference.
- **Mechanical Flexibility:** Retention of flexibility down to a 2 mm bend radius.
- **Environmental Durability:** Performance retention after 1,000 h of humidity exposure and 500 thermal cycles, aligned with RTCA DO-160G tests.
- **Radiation Dose:** MCNP6.2 simulations project an eightfold reduction in processor radiation dose.

Background & Context

Flight-critical avionics at cruise altitudes are simultaneously threatened by atmospheric proton radiation and EMI. Traditional protection requires separate layers—typically aluminum- or lead-based barriers for radiation and conductive copper-mesh for EMI. These separate strategies increase the total mass, volume, and integration complexity of avionics enclosures.

Significance & Outlook

By combining proton attenuation and EMI shielding into a single conformal material, this nanocomposite addresses the mass and volume constraints of aerospace electronics. The balance of shielding effectiveness, flexibility, and mass efficiency supports the development of lightweight, multifunctional protection systems for aerospace environments.

Source: https://doi.org/10.21203/rs.3.rs-10946351/v1

Collected: November 21, 2026 | Automated Research System (AI)

#06 PEEK Scaffolds: Gradient-Porosity TPMS Geometries for Bone Repair

Published November 13, 2026 The Journal of Craniofacial Surgery



OVERVIEW

Researchers evaluated five triply periodic minimal surface (TPMS) geometries in polyether ether ketone (PEEK) scaffolds, finding that Split P scaffolds provide the optimal balance of biomechanical and hydrodynamic performance. The study demonstrates that adjusting central porosity and geometry significantly impacts stiffness, stress concentration, and permeability for craniofacial bone defect repair.

IN DEPTH

Key Findings

The Split P scaffold geometry demonstrated the best overall balance between biomechanical and hydrodynamic performance. While Lidinoid and Diamond scaffolds exhibited the highest construct stiffness, the Schwarz and Split P geometries showed the highest permeability. Additionally, Gyroid and Split P scaffolds maintained the most uniform velocity distributions during hydrodynamic assessment.

Technical Details

The study analyzed five TPMS geometries: Diamond, Gyroid, Schwarz, Split P, and Lidinoid. The scaffolds were designed as cylindrical constructs with a diameter of 10 mm and a height of 10 mm. A gradient-porosity design was implemented to balance structural support and mass transport:

- **Peripheral Zone:** A 2-mm zone maintained a low porosity of 50% to provide mechanical support.
- **Central Region:** A 3-mm radius region featured variable porosities of 50%, 60%, 70%, and 80%.

Evaluation methods included uniaxial compression testing, computational fluid dynamics, and finite element analysis under compressive and rotational loads. Results indicated that increasing central porosity reduced both compressive and rotational stiffness and increased stress concentrations at the transition zones. The highest peak von Mises stresses occurred in Schwarz scaffolds under compressive loading and in Diamond scaffolds under rotational loading. Conversely, higher central porosity improved permeability and reduced the inlet-to-outlet pressure differential.

Background & Context

Large segmental craniofacial bone defects present a significant clinical challenge. Scaffold-based bone tissue engineering is a promising regenerative strategy to address these defects, requiring materials that can mimic the mechanical properties of bone while allowing for the transport of nutrients and waste.

Significance & Outlook

The findings highlight that both geometry and gradient-porosity are critical factors in determining the behavior of PEEK scaffolds. By optimizing these parameters, specifically through the use of Split P geometries, there is a clear potential for clinical translation in the repair of craniofacial bone defects.

Source: https://doi.org/10.1097/scs.0000000000013589

Collected: November 21, 2026 | Automated Research System (AI)

#07 PA6 Crystallization: Bisurea Additives and Optical Clarity 2025

Published November 17, 2026 Plastics Engineering (SPE) USA



OVERVIEW

Bisurea-based supramolecular additives significantly accelerate polyamide 6 (PA6) crystallization and shift the crystalline phase balance toward the α-phase. This modification reduces haze from 98.2% to approximately 19–20% in injection-molded specimens, enhancing optical clarity without substantially altering overall crystallinity.

IN DEPTH

Key Findings

Bisurea-based nucleating agents improve the optical clarity of injection-molded PA6 by promoting the formation of smaller crystallites and the α crystalline phase. In specimens with additive concentrations between 0.8 and 1.5 wt.%, haze decreased from 98.2% (neat PA6) to approximately 19–20%, while clarity increased from 68.4% to over 97%.

Technical Details

Researchers synthesized six bisurea compounds featuring a trans-1,4-disubstituted cyclohexane core with varying aliphatic side groups. These compounds form hydrogen-bonded supramolecular assemblies that serve as heterogeneous nucleation sites. Key technical results include:

- **Nucleation Temperature:** The peak crystallization temperature increased from 186.5°C for neat PA6 to above 191°C at concentrations as low as 0.02 wt.%.
- **Crystallization Kinetics:** At an isothermal temperature of 206°C, bisurea compound 2b reduced the crystallization half-time from 21.3 minutes (neat PA6) to 10.8 minutes at 0.02 wt.%, and further to 5.3 minutes at 1.0 wt.%.
- **Phase Composition:** While total crystallinity remained relatively stable (30.2% for neat PA6 vs. 31.0% for 1.0 wt.% additive), the α/γ phase ratio shifted from 57/43 to 90/10.
- **Thermal Stability:** The nucleating effect persisted through repeated processing; one compound showed a peak crystallization temperature decrease of only 0.8°C after 12 heating and cooling cycles.

Background & Context

Conventional nucleating agents typically provide sites for crystal formation, but supramolecular additives utilize molecular self-assembly to target nucleation kinetics and morphology. This study focused on how molecular architecture influences the interaction between the additive and the polymer matrix during cooling.

Significance & Outlook

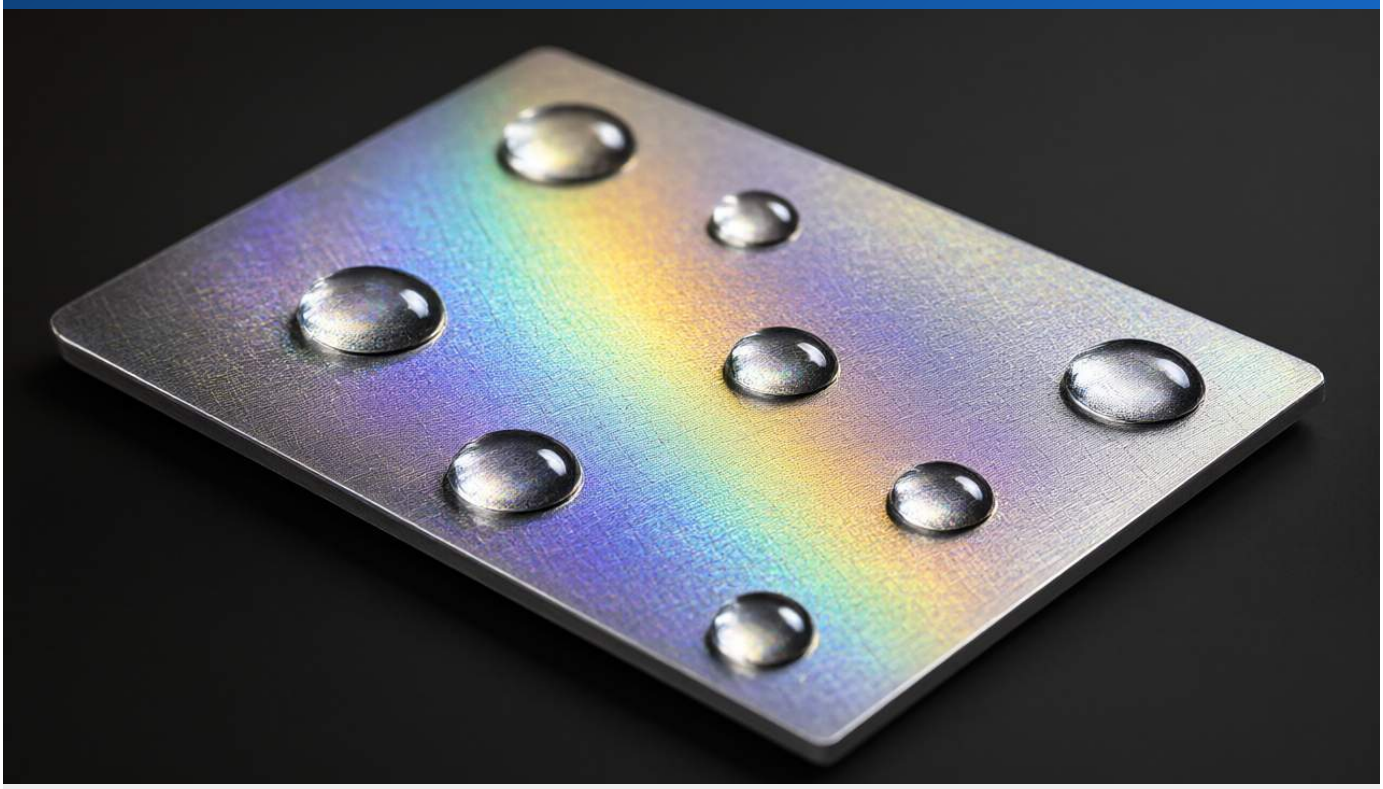
The ability to manipulate polymorphism and crystalline morphology without changing the base resin or overall crystallinity allows for precise control over the final properties of semicrystalline polymers. While the acceleration of crystallization kinetics is relevant to thermoplastic processing, the study did not establish specific reductions in industrial injection-molding cycle times.

Source: https://www.plasticsengineering.org/2026/11/supramolecular-additives-reshape-pa6-crystallization-012645/

Collected: November 21, 2026 | Automated Research System (AI)

#08 Fluorine-Free Laser Coating: Durable Protection for 7075 Alloy

Published November 18, 2026 European Coatings



OVERVIEW

Researchers have developed a fluorine-free superhydrophobic coating for 7075 aluminium alloy that achieves a water contact angle of 163.4° and a corrosion protection efficiency of 99.86%. By combining femtosecond laser texturing with organic-inorganic reinforcement, the coating significantly reduces ice adhesion to 34 kPa. This technology provides a sustainable alternative to fluorinated modifiers for aerospace, marine, and transport applications.

IN DEPTH

Key Findings

The developed coating for 7075 aluminium alloy demonstrates high durability and protective performance. It achieves a water contact angle of 163.4°, a sliding angle of 2.1°, and a corrosion protection efficiency of 99.86%. In anti-icing tests at –20 °C, the coating prolonged freezing time from 181 s to 857 s and reduced ice adhesion strength from 142 kPa to 34 kPa. These properties remained stable after 80 icing/de-icing cycles.

Technical Details

The coating process utilizes a multi-step strategy to ensure stability and low surface energy without using fluorine:

- **Surface Texturing:** Femtosecond laser texturing creates a biomimetic cauliflower-like hierarchical interface, which maintains the Cassie-Baxter wetting state.
- **Interfacial Anchoring:** An Al-O-Si layer is formed using γ-aminopropyltriethoxysilane (KH550).
- **Structural Reinforcement:** A spot-like reinforced skeleton is constructed using KH570-modified zinc oxide and low-solid-content E44 epoxy resin to prevent the backfilling of micro/nanostructures.
- **Outer Layer:** Octadecyltrimethoxysilane (OTMS) is applied to provide the final low-surface-energy layer.

Background and Context

Commercial adoption of superhydrophobic coatings for aluminium alloys has been limited by three primary factors: the regulatory scrutiny of fluorinated modifiers, weak interfacial adhesion, and the degradation of performance caused by the backfilling of micro/nanostructures. This research addresses these limitations by replacing fluorinated chemistry with a reinforced organic-inorganic skeleton and laser-induced biomimetic structures.

Significance and Outlook

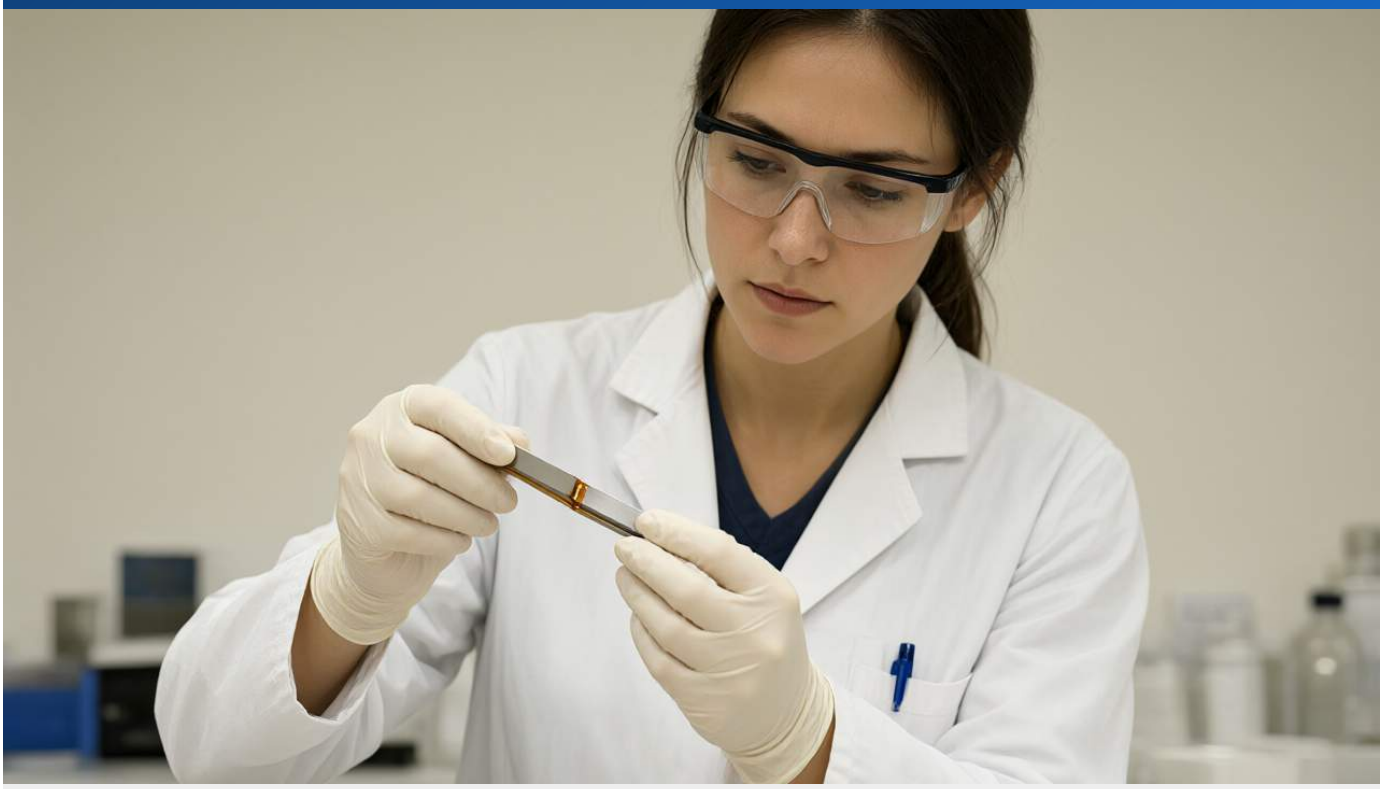
The coating exhibits robust durability across various stress tests, including 240 abrasion cycles, 200 tape-peeling cycles, UV irradiation, thermal ageing, and 480 h immersion in wide-pH solutions. Electrochemical impedance spectroscopy after 100 h in 3.5 wt.% NaCl solution showed charge-transfer resistance increasing from 33.76 to 2.34×10^4 $\Omega \cdot cm^2$. Due to its resilience in harsh environments, this fluorine-free strategy is positioned for potential use in the transport, marine, and aerospace sectors.

Source: https://www.european-coatings.com/news/coatings-technologies/fluorine-free-laser-coating-protects-aluminium-alloy-durably/

Collected: November 21, 2026 | Automated Research System (AI)

#09 Polyolefin Upcycling: ETH Zurich's 2026 High-Strength Adhesive Tech

Published November 18, 2026　新浪财经（出典：买化塑）　China



OVERVIEW

Researchers at ETH Zurich have developed a visible-light-driven grafting method to convert waste polyethylene (PE) and polypropylene (PP) into high-strength industrial adhesives. The process achieves lap-shear strengths up to 13.4 MPa on metal substrates, enabling the upcycling of low-value plastic waste into high-performance functional materials.

IN DEPTH

Key Findings

A research team led by Professor Tae-Lim Choi at ETH Zurich has successfully converted waste polyolefins into industrial-grade adhesives. In validation tests, a 13 mg sample of low-density polyethylene (LDPE) grafted with functional polymers (LDPE–g–PNEtAM) was capable of lifting a 20 kg kettlebell. Further testing demonstrated the material's ability to support the weight of an adult male weighing approximately 80 kg during hanging and pull-up exercises. On metal substrates, the resulting adhesive reached a maximum lap-shear strength of 13.4 MPa, surpassing the performance of tested commercial hot-melt adhesives.

Technical Details

The team utilized a "Direct Polymer-on-Polymer Grafting under Visible Light" method. The technical process involves the following steps:

- **Activation:** Chlorinated solvents are used under visible light to generate chlorine radicals.
- **Grafting:** These radicals create reactive sites on the stable carbon-hydrogen chains of the polyolefin main chain.
- **Polymerization:** Vinyl monomers are introduced to generate new functional polymer side chains.

This method eliminates the need for expensive catalysts, initiators, or high-temperature processing. The researchers can control the number of grafting sites by adjusting the light wavelength and the degree of chlorination of the solvent.

Background and Context

Polyolefins, including PE and PP, account for a significant portion of the 4.5 billion tons of plastic produced annually. Due to their chemical stability, these materials are difficult to selectively depolymerize. Traditional mechanical recycling often results in degraded material properties, limiting recycled plastics to low-value products like flower pots or paving slabs, while pyrolysis requires high energy input.

Significance and Outlook

Beyond adhesives, the team suggests that grafting different polymers can introduce hydrophilicity, acidity, alkalinity, or other chemical functionalities to polyolefins. Current industrial collaborations are focusing on food packaging to improve oxygen barrier properties while maintaining waterproofing. Additionally, these functional polymers may serve as binding agents to improve the quality of other recycled plastics. ETH Zurich has applied for a patent for this technology, though industrialization remains subject to further validation regarding scale, cost, and solvent management.

Source: https://finance.sina.com.cn/roll/2026-11-18/doc-inizeacc1573112.shtml

Collected: November 21, 2026 | Automated Research System (AI)

#10 Nissan and Food Ribbon: Pineapple Leaf Fiber Exterior Parts Specs

Published November 19, 2026 MSRweb Japan



OVERVIEW

Nissan and Food Ribbon have developed the world's first automotive exterior parts using Natural Fiber Reinforced Plastics (NFRP) derived from pineapple leaf fibers. The material achieves higher tensile strength than conventional hemp-based natural fibers, utilizing a waste resource of over 50 million tons annually.

IN DEPTH

Key Findings

Nissan and Food Ribbon announced on November 17, 2026, the joint development of automotive exterior components utilizing Natural Fiber Reinforced Plastics (NFRP) made from pineapple leaf fibers. This development marks the first time such materials have been applied to automotive exterior parts, achieving tensile strength that exceeds that of conventional hemp-based natural fiber materials.

Technical Details

The development team established a world-first technical process to convert fibers extracted from pineapple leaves into flat yarns, which are then woven into fabrics for use as composite materials. As part of the intellectual property arrangement, Nissan has licensed the following manufacturing know-how to Food Ribbon:

- Production of flat yarns and woven fabrics from extracted pineapple leaf fibers.
- Manufacturing of prepregs (molding intermediate materials) created by impregnating the fibers with resin.

Background and Context

The project addresses the environmental issue of pineapple leaf waste, which exceeds 50 million tons annually according to 2024 FAO statistics. From a regulatory perspective, certain racing categories using modified sports cars mandate that exterior part modifications be made exclusively from natural fiber reinforced plastics. However, existing natural fiber materials have faced challenges regarding cost and stable procurement due to limited supply sources.

This initiative aligns with the "Nissan Green Program 2030," a mid-term environmental action plan focused on researching sustainable materials that are lightweight, low-cost, and have a low environmental impact.

Significance and Outlook

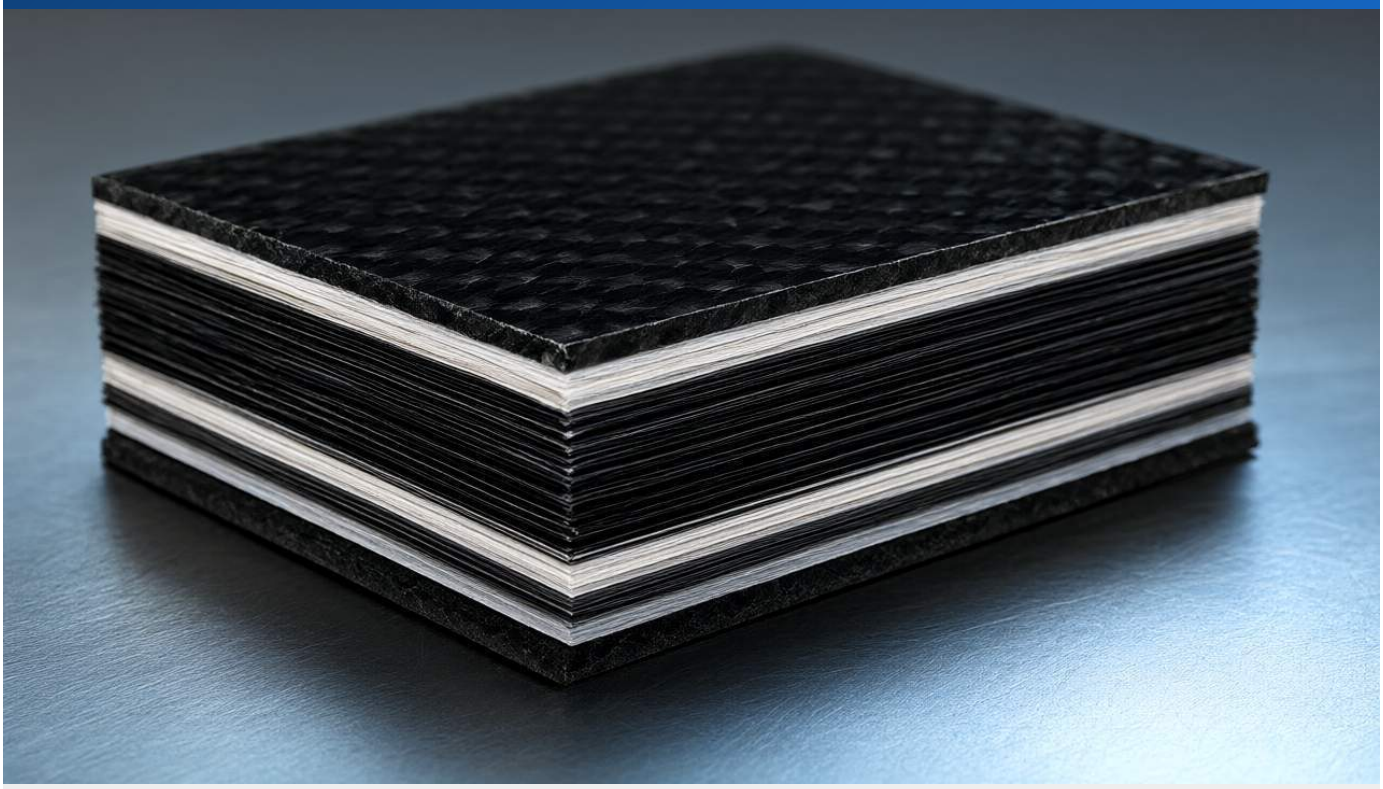
The resulting material is characterized as being lightweight and environmentally friendly, with potential applications extending beyond the automotive sector. The developed exterior parts will be exhibited at the "sampe Japan Advanced Materials Technology Exhibition 2026."

Source: https://msrweb.jp/article/11863/

Collected: November 21, 2026 | Automated Research System (AI)

#11 CFRP Manufacturing: Kumoh Nat'l Inst't improves strength and toughness

Published November 18, 2026 머니투데이 South Korea



OVERVIEW

Researchers at Kumoh National Institute of Technology have developed a manufacturing technique that simultaneously improves the interlaminar fracture toughness and strength of Carbon Fiber Reinforced Plastics (CFRP). By applying a low-melting-point polyamide nanofiber web, the team increased interlaminar fracture toughness by up to 296% while enhancing flexural and shear strength.

IN DEPTH

Key Findings

A research team led by Professor Eun Jong-hyun at Kumoh National Institute of Technology has developed a method to resolve the trade-off between strength and toughness in Carbon Fiber Reinforced Plastics (CFRP). The team achieved a maximum increase of 296% in interlaminar fracture toughness, alongside a 20% increase in flexural strength and a 29% increase in interlaminar shear strength compared to conventional CFRP.

Technical Details

The process involves inserting a "low-melting-point polyamide (LMPA) nanofiber web" between CFRP layers to prevent interlaminar cracking. The technical implementation included the following steps:

- **Material Preparation:** Polyamide with a low melting point (133–152°C) was dissolved in eco-friendly ethanol rather than toxic solvents.
- **Coating Process:** Using an electrospinning method, a thin nanofiber web with a thickness of 6–29μm was coated onto the carbon fiber surface.
- **Thermal Processing:** The material was manufactured at a molding temperature of 180°C to optimize the integration of the layers.

Background and Context

CFRP is widely utilized in aircraft fuselages, automotive parts, and high-pressure hydrogen tanks due to its lightweight and rigid properties. However, the epoxy resin connecting the carbon fiber layers is susceptible to impact, often leading to "interlaminar delamination." While previous attempts to mitigate this involved adding tough thermoplastic materials, these typically resulted in a decrease in overall strength as toughness increased.

Significance and Outlook

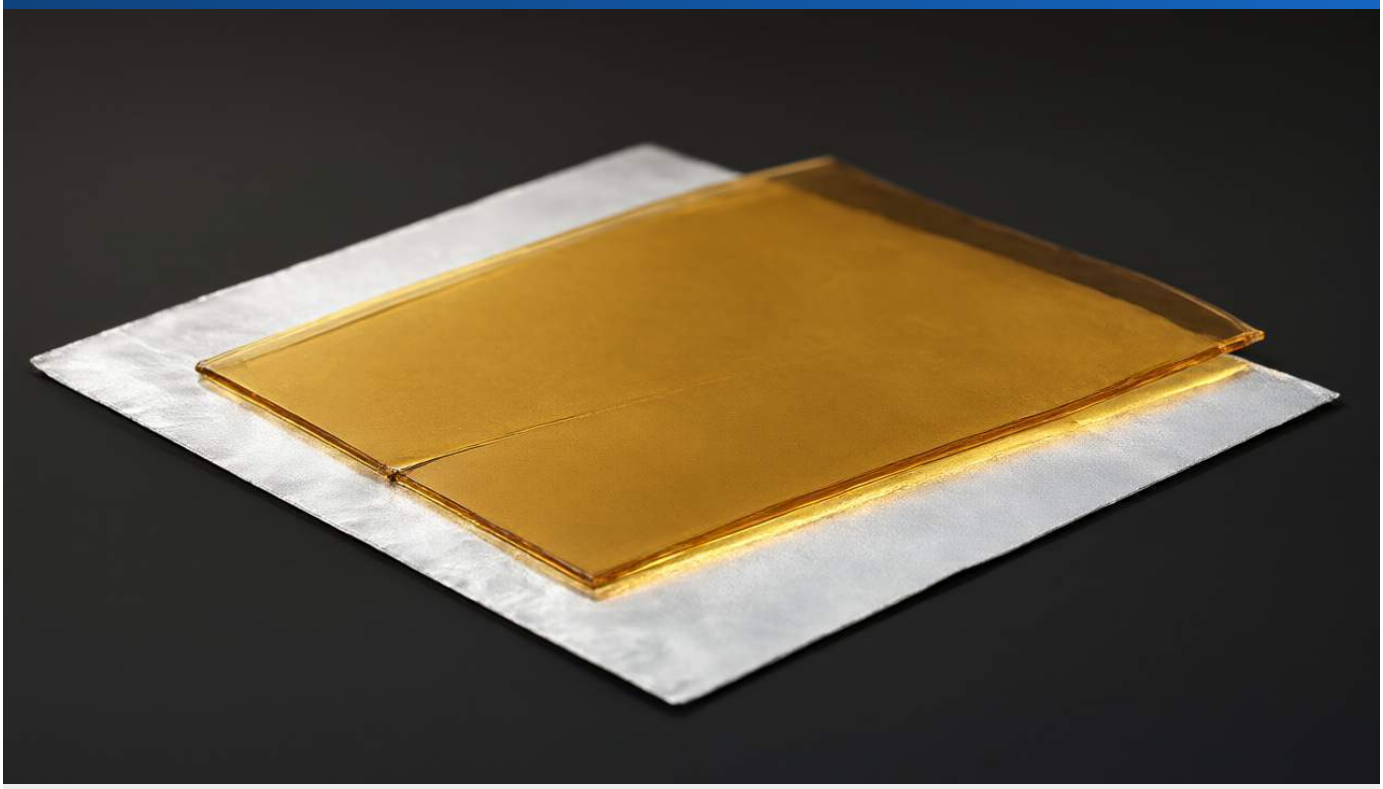
This research demonstrates that the long-standing challenge of balancing strength and toughness in composite materials can be overcome through the precise control of nanofiber application and molding temperatures. The findings were published online on November 3 in the international journal *Composites Part B: Engineering* (IF approx. 14). The technology is expected to be applied broadly in lightweight structural materials for aerospace and future mobility. This study was supported by the Gyeongsangbuk-do RISE project.

Source: https://www.mt.co.kr/policy/2026/11/18/2026111817440141754

Collected: November 21, 2026 | Automated Research System (AI)

#12 Dual-Salt Polymer Electrolyte: Self-Healing Li-Metal Battery Specs

Published November 14, 2026 Elettronauti イタリア



OVERVIEW

Researchers have developed a self-healing dual-salt polymer electrolyte for lithium metal batteries capable of operating at room temperature. The material achieves an ionic conductivity of 2.23 mS cm^{-1} and suppresses dendrite growth, enhancing both safety and cycle life.

IN DEPTH

Key Findings

The developed self-healing polymer electrolyte enables stable lithium deposition and dissolution for over 2,000 hours in Li||Li symmetric cells. In full-cell configurations, the $LiFePO_4$||Li cell delivered 133 mAh g^{-1} at 1C, retaining 75% of its initial capacity after 700 cycles. The NMC811||Li configuration achieved 135 mAh g^{-1}, maintaining 72% capacity after 250 cycles.

Technical Details

The electrolyte utilizes a dual-salt strategy to decouple Li^+ transport. By limiting the movement of anions within the polymer network through interactions between the two salts, a higher number of Li^+ ions participate in charge transport. The reported technical specifications include:

- Ionic conductivity: 2.23 mS cm^{-1}
- Li^+ transport number: 0.55
- Additional properties: Flame retardancy and promotion of uniform lithium deposition to suppress dendrite formation.

Background & Context

Conventional gel polymer electrolytes often suffer from high crystallinity, which reduces ionic conductivity and the Li^+ transport number. These materials typically exhibit high interfacial resistance and uncontrolled lithium dendrite growth, which complicates stable operation at room temperature. The research, led by Soumallya Banerjee and colleagues, was published in 2026 in *Advanced Functional Materials* under the title “Decoupling Li^+ Transport in Self-Healing Polymer Dual-Salt Electrolytes for Room Temperature Lithium Metal Batteries”.

Significance & Outlook

Co-author Chih Wei Chu, a researcher at Academia Sinica and the National Taiwan University, describes this dual-salt approach as a promising strategy for room-temperature lithium metal batteries. By combining performance improvements with enhanced safety and a reduction in inactive lithium formation, the electrolyte addresses critical barriers to the viability of polymer-based lithium metal systems.

Source: https://elettronauti.it/articolo/un-elettrolita-autoriparante-a-doppio-sale-per-batterie-al-litio/

Collected: November 21, 2026 | Automated Research System (AI)