TROY TECHNICAL

ADHESIVES & SEALANTS
WEEKLY REPORT

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

Bond-line performance, cure process, durability and cross-industry qualification

10	10
ANALYZED ARTICLES	PRIORITY THEMES

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



Adhesives & Sealants: the boundary moved from isolated claims to qualification evidence

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

SIGNAL 01 | CHEMISTRY

Diamond Foundry: 200mm Single Crystal Diamond for AI Cooling

Diamond Foundry has produced the world's first 200mm diameter single crystal diamond, doubling the size of its 2023 100mm version.

SIGNAL 02 | FORMULATION

JA DeepBlue 5.0 TOPCon: Reduced Creepage Distance and Specs

JA has developed the DeepBlue 5.0 TOPCon module, which utilizes butyl sealant to reduce the minimum creepage distance from 10.4 mm to 3.5 mm.

SIGNAL 03 | APPLICATION & CURE

Citric Acid Battery Glue: Water-Soluble Recycling vs Fluorine

Engineers have developed a water-soluble battery glue using citric acid that simplifies recycling and reduces manufacturing energy.

SIGNAL 04 | QUALIFIED PRODUCT

Spinheat: NTU and Motherson's Magnetic Curing Tech for Coatings

Nanyang Technological University (NTU) and Motherson are collaborating to transition "Spinheat," a magnetic heating technology, from the laboratory to industrial production.

DECISION

Focus this week's management attention on bond-line performance, cure process, durability and cross-industry qualification. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: evaluate the complete joint or sealed system under process and lifetime conditions.
2. Suppliers: provide substrate preparation, cure window, rework, aging and failure-analysis evidence.
3. Executives: track adhesion aging, cure variability, outgassing, regulation, repair and scale.

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

200mm
A10

SOURCE-BOUND CONDITION
Diamond Foundry has produced the world's first 200mm diameter single crystal diamond, doubling the size of its 2023 100mm version.

10.4 mm
A09

SOURCE-BOUND CONDITION
JA has developed the DeepBlue 5.0 TOPCon module, which utilizes butyl sealant to reduce the minimum creepage distance from 10.4 mm to 3.5 mm.

000 cycl es
A03

SOURCE-BOUND CONDITION
In tests, batteries using this glue maintained 75.7 percent capacity after 1,000 cycles, outperforming standard fluorine-based glues.

5.3 W
A04

SOURCE-BOUND CONDITION
Henkel has commercialized Loctite Bergquist TGR 5000SF, a silicone-free thermal grease featuring a thermal conductivity of 5.3 W/m-K and a bond line thinner than 25 µm.

39%
A01

SOURCE-BOUND CONDITION
The modifier reduced the peak heat release rate (PHRR) by approximately 39% while simultaneously improving tensile and impact strength.

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

Chemistry

P01/P06

Diamond Foundry has produced the world's first 200mm diameter single crystal diamond, doubling the size of its 2023 100mm.

2

Formulation

P02/P07

JA has developed the DeepBlue 5.0 TOPCon module, which utilizes butyl sealant to reduce the minimum creepage distance from.

3

Application & cure

P03/P08

Engineers have developed a water-sol uble battery glue using citric acid that simplifies recycling and reduces manufacturing.

4

Qualified product

P04/P09

Nanyang Technologica l University (NTU) and Motherson are collaborating to transition "Spinheat," a magnetic heating.

5

Repair & circularity

P05/P10

Henkel has commercia lized Loctite Bergquist TGR 5000SF, a silicone-free thermal grease featuring a thermal conductivity of.

EVIDENCE REQUIRED AT EACH HANDOFF

Chemistry to Formulation	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.
Formulation to Application & cure	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.
Application & cure to Qualified product	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.
Qualified product to Repair & circularity	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck adhesion aging, cure variability, outgassing, regulation, repair and scale.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented adhesion aging, cure variability, outgassing, regulation, repair and scale.

Priority map: maturity and next decision locus



P01	Diamond Foundry: 200mm Single Crystal Diamond for AI Cooling Tech / process | cue: no system/business cue
P02	JA DeepBlue 5.0 TOPCon: Reduced Creepage Distance and Specs Tech / process | cue: no system/business cue
P03	Citric Acid Battery Glue: Water-Soluble Recycling vs Fluorine Business / rules | cue: capacity
P04	Spinheat: NTU and Motherson's Magnetic Curing Tech for Coatings System / adoption | cue: system
P05	Loctite Bergquist TGR 5000SF: Silicone-Free Thermal Grease Specs System / adoption | cue: commercialized
P06	PSMMA Polymer: Underwater Bonding and Shaping via Hydraulicity Tech / process | cue: no system/business cue
P07	MacDermid Alpha BondPad: SiC Power Module Sintering Specs Tech / process | cue: no system/business cue
P08	[CMMIm][H2PO4] Ionic Liquid: Epoxy Resin Flame Retardancy Specs Tech / process | cue: no system/business cue
P09	Cu/Cu Joining: Laser-Structured Surfaces for Paste-Free Bonds Tech / process | cue: no system/business cue
P10	Noctua NT-CP1: Carbon Nanotube Thermal Pad Specs and Performance 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 Diamond Foundry: 200mm Single Crystal Diamond for AI Cooling

A10 | Chemistry | Research

2026-11-09

FACT

Diamond Foundry has produced the world's first 200mm diameter single crystal diamond, doubling the size of its 2023 100mm version. This expansion increases the theoretical material area fourfold, potentially enabling larger heat-spreading substrates for high-power AI semiconductors.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: TECH / PROCESS

P02 JA DeepBlue 5.0 TOPCon: Reduced Creepage Distance and Specs

A09 | Formulation | Pilot

2026-11-09

FACT

JA has developed the DeepBlue 5.0 TOPCon module, which utilizes butyl sealant to reduce the minimum creepage distance from 10.4 mm to 3.5 mm. This design increases the active cell area by approximately 1% and enhances resilience against humidity ingress and wet leakage.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

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

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

P03 Citric Acid Battery Glue: Water-Soluble Recycling vs Fluorine

A03 | Application & cure | Product adoption

2026-11-12

FACT

Engineers have developed a water-soluble battery glue using citric acid that simplifies recycling and reduces manufacturing energy. In tests, batteries using this glue maintained 75.7 percent capacity after 1,000 cycles, outperforming standard fluorine-based glues.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

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

P04 Spinheat: NTU and Motherson's Magnetic Curing Tech for Coatings

A02 | Qualified product | Product adoption

2026-11-12

FACT

Nanyang Technological University (NTU) and Motherson are collaborating to transition "Spinheat," a magnetic heating technology, from the laboratory to industrial production. The system uses magnetic nanoparticles to cure coatings in one hour with bonding strength comparable to 24-hour conventional oven curing, significantly reducing energy consumption and processing time.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

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

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

P05 Loctite Bergquist TGR 5000SF: Silicone-Free Thermal Grease Specs

A04 | Repair & circularity | Research

2026-11-10

FACT

Henkel has commercialized Loctite Bergquist TGR 5000SF, a silicone-free thermal grease featuring a thermal conductivity of 5.3 W/m-K and a bond line thinner than 25 µm. Designed for high-power electronics in 5G, data centers, and power equipment, the material is engineered to resist pump-out and eliminate silicone outgassing.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 1/5 | DECISION LOCUS: SYSTEM / ADOPTION

P06 PSMMA Polymer: Underwater Bonding and Shaping via Hydraulicity

A06 | Chemistry | Pilot

2026-11-13

FACT

Researchers at Institute of Science Tokyo have developed poly(silatranylmethyl methacrylate) (PSMMA), an organic polymer that hardens upon contact with water. The material transitions from a workable putty to a water-resistant solid, achieving tensile shear strengths of 0.7-1.6 MPa in underwater bonding tests.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

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

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

P07 MacDermid Alpha BondPad: SiC Power Module Sintering Specs

A08 | Formulation | Research

2026-11-10

FACT

MacDermid Alpha is introducing BondPad, a copper-foil solution using Argomax silver sinter film for die-topside attach in SiC power packages. The technology demonstrates a 30-fold increase in life cycles compared to conventional aluminum wirebonding under specific power-cycling tests. This advancement enables higher reliability for high-power semiconductor packages operating at elevated temperatures and switching frequencies.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 1/5 | DECISION LOCUS: TECH / PROCESS

P08 [CMMIm][H2PO4] Ionic Liquid: Epoxy Resin Flame Retardancy Specs

A01 | Application & cure | Research

2026-11-11

FACT

A phosphorus-nitrogen synergistic imidazolium ionic liquid, [CMMIm][H2PO4], significantly enhances the flame retardancy and mechanical properties of epoxy resin. The modifier reduced the peak heat release rate (PHRR) by approximately 39% while simultaneously improving tensile and impact strength.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 1/5 | DECISION LOCUS: TECH / PROCESS

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

P09 Cu/Cu Joining: Laser-Structured Surfaces for Paste-Free Bonds

A07 | Qualified product | Research

Prior release 2026-11-06

FACT

Laser-structured copper surfaces enable direct Cu/Cu joining without filler metals or sintering pastes, achieving apparent shear strengths of 16 and 35 MPa. The study demonstrates that finer, more densely distributed surface features significantly improve interfacial contact and joint strength. This approach reduces process complexity for high-power electronic systems requiring high thermal and electrical conductivity.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 1/5 | DECISION LOCUS: TECH / PROCESS

P10 Noctua NT-CP1: Carbon Nanotube Thermal Pad Specs and Performance

A05 | Repair & circularity | Research

2026-11-13

FACT

Noctua has released the NT-CP1, a carbon nanotube thermal pad for AM5 and AM4 CPUs that improves in thermal conductivity over time through thermal cycling. While initial performance is lower than high-performance paste, it can eventually surpass NT-H1, with the break-in period varying from 130 to 3,700 cycles depending on the hardware configuration.

WHY IT MATTERS

The decision relevance is bond-line performance, cure process, durability and cross-industry qualification. 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 substrate preparation, cure window, rework, aging and failure-analysis evidence.

ACTION

Within 30 days, evaluate the complete joint or sealed system under process and lifetime conditions; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: adhesion aging, cure variability, outgassing, regulation, repair and scale.

EDITORIAL SCORE 19/25 | MATURITY 1/5 | 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	evaluate the complete joint or sealed system under process and lifetime conditions	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 substrate preparation, cure window, rework, aging and failure-analysis evidence	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 adhesion aging, cure variability, outgassing, regulation, repair and scale.	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 01-10

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	[CMMIm][H2PO4] Ionic Liquid: Epoxy Resin Flame Retardancy Specs	https://doi.org/10.21203/rs.3.rs-11314870/v1
A02	Spinheat: NTU and Motherson's Magnetic Curing Tech for Coatings	https://www.miragenews.com/ntu-motherson-develop-magnetic-tech-to-cut-time-1776338/
A03	Citric Acid Battery Glue: Water-Soluble Recycling vs Fluorine	https://www.earth.com/science/glue-used-in-batteries-makes-recycling-hard-so-engineers-designed-one-that-comes-off-in-water/
A04	Loctite Bergquist TGR 5000SF: Silicone-Free Thermal Grease Specs	https://news.europawire.eu/henkel-expands-thermal-interface-portfolio-with-silicone-free-loctite-bergquist-tgr-5000sf-grease/eu-press-release/2026/11/10/15/32/04/187055/
A05	Noctua NT-CP1: Carbon Nanotube Thermal Pad Specs and Performance	https://xenospectrum.com/en/noctua-nt-cp1-thermal-pad/
A06	PSMMA Polymer: Underwater Bonding and Shaping via Hydraulicity	https://www.miragenews.com/water-curing-polymer-enables-underwater-bonding-1776851/
A07	Cu/Cu Joining: Laser-Structured Surfaces for Paste-Free Bonds	https://doi.org/10.21203/rs.3.rs-11156221/v1
A08	MacDermid Alpha BondPad: SiC Power Module Sintering Specs	https://www.bisinfotech.com/macdermid-alpha-showcases-upcoming-technology-for-sic-power-modules-at-electronica-2026/
A09	JA DeepBlue 5.0 TOPCon: Reduced Creepage Distance and Specs	https://taiyangnews.info/technology/ja-topcon-creeepage-distance-cemented-joint
A10	Diamond Foundry: 200mm Single Crystal Diamond for AI Cooling	https://xenospectrum.com/diamond-foundry-wafer-chip-cooling/

Adhesives_Sealants — Selected Articles

Date: 2026-11-15

Articles: 10

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#05 Noctua NT-CP1: Carbon Nanotube Thermal Pad Specs and Performance

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#10 Diamond Foundry: 200mm Single Crystal Diamond for AI Cooling

#01 [CMMIm][H2PO4] Ionic Liquid: Epoxy Resin Flame Retardancy Specs

Published November 11, 2026　Research Square（プレプリント）



OVERVIEW

A phosphorus-nitrogen synergistic imidazolium ionic liquid, [CMMIm][H2PO4], significantly enhances the flame retardancy and mechanical properties of epoxy resin. The modifier reduced the peak heat release rate (PHRR) by approximately 39% while simultaneously improving tensile and impact strength.

IN DEPTH

Key Findings

The introduction of 1-(carbamoylmethyl)-2-methylimidazolium dihydrogen phosphate ([CMMIm][H2PO4]) as a multifunctional modifier significantly improves the fire resistance of epoxy resin (EP). In the EP-4 sample, the Limiting Oxygen Index (LOI) increased from 20.41% to 30.68%. Furthermore, the peak heat release rate (PHRR) decreased from 923.43 $kW \cdot m^{-2}$ to 563.61 $kW \cdot m^{-2}$, representing a reduction of approximately 39%.

Technical Details

Researchers evaluated the modifier using a suite of analytical methods, including TGA, Raman spectroscopy, scanning electron microscope (SEM), the cone calorimeter method, and mechanical testing. Thermal analysis at 800°C showed that the carbonized residue content increased from 11.64% to 16.90%. Raman spectroscopy indicated a more stable carbonization structure, as the ID/IG ratio decreased from 0.85 to 0.78.

Mechanical testing of the EP-4 formulation demonstrated the following properties:

- Tensile strength: 73.91 MPa
- Bending modulus: 3522.38 MPa
- Impact strength: 16.75 $kJ \cdot m^{-2}$

Background & Context

Epoxy resins are widely utilized across various engineering applications due to their versatility. However, the material possesses inherent flammability issues. A primary challenge for engineers and material scientists has been balancing the integration of flame retardants with the maintenance or improvement of the resin's mechanical properties, as many additives typically degrade structural integrity.

Significance & Outlook

The synthesis of the amide-functionalized imidazoline ionic liquid [CMMIm][H2PO4] provides an effective strategy for overcoming the trade-off between safety and performance. By acting as a phosphorus-nitrogen synergistic modifier, it enhances the thermal stability and carbonization of the epoxy resin while simultaneously reinforcing its mechanical strength, offering a viable path for high-performance engineering applications requiring strict fire safety standards.

Source: https://doi.org/10.21203/rs.3.rs-11314870/v1

Collected: November 15, 2026 | Automated Research System (AI)

#02 Spinheat: NTU and Motherson's Magnetic Curing Tech for Coatings

Published November 12, 2026 Mirage News Singapore



OVERVIEW

Nanyang Technological University (NTU) and Motherson are collaborating to transition "Spinheat," a magnetic heating technology, from the laboratory to industrial production. The system uses magnetic nanoparticles to cure coatings in one hour with bonding strength comparable to 24-hour conventional oven curing, significantly reducing energy consumption and processing time.

IN DEPTH

Key Findings

The collaboration between NTU Singapore and automotive supplier Motherson focuses on implementing Spinheat, a magnetic heating technology designed to reduce the time and energy required to cure industrial coatings. In laboratory tests, adhesive coatings cured via magnetic induction for one hour achieved bonding strength equivalent to those cured in conventional ovens for 24 hours.

Technical Details

Spinheat utilizes specially designed magnetic nanoparticles integrated into materials such as resins, adhesives, and paints. When these materials are exposed to an alternating magnetic field, the particles generate internal heat, enabling the coating to cure without the need to heat the entire component in an industrial oven. The latest iteration of the technology incorporates real-time temperature feedback to adjust the magnetic field during the curing process, which prevents overheating, bubbles, and other coating defects.

Background and Context

The research is led by Professor Raju V. Ramanujan and Associate Professor Terry Steele from NTU's School of Materials Science and Engineering (MSE), who first demonstrated magnetic-field-activated epoxy curing in 2020. Motherson, a global specialist with over 475 facilities across 47 countries, is providing the automotive engineering and manufacturing capabilities necessary to adapt the technology for real-world production. The project utilizes Motherson's proprietary SVAG E3 methodology to test the technology under industrial conditions.

Significance and Outlook

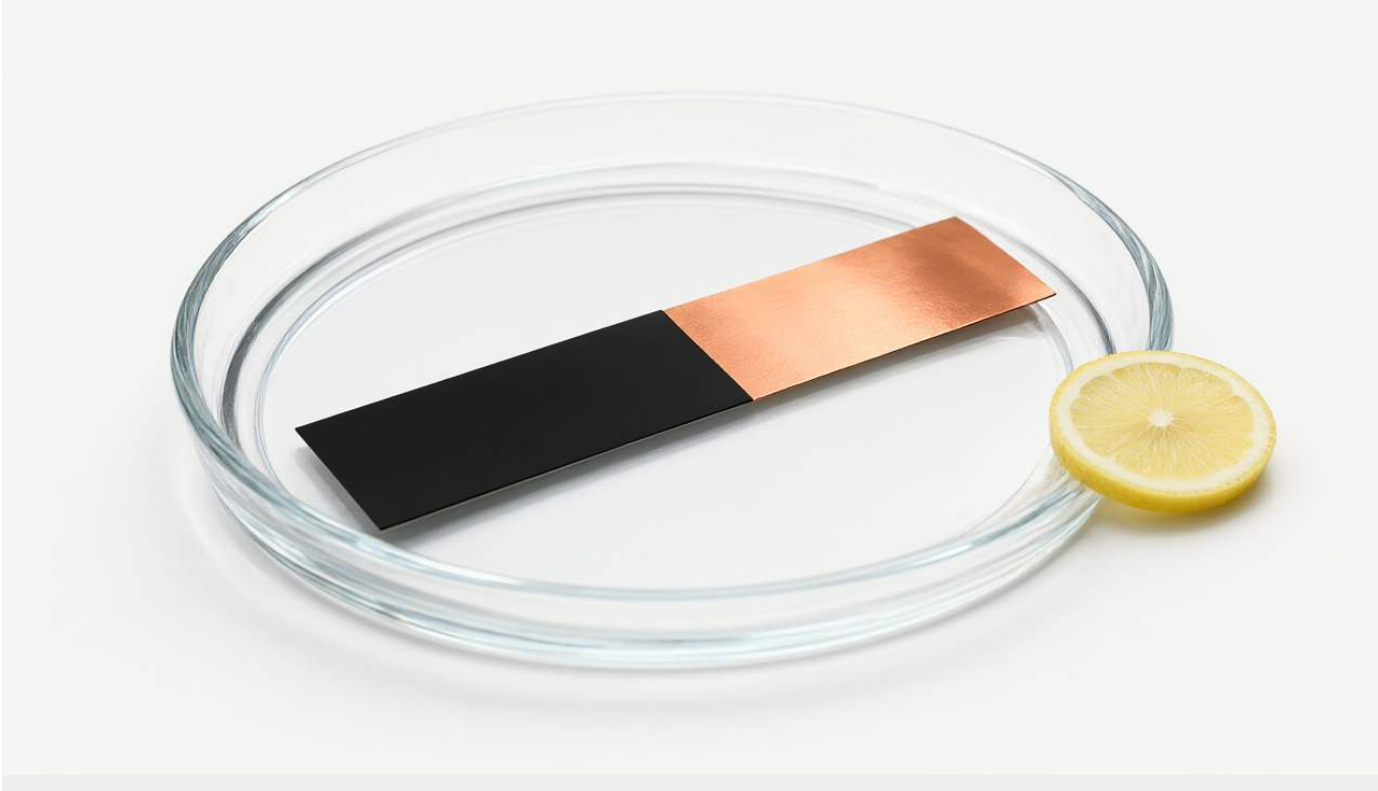
By eliminating the need for large industrial ovens, Spinheat can reduce carbon emissions, energy consumption, and the physical space required for curing equipment. It also prevents heat damage to heat-sensitive materials within components. Researchers are currently investigating manufacturing requirements including coating thickness, curing speed, and component shapes. Beyond automotive resin coatings, potential applications include aerospace components, composite manufacturing and repair, and vehicle coatings. Intellectual property has been filed through NTUitive, and the project aligns with Singapore's Research, Innovation and Enterprise 2030 (RIE2030) priorities for advanced manufacturing.

Source: https://www.miragenews.com/ntu-motherson-develop-magnetic-tech-to-cut-time-1776338/

Collected: November 15, 2026 | Automated Research System (AI)

#03 Citric Acid Battery Glue: Water-Soluble Recycling vs Fluorine

Published November 12, 2026 Earth.com USA



OVERVIEW

Engineers have developed a water-soluble battery glue using citric acid that simplifies recycling and reduces manufacturing energy. In tests, batteries using this glue maintained 75.7 percent capacity after 1,000 cycles, outperforming standard fluorine-based glues.

IN DEPTH

Key Findings

A new water-soluble glue developed by engineers at the University of California San Diego, in collaboration with the Toyota Research Institute of North America and Arizona State University, enables the clean removal of electrode coatings using purified water. In tests using lithium iron phosphate, cells with the new glue retained 75.7 percent of their starting capacity after 1,000 rounds of charging and draining, while standard-glue cells lost capacity faster, particularly after 400 rounds. A pouch cell configuration maintained 76.4 percent capacity after 1,600 rounds.

Technical Details

The glue consists of a mixture of carboxymethyl cellulose, polyacrylic acid, and citric acid, with lithium hydroxide added to prevent the corrosion of aluminum foil. This composition prevents the cracking and brittleness associated with existing water-based glues. The glue accounts for 2 percent of the electrode's weight.

- **Manufacturing:** Standard fluorine glues require toxic solvents and vacuum drying at 248°F (120°C) for 12 hours. The new glue dries in an ordinary oven at 140°F (60°C) for four hours.
- **Recycling:** While standard glues require high heat or corrosive chemicals for removal, the new glue dissolves in purified water.
- **Material Recovery:** Recovered lithium iron phosphate from the new-glue cells showed no detectable fluorine and handled fast charging better than material recycled from standard-glue batteries.

Background & Context

Standard lithium-ion batteries rely on fluorine-containing plastic glues to bind charge-storing powder to metal foil. These glues are highly stable, which aids battery longevity but creates residues that make recycling difficult and expensive. The new citric acid-based alternative reduces the total fluorine content of a cell by approximately 30 percent, as fluorine remains present in the battery's liquid salt.

Significance & Outlook

Estimates suggest that producing a cell with the new glue would produce 6.9 percent less greenhouse gas and use 9.3 percent less energy. Recycling would use 10 percent less energy and release 7.2 percent less greenhouse gas. While these figures are scenario-based comparisons rather than plant measurements, the technology demonstrates viability across various materials, including silicon and nickel-rich electrodes.

Source: https://www.earth.com/science/glue-used-in-batteries-makes-recycling-hard-so-engineers-designed-one-that-comes-off-in-water/

Collected: November 15, 2026 | Automated Research System (AI)

#04 Loctite Bergquist TGR 5000SF: Silicone-Free Thermal Grease Specs

Published November 10, 2026 EuropaWire USA



OVERVIEW

Henkel has commercialized Loctite Bergquist TGR 5000SF, a silicone-free thermal grease featuring a thermal conductivity of 5.3 W/m-K and a bond line thinner than 25 µm. Designed for high-power electronics in 5G, data centers, and power equipment, the material is engineered to resist pump-out and eliminate silicone outgassing.

IN DEPTH

Key Findings

Henkel has introduced Loctite Bergquist TGR 5000SF, a high-performance, silicone-free thermal interface material (TIM) designed for critical high-power electronic components. The grease achieves a thermal conductivity of 5.3 W/m-K after solvent evaporation and a thermal impedance of 5.6 mm2-K/W. A primary technical advantage is its resistance to "pump-out"—the migration of material over time—which improves long-term reliability in high-temperature and high-cycling environments.

Technical Details

The material utilizes a solvated formulation to reduce compression stress and improve automated dispensing. Key performance specifications include:

- **Bond Line Thickness:** Less than 25 µm at 40 psi.
- **Thermal Stability:** Less than 15% thermal degradation after 1,000 hours at various temperatures.
- **Environmental Resistance:** No performance loss during thermal cycling between -40° C and 125° C, and no drop after 1,000 hours at 85° C/85° RH.
- **High-Temperature Durability:** Minimal thermal impedance loss after 1,000 hours at 125° C.

For manufacturing, the grease supports both manual and automated dispensing and includes a UV tracer to verify placement and coverage.

Background and Context

Loctite Bergquist TGR 5000SF is intended for infrastructure supporting data centers, telecommunications, and power generation. Specific target applications include 5G antennas, remote radio units, data center switches, routers, servers, and power electronics such as insulated-gate bipolar transistors (IGBTs), motor drives, and power modules. The silicone-free chemistry is specifically designed to eliminate outgassing concerns, preventing contamination in sensitive applications.

Significance and Outlook

By minimizing the bond line and reducing thermal resistance, this TIM enables more efficient heat dissipation for components operating in high-power environments. The combination of pump-out resistance and stability under prolonged heat and humidity exposure is intended to maintain component performance over the entire working life of the system.

Source: https://news.europawire.eu/henkel-expands-thermal-interface-portfolio-with-silicone-free-loctite-bergquist-tgr-5000sf-grease/eu-press-release/2026/11/10/15/32/04/187055/

Collected: November 15, 2026 | Automated Research System (AI)

#05 Noctua NT-CP1: Carbon Nanotube Thermal Pad Specs and Performance

Published November 13, 2026 XenoSpectrum USA



OVERVIEW

Noctua has released the NT-CP1, a carbon nanotube thermal pad for AM5 and AM4 CPUs that improves in thermal conductivity over time through thermal cycling. While initial performance is lower than high-performance paste, it can eventually surpass NT-H1, with the break-in period varying from 130 to 3,700 cycles depending on the hardware configuration.

IN DEPTH

Key Findings

The NT-CP1 thermal pad exhibits a two-stage performance improvement process. Initial cooling is limited by a phase-change polymer coating, but performance increases as the pad undergoes thermal cycles—defined as the contact surface heating above 60°C and cooling below 50°C. In tests comparing the pad to NT-H1 paste, the number of cycles required to overtake the paste ranged from 130 to 3,700. For example, with a 7950X and NL-LC1-24, the pad surpassed NT-H1 at 130 cycles and was approximately 2°C cooler by 1,000 cycles.

Technical Details

Manufactured by Carbice, the NT-CP1 is a 33 × 33 mm sheet with a total thickness of 90 µm. Its architecture consists of a 50 µm aluminum core for structural strength and lateral heat spreading, sandwiched between two 20 µm layers of vertically aligned carbon nanotubes for vertical heat transfer. The surface features a tacky phase-change polymer coating that flows when heated to improve contact.

The break-in process occurs in two phases:

- **Initial phase:** Under loads of 200 W or more, the coating changes within the first 5 to 10 cycles.
- **Secondary phase:** The nanotubes gradually conform to surface irregularities over several hundred to several thousand additional cycles.

Independent measurements by Igor'sLAB showed the joint thickness decreasing from 90.8 µm to approximately 68–70 µm during the first heat-up.

Background and Context

Noctua provides an optional break-in script using Prime95 to accelerate this process; 100 cycles of alternating 5-minute load and cooling periods take approximately 16 hours and 35 minutes. The pad is designed for the AMD AM5 and AM4 platforms and is priced at US$24.95 / €24.95.

Significance and Outlook

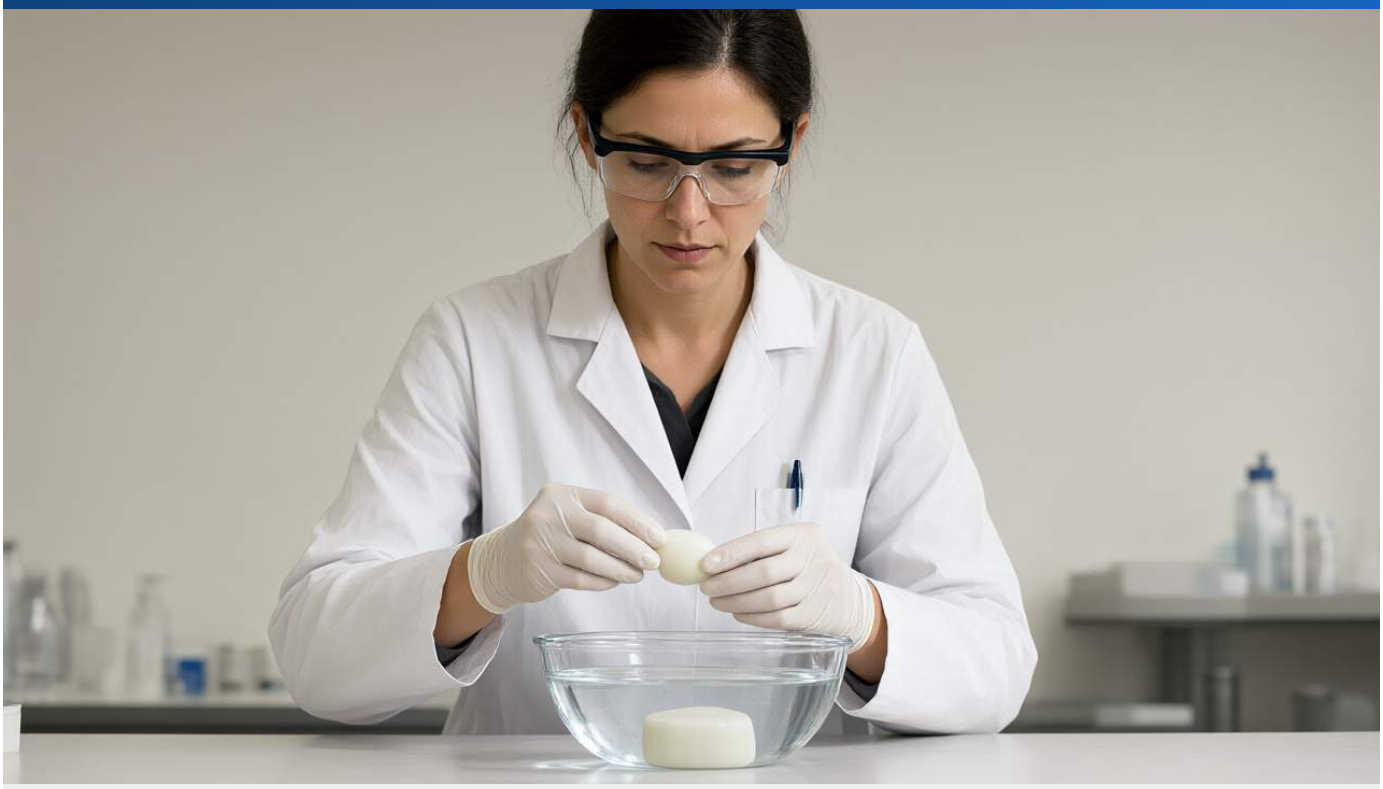
The NT-CP1 is positioned for long-term stability, with Noctua citing tests of over 100,000 thermal cycles and a projected lifespan of 10 years or more. While the pad can often be reused, Noctua does not officially support reuse in critical applications, particularly if the pad shows sharp creases or exposed aluminum.

Source: https://xenospectrum.com/en/noctua-nt-cp1-thermal-pad/

Collected: November 15, 2026 | Automated Research System (AI)

#06 PSMMA Polymer: Underwater Bonding and Shaping via Hydraulicity

Published November 13, 2026 Mirage News（Institute of Science Tokyo） Japan



OVERVIEW

Researchers at Institute of Science Tokyo have developed poly(silatranylmethyl methacrylate) (PSMMA), an organic polymer that hardens upon contact with water. The material transitions from a workable putty to a water-resistant solid, achieving tensile shear strengths of 0.7-1.6 MPa in underwater bonding tests.

IN DEPTH

Key Findings

Institute of Science Tokyo researchers have developed a silatrane-based hydraulic polymer, poly(silatranylmethyl methacrylate) (PSMMA), capable of spontaneous hardening in wet environments. The material functions similarly to cement; when PSMMA powder is mixed with water, it transforms into a soft, sticky putty, then a gel, and finally a rigid, water-resistant solid. In practical demonstrations, the polymer successfully bonded fragments of a broken glass vial with no leakage and achieved tensile shear strengths between 0.7-1.6 MPa when joining different substrates underwater.

Technical Details

The material's hydraulicity is derived from silatrane groups, which possess an internal interaction between silicon and nitrogen that increases hydrophilicity. The hardening process occurs in two primary stages:

- **Hydrolysis:** Water triggers the breaking of chemical bonds within the silatrane groups.
- **Condensation:** The resulting groups link to form a three-dimensional, crosslinked silsesquioxane network.

Analysis indicates that approximately 95% of the silatrane groups react within 24 hours of curing. The reaction is further accelerated by triethanolamine, which is released during the process and acts as a catalyst. As the silsesquioxane network forms, the material's character shifts from hydrophilic to water-resistant.

Background and Context

While cement naturally exhibits hydraulicity, reproducing this in organic polymers has been difficult due to the challenge of combining bulk curing with water resistance. This research, led by Assistant Professor Akira Takahashi, graduate student Rei Tokumitsu, and Professor Hideyuki Otsuka from the Department of Chemical Science and Engineering, was published in *Angewandte Chemie International Edition* on September 10, 2026.

Significance and Outlook

PSMMA provides a method for shaping and curing organic materials in wet environments, as demonstrated by the creation of cubic and spiral forms using molds underwater. While the current material is noted to be brittle, the researchers intend to explore copolymerization to improve mechanical properties and investigate the relationship between the extent of curing and adhesive strength.

Source: https://www.miragenews.com/water-curing-polymer-enables-underwater-bonding-1776851/

Collected: November 15, 2026 | Automated Research System (AI)

#07 Cu/Cu Joining: Laser-Structured Surfaces for Paste-Free Bonds

Published November 06, 2026　Research Square（プレプリント）



OVERVIEW

Laser-structured copper surfaces enable direct Cu/Cu joining without filler metals or sintering pastes, achieving apparent shear strengths of 16 and 35 MPa. The study demonstrates that finer, more densely distributed surface features significantly improve interfacial contact and joint strength. This approach reduces process complexity for high-power electronic systems requiring high thermal and electrical conductivity.

IN DEPTH

Key Findings

Direct Cu/Cu joining without the use of sintering pastes, filler metals, or permanent intermediate layers is achievable through laser-structuring of copper surfaces. The study identified two structure variants, with Variant II delivering a higher apparent shear strength of 35 MPa compared to 16 MPa for Variant I. This performance gap is attributed to Variant II's finer and more densely distributed features, which resulted in a larger surface-enlargement factor and a more continuous interfacial contact morphology.

Technical Details

The researchers utilized a kinematic surface simulation to determine the optimal laser parameter combinations for creating pronounced microstructured topographies. Following the simulation, two distinct structure variants were produced, differing in their lateral feature sizes and surface-enlargement factors. These surfaces were joined under the application of heat and pressure.

To evaluate the quality and strength of the joints, the study employed a comprehensive suite of characterization techniques:

- Optical microscopy and scanning electron microscopy (SEM)
- Laser scanning microscopy
- Cross-sectional analysis and fracture-surface examination
- Preliminary adapted die-shear testing

Background & Context

Modern electronic systems are facing increasing demands for higher power density and improved thermal management. These requirements necessitate joining technologies that can provide high electrical and thermal conductivity while maintaining mechanical stability. Traditional methods often rely on intermediate layers or pastes, which can increase process complexity and potentially hinder conductivity.

Significance & Outlook

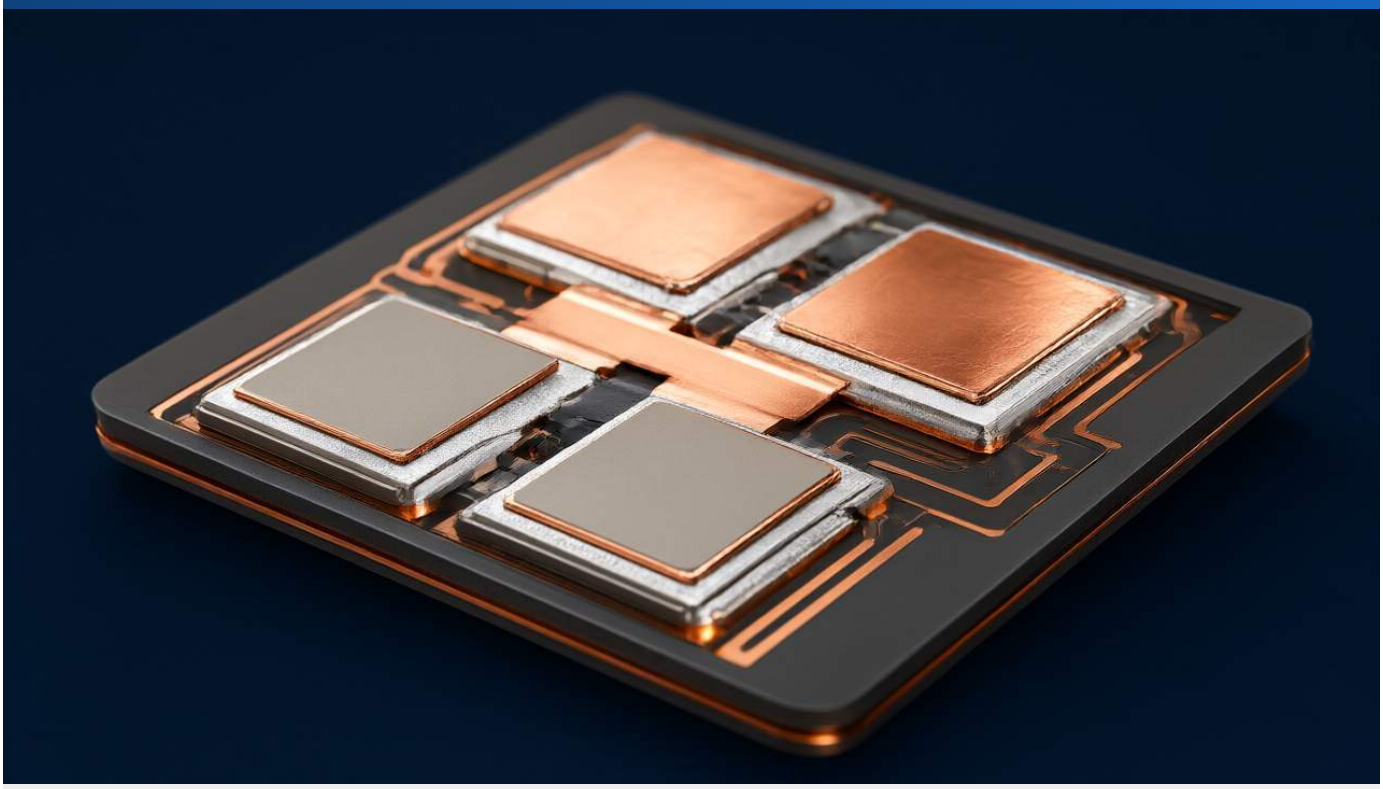
The results indicate that the lateral distribution of laser-generated surface features is a critical factor in the formation of direct Cu/Cu joints. By eliminating the need for filler materials, this paste-free approach offers a path toward reducing complexity in the assembly of high-performance electronic components while maintaining sufficient mechanical stability.

Source: https://doi.org/10.21203/rs.3.rs-11156221/v1

Collected: November 15, 2026 | Automated Research System (AI)

#08 MacDermid Alpha BondPad: SiC Power Module Sintering Specs

Published November 10, 2026 Bisinfotech USA



OVERVIEW

MacDermid Alpha is introducing BondPad, a copper-foil solution using Argomax silver sinter film for die-topside attach in SiC power packages. The technology demonstrates a 30-fold increase in life cycles compared to conventional aluminum wirebonding under specific power-cycling tests. This advancement enables higher reliability for high-power semiconductor packages operating at elevated temperatures and switching frequencies.

IN DEPTH

Key Findings

The BondPad technology achieves over 75,000 cycles under specified power-cycling test conditions, compared to 2,500 cycles for standard conventional aluminum wirebond references. This performance was measured using a 110°C temperature swing, a maximum junction temperature of 175°C, and a current of 180 amperes, with failure defined as a 5% increase in drain-to-source voltage.

Technical Details

BondPad consists of a 50 µm nominal copper foil combined with an Argomax silver sinter film. During the sintering process, the Argomax layer creates a metallurgical bond with the die topside, resulting in a consistent sintered bond line of approximately 20 µm. The exposed copper surface then serves as a landing area for subsequent copper wire or copper ribbon bonding.

Compared to silver sinter paste-based approaches, the BondPad film-laminated solution provides several technical advantages:

- Elimination of print and dispense dimensional variability.
- Precise control of bond line thickness.
- Reduction in overall processing time.
- Compatibility with existing wire-bonding equipment and tape-and-reel machine placement for automated assembly.

Background and Context

As silicon carbide (SiC) power devices increase operating temperatures and switching frequencies, manufacturers are shifting away from conventional solder and aluminum wire-bonding. There is an increasing demand for sintered die attach and die-topside interconnects capable of withstanding demanding thermal-cycling conditions. MacDermid Alpha is also presenting other sintering and solder products, including ALPHA ARGOMAX AccuLam 8022 silver sintering film and ALPHA TrueHeight Solder Preforms.

Significance and Outlook

The transition of silver sintering technology from traditional die attach to die-topside interconnects addresses the critical need for interface reliability as power density increases. By utilizing established manufacturing infrastructure while improving process control, BondPad provides a scalable method for enhancing the reliability of high-power SiC power modules.

Source: https://www.bisinfotech.com/macdermid-alpha-showcases-upcoming-technology-for-sic-power-modules-at-electronica-2026/

Collected: November 15, 2026 | Automated Research System (AI)

#09 JA DeepBlue 5.0 TOPCon: Reduced Creepage Distance and Specs

Published November 09, 2026 TaiyangNews



OVERVIEW

JA has developed the DeepBlue 5.0 TOPCon module, which utilizes butyl sealant to reduce the minimum creepage distance from 10.4 mm to 3.5 mm. This design increases the active cell area by approximately 1% and enhances resilience against humidity ingress and wet leakage.

IN DEPTH

Key Findings

The JA DeepBlue 5.0 TOPCon module, scheduled for mass production starting in Q2 2026, is certified to the IEC 61730-1:2023 standard. The module integrates high-insulation boundary sealing technology and a butyl sealant to create cemented joints, allowing for a reduced minimum creepage distance of 3.5 mm compared to the traditional 10.4 mm. This modification enables a larger cell size within the 2,382 × 1,134 mm module dimensions, resulting in an active area gain of approximately 1%.

Technical Details

The module utilizes "Bycium+ 5.0" multi-cut G12R TOPCon cells, which are sliced into three equal sections along the length side. These strips are interconnected by overlapping cut edges to create a gapless interconnection, using a buffer film to absorb mechanical stress and prevent microcracks. To further optimize space, the ribbon interconnection section is moved to the rear, saving roughly 25 mm in module length compared to conventional designs. Additionally, Composite Structure Enhancement (CSE) technology is used to maintain uniform laminate thickness across the module.

The boundary sealing employs a non-polar butyl rubber copolymer that is chemically compatible with standard encapsulating materials. This material provides a higher barrier against humidity and gases than EVA or POE and offers stable volume resistivity to improve insulation resistance. Furthermore, the module features a triangle-shaped rear glass design that separates ribbon holes, reducing mechanical stress on hole sections by up to 14% under extreme load testing.

Background and Significance

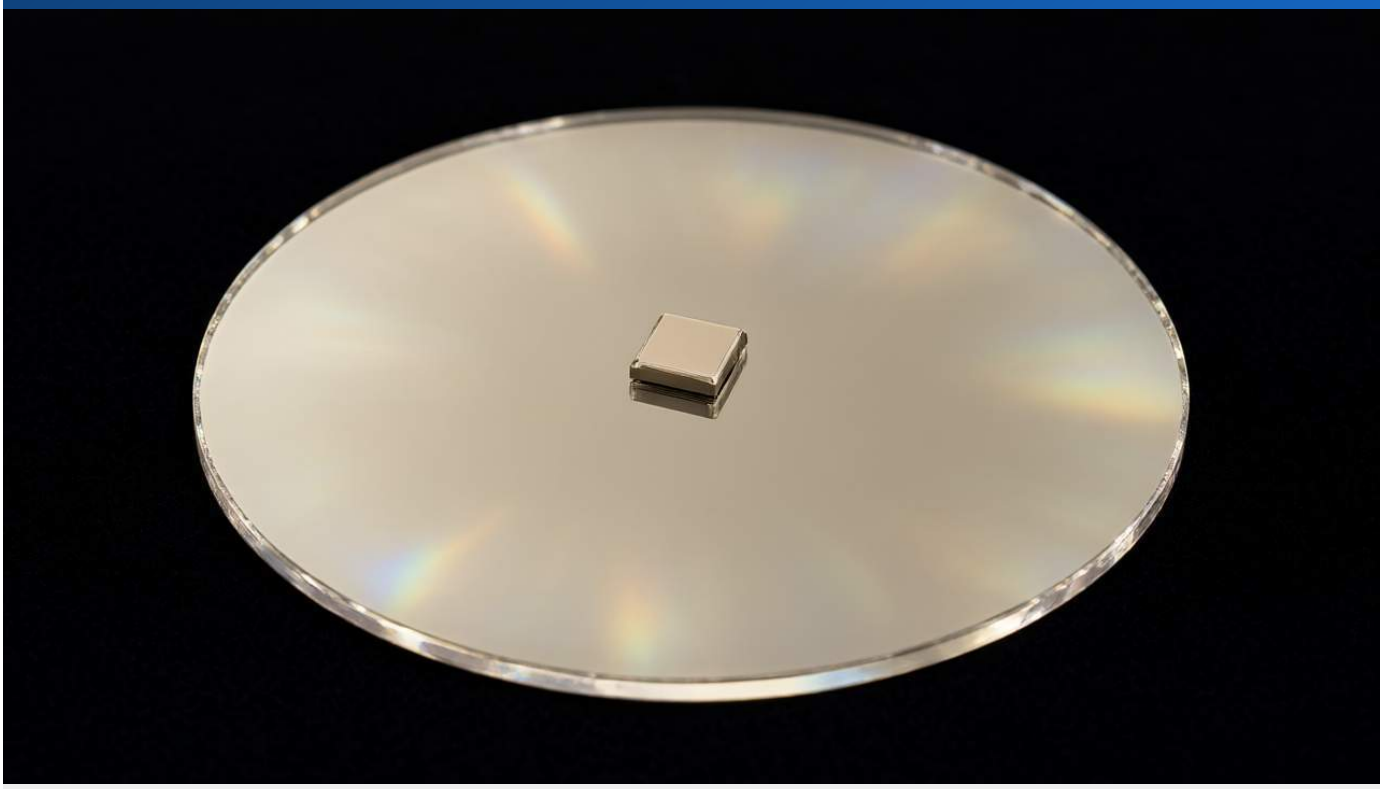
These advancements address PV module reliability by combining material changes with design refinements. The use of butyl sealant specifically improves the module's Water Vapor Transmission Rate (WVTR) and overall resilience against humidity ingress. Regarding environmental durability, the module has achieved a Class A+ partial shading resistance certification from TÜV Rheinland across five different shading scenarios, ensuring performance stability under various external obstacles.

Source: https://taiyangnews.info/technology/ja-topcon-creeepage-distance-cemented-joint

Collected: November 15, 2026 | Automated Research System (AI)

#10 Diamond Foundry: 200mm Single Crystal Diamond for AI Cooling

Published November 09, 2026 XenoSpectrum USA



OVERVIEW

Diamond Foundry has produced the world's first 200mm diameter single crystal diamond, doubling the size of its 2023 100mm version. This expansion increases the theoretical material area fourfold, potentially enabling larger heat-spreading substrates for high-power AI semiconductors.

IN DEPTH

Key Findings

Diamond Foundry announced on November 5, 2026, the successful creation of a single crystal diamond with a diameter of 200mm. This represents a significant scale-up from the 100mm version released in October 2023. The company emphasizes that this is a continuous single crystal structure, rather than a polycrystalline diamond or a composite of smaller crystals.

Technical Details

The increase in diameter from 100mm to 200mm results in a theoretical area increase from approximately 78.5cm² to 314cm². This 200mm size aligns with the standard 8-inch wafer diameter used in the semiconductor industry. However, the company noted that the current achievement refers to unpolished material immediately after growth; polished substrates ready for semiconductor manufacturing have not yet begun shipping.

The development required advancements in several technical areas, including:

- Plasma control and chemical reactions during crystal growth.
- Reaction furnace design and temperature management.
- Measurement technology.

Background and Context

The breakthrough is the result of approximately 25 years of research by Stefan Gsell and Martin Fischer. Both joined Diamond Foundry following the company's acquisition of Augsburg Diamond Technology in 2022. Single crystal diamond is targeted for AI GPU cooling due to its high thermal conductivity and electrical insulation, which help mitigate "hot spots" in high-power chips.

Significance and Outlook

While the material area has increased, Diamond Foundry cautions that actual cooling performance depends on the thermal resistance of the bonding layer between the chip and the diamond, as well as the external cooling mechanism. Data regarding defect density, yield, and effective diameter after processing have not been disclosed.

CEO Martin Roscheisen indicated that this milestone makes the production of 300mm single crystal diamonds technically foreseeable. However, specific timelines for mass production, pricing, and supply conditions for the 200mm material remain unspecified.

Source: https://xenospectrum.com/diamond-foundry-wafer-chip-cooling/

Collected: November 15, 2026 | Automated Research System (AI)