

Functional Materials

Weekly Intelligence Report

2026-06-20 | 16 articles | 8 countries

troy-technical.jp

This Week's Keyword

Advanced Materials

AI, Rare Earths, and Next-Gen Coatings

16

articles

Total Articles Analyzed

8

countries

Source Countries/Regions

\$39.9B

USD

SMA Market by 2033

\$10.3B

USD

VC in Advanced Materials

All 16 Articles This Week — 5-Axis Evaluation Matrix

How to read columns — Tech Novelty: degree of breakthrough Market Proximity: closeness to commercialization Market Impact: industry-wide effect Data Reliability: quantitative data & peer review US/EU Relevance: direct impact on US/European companies & supply chains

#	Article Title	Type	Tech Novelty	Market Proximity	Market Impact	Data Reliability	US/EU Relevance	Summary
#01	AI Autonomous Labs	Research	●●●●● ●	●●○○○ ○	●●●●● ●	●●○○○ ○	●●●●● ●	AI-powered autonomous labs drastically shorten materials discovery cycles for climate solutions.
#02	Superhydrophobic Concrete	Research	●●●●● ○	●●●○○ ○	●●●○○ ○	●●●●● ○	●●●●● ●	Novel organosilane sol-gel coating provides durable superhydrophobicity to concrete for 21 months.
#03	SMA Wound Closure	Research	●●●●● ●	●●○○○ ○	●●●●● ○	●●○○○ ○	●●●○○ ○	Chinese team develops programmable SMA metamaterial device for multi-axial wound closure, accelerating healing.
#04	Granular Metamaterial	Research	●●●●● ●	●●○○○ ○	●●●●● ○	●●○○○ ○	●●●●● ●	Rice-inspired granular metamaterial stiffens instantly on impact, enabling passive adaptive protection.
#05	Fluorine-Free Coating	Research	●●●●● ○	●●○○○ ○	●●●○○ ○	●●●●● ●	●●●●● ○	Dual thermo-photo curing yields durable, fluorine-free superhydrophobic coating, retaining efficacy after abrasion.
#06	SMA Market (openPR)	Market Overview	●○○○○ ○	●●●●● ●	●●●●● ○	●●○○○ ○	●●●●● ●	Shape Memory Alloy market projected to reach \$35.62B by 2035, driven by medical devices.
#07	Interpretable AI for Mats	Research	●●●●● ○	●●○○○ ○	●●●●● ●	●●○○○ ○	●●●●● ○	Tokyo University of Science unveils interpretable AI to decipher material property predictions, accelerating design.
#08	Rare Earth-Free Magnets	Corporate Strategy	●●●●● ○	●●●●● ○	●●●●● ●	●●○○○ ○	●●●●● ●	Rare earth-free magnet development accelerates, Niron Magnetics targets 1,500 tons/year by 2028.
#09	Infineon Embedded Mem	Corporate Strategy	●●○○○ ○	●●●●● ○	●●●●● ○	●●○○○ ○	●●●●● ●	Infineon emphasizes advanced embedded memory and material technologies for system reliability in semiconductors.
#10	Functional Mats Mkt	Market Overview	●○○○○ ○	●●●●● ●	●●●●● ○	●●○○○ ○	●●●●● ●	North America leads the functional advanced materials market, driven by healthcare materials and research.
#11	EU Mats Grant Program	Corporate Strategy	●●○○○ ○	●●○○○ ○	●●●●● ○	●●○○○ ○	●●●●● ●	EU launches grant program for advanced materials, boosting recycled carbon fiber and next-gen Li-ion batteries.
#12	SMA Market (Custom)	Market Overview	●○○○○ ○	●●●●● ●	●●●●● ○	●●○○○ ○	●●●●● ●	Shape Memory Alloys market to reach \$39.9B by 2033, driven by medical, aerospace, and automotive demand.

#	Article Title	Type	Tech Novelty	Market Proximity	Market Impact	Data Reliability	US/EU Relevance	Summary
#13	SMA Market (Insight)	Market Overview	●○○○ ○	●●●● ●	●●●● ○	●●●○ ○	●●●● ●	Shape Memory Alloys market to hit \$29.13B by 2034, fueled by medical device adoption and aerospace-defense demand.
#14	VC Invest Mats Sector	Market Overview	●○○○ ○	●●●● ●	●●●● ○	●●●○ ○	●●●● ●	Over \$10.3B in VC invested in advanced materials; de-risked manufacturing critical for funding.
#15	USA Rare Earth Funding	Corporate Strategy	●●●○ ○	●●●○ ○	●●●● ●	●●●○ ○	●●●● ●	USA Rare Earth secures \$3.5B to accelerate domestic 'mine-to-magnet' supply chain by 2028.
#16	Flexible TEG	Research	●●●● ●	●●○○ ○	●●●● ○	●●●● ●	●●●○ ○	Ultra-high-performance Ag ₂ Se-based flexible thermoelectric generator achieves ZT of 1.15 for wearables.

●●●●○ High ●●●○ Med-High ●●○○○ Med ●○○○○ Low | Yellow highlight = featured article

Three Questions That Demand Your Decision This Week

1 Is your supply chain exposed to rare earth risks?

China's tightening export controls and US/EU efforts to build domestic 'mine-to-magnet' supply chains (e.g., USA Rare Earth's \$3.5B funding, Niron's 2028 target) signal critical shifts. Assess your reliance on current sources.

2 Are you leveraging AI for materials discovery?

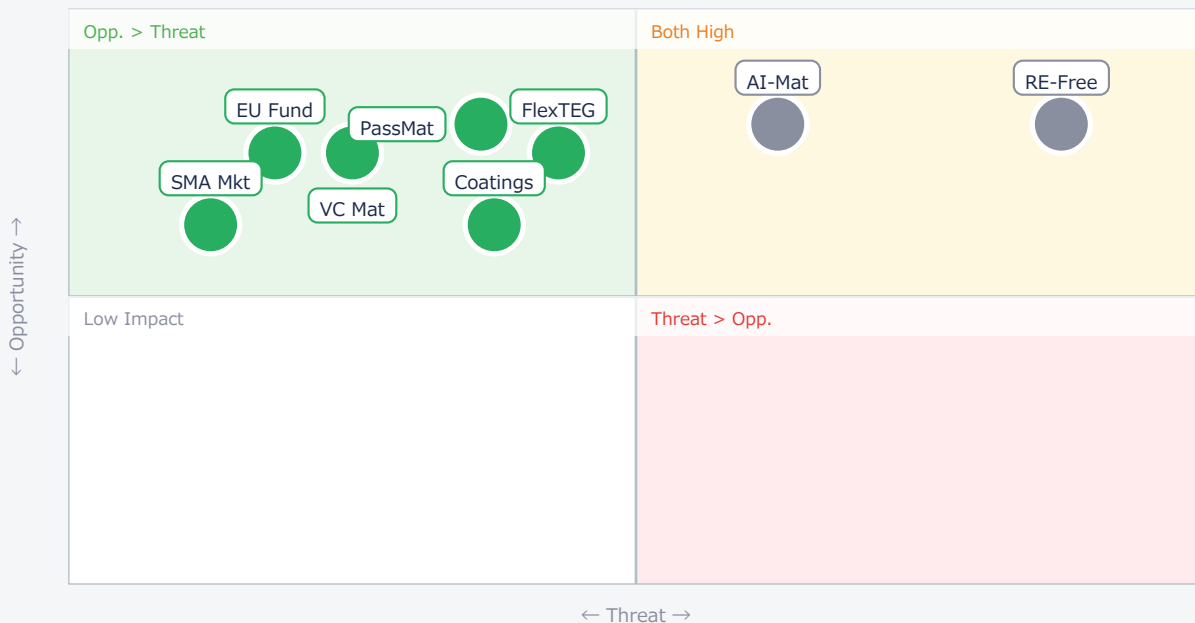
AI-powered autonomous labs can drastically accelerate materials innovation, compressing years into weeks. Competitors adopting interpretable AI for R&D; will gain a significant lead in developing next-gen functional materials.

3 How will next-gen coatings impact your products?

Breakthroughs in durable, fluorine-free superhydrophobic coatings (21-month field test, 66m abrasion resistance) offer eco-friendly performance. Evaluate if these make your current protective solutions obsolete or open new product categories.

Opportunities vs. Threats for US/European Companies

Opportunity vs. Threat Matrix for US/European Companies



Item	Quadrant	↑ Opportunity	↓ Threat
● RE-Free	Critical	Diversify supply	China dominance
● AI-Mat	Critical	Accelerate R&D;	Competitor lead
● SMA Mkt	Opp.	New products	Missed growth
● Coatings	Opp.	Eco-friendly durable	Lagging tech
● EU Fund	Opp.	EU R&D; boost	Non-EU lag
● VC Mat	Opp.	Fund innovation	Slow scale-up
● FlexTEG	Opp.	Wearable power	Niche market

● PassMat	Opp.	Adaptive protect	Early stage
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Deep Dive ① — Rare Earth-Free Magnets & Supply Chain Diversification

#08 | 2026/06/12 | TrendForce | Tech Novelty ●●●●○ Proximity ●●●●○ Market Impact ●●●●● Data Reliability ●●●●○ US/EU Relevance ●●●●●

Global efforts to reduce reliance on China's rare earth supply are accelerating. Niron Magnetics aims for 1,500 tons/year of iron-nitrogen based rare earth-free magnets by 2028, with commercial deployment in European speakers this year. ZF Friedrichshafen is developing magnet-free EV motors for mass production, while Japan's Daido Steel has commercialized high-performance permanent magnets using only light rare earths for Honda hybrid vehicles.

These initiatives address geopolitical supply risks and rising demand from EV and wind energy sectors. The shift towards rare earth-free or light rare earth-only solutions is critical for supply chain stability and cost reduction in high-performance applications.

► Strategic Analyst's Perspective

Strategic Analyst's Perspective: Niron's 2028 target is ambitious but vital given geopolitical pressures. ZF's magnet-free EV motors signal a fundamental shift. [Opportunity] US/EU materials suppliers can capture market share by developing and scaling rare earth-free alternatives. OEMs can diversify supply chains, reducing geopolitical risk. [Threat] Companies reliant on traditional rare earth magnets face supply instability. Asian competitors are actively developing solutions. Next Actions: [Procurement] Identify alternative magnet suppliers. [R&D;] Invest in rare earth-free magnet R&D; or magnet-free motor designs. [Strategy] Assess geopolitical risks to current magnet supply.

Deep Dive ② — AI-Powered Autonomous Labs for Materials Discovery

#01 | 2026/06/11 | The World Economic Forum | Tech Novelty ●●●●● Proximity ●●○○○ Market Impact ●●●●● Data Reliability ●●○○○ US/EU Relevance ●●●●●

AI-powered 'self-driving labs' are transforming materials innovation, especially for climate crisis mitigation. These closed-loop systems use AI to propose novel material candidates, then employ automated experiments for rapid synthesis and characterization, drastically shortening development cycles from months/years to weeks.

This convergence of computational science, machine learning, and robotics allows AI to learn, refine models, and optimize candidates with minimal human intervention. Companies like Pheno are already developing integrated high-throughput experimentation and AI platforms, signaling a paradigm shift in materials science.

► Strategic Analyst's Perspective

Strategic Analyst's Perspective: While 'weeks' for discovery is optimistic for complex materials, the acceleration potential is undeniable. This is a foundational shift. [Opportunity] US/EU R&D; divisions can leverage AI platforms to drastically shorten material development cycles, gaining a competitive edge. Technology licensors can develop and license AI/robotics platforms. [Threat] Companies not investing in AI-driven R&D; risk being outpaced in materials innovation. Talent gaps in AI/materials science integration are critical. Next Actions: [R&D;] Pilot AI-driven materials discovery platforms. [Strategy] Evaluate AI capabilities of competitors. [Executive] Allocate budget for AI/robotics in R&D.;

Deep Dive ③ — Ultra-High-Performance Flexible Thermoelectric Generators

#16 | 2026/06/19 | Energy & Environmental Science (RSC Publishing) | Tech Novelty ●●●●● Proximity ●●○○○
Market Impact ●●●●○ Data Reliability ●●●●● US/EU Relevance ●●●○○

A flexible Ag₂Se-based thermoelectric generator achieved a record-high ZT value of 1.15 at 300K (near room temperature), significantly advancing its application in wearable electronics. It demonstrates a normalized power density of approximately 9.09 μW m⁻¹ K⁻², capable of powering portable devices from body heat or ambient waste heat.

This breakthrough addresses the challenge of high-efficiency power generation in low-temperature difference environments, paving the way for battery-free wearable devices and IoT sensors. The unique process for forming Ag₂Se layers on flexible substrates ensures resistance to bending and twisting.

► Strategic Analyst's Perspective

Strategic Analyst's Perspective: ZT of 1.15 at 300K for a flexible TEG is a significant lab breakthrough. Scaling production for flexible, robust, and cost-effective devices remains the primary hurdle. [Opportunity] US/EU device manufacturers can integrate these TEGs into next-gen wearables, IoT sensors, and medical patches for battery-free operation. Materials suppliers can develop scalable Ag₂Se synthesis. [Threat] Companies reliant on traditional battery solutions for wearables may be disrupted. Asian competitors could commercialize this technology faster. Next Actions: [R&D;] Investigate Ag₂Se material properties and flexible device integration. [Business Dev] Explore partnerships with research institutions or startups. [Product Dev] Assess potential for battery-free wearable prototypes.

Other Notable Articles

#02 Novel Organosilane Sol-Gel Coating Sustains Superhydrophobicity on Concrete for 21 Months (European Coatings)
Tech Novelty ●●●●○ Proximity ●●●○○ Market Impact ●●●○○

Highly durable, long-lasting superhydrophobic concrete coating offers significant maintenance reduction for infrastructure.

#04 Rice-Inspired Granular Metamaterial Achieves Instantaneous Stiffening on Impact (ScienceDaily)
Tech Novelty ●●●●● Proximity ●●○○○ Market Impact ●●●●○

Passively adaptive material that stiffens on impact without electronics opens new avenues for protective gear and soft robotics.

#05 Dual Thermo-Photo Curing Yields Fluorine-Free Superhydrophobic Coating (PubMed)
Tech Novelty ●●●●○ Proximity ●●○○○ Market Impact ●●●○○

Durable, fluorine-free superhydrophobic coating (66m abrasion resistance) offers an eco-friendly alternative to PFAS materials.

#09 Infineon Emphasizes Built-In Confidence Through Advanced Embedded Memory and Material Technologies (EE Times)
Tech Novelty ●●●○○ Proximity ●●●○○ Market Impact ●●●●○

Infineon highlights critical role of advanced materials in embedded memory for semiconductor reliability, especially for automotive/IoT.

#15 USA Rare Earth Secures \$3.5 Billion to Accelerate Domestic 'Mine-to-Magnet' Supply Chain (The Motley Fool)
Tech Novelty ●●●○○ Proximity ●●●○○ Market Impact ●●●●●

Substantial US investment aims to establish a domestic rare earth 'mine-to-magnet' supply chain by 2028, reducing foreign reliance.

Recommended Actions This Week

Action recommendations based on article evaluation matrix and opportunity/threat analysis.

■ Immediate (this week)

- [Procurement] Conduct an urgent audit of rare earth magnet supply chains to identify exposure to geopolitical risks and single-source dependencies.
- [R&D;] Form a cross-functional task force to evaluate current AI capabilities in materials R&D; and identify pilot projects for autonomous labs.

■ Short-term (1 month)

- [Strategy] Develop a roadmap for diversifying magnet sourcing, including engagement with rare earth-free magnet developers like Niron Magnetics.
- [R&D;] Initiate feasibility studies for integrating advanced superhydrophobic coatings (fluorine-free) into existing product lines or new construction projects.
- [Business Dev] Explore potential partnerships with EU-funded research groups or startups in recycled carbon fiber and next-gen battery technologies.

■ Medium-long term (quarter+)

- [Executive] Allocate significant R&D; budget for AI-driven materials discovery platforms and talent acquisition in computational materials science.
- [Legal/IP] Review IP landscape for rare earth-free magnets and flexible thermoelectric generators to identify licensing opportunities or defensive strategies.
- [Product Dev] Begin conceptual design for battery-free wearable devices leveraging flexible thermoelectric generators, targeting 3-5 year market entry.
- [Strategy] Establish a dedicated venture fund or corporate accelerator for advanced materials startups, focusing on de-risked manufacturing and scale-up.

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FunctionalMaterials — Selected Articles

Date: 2026-06-20

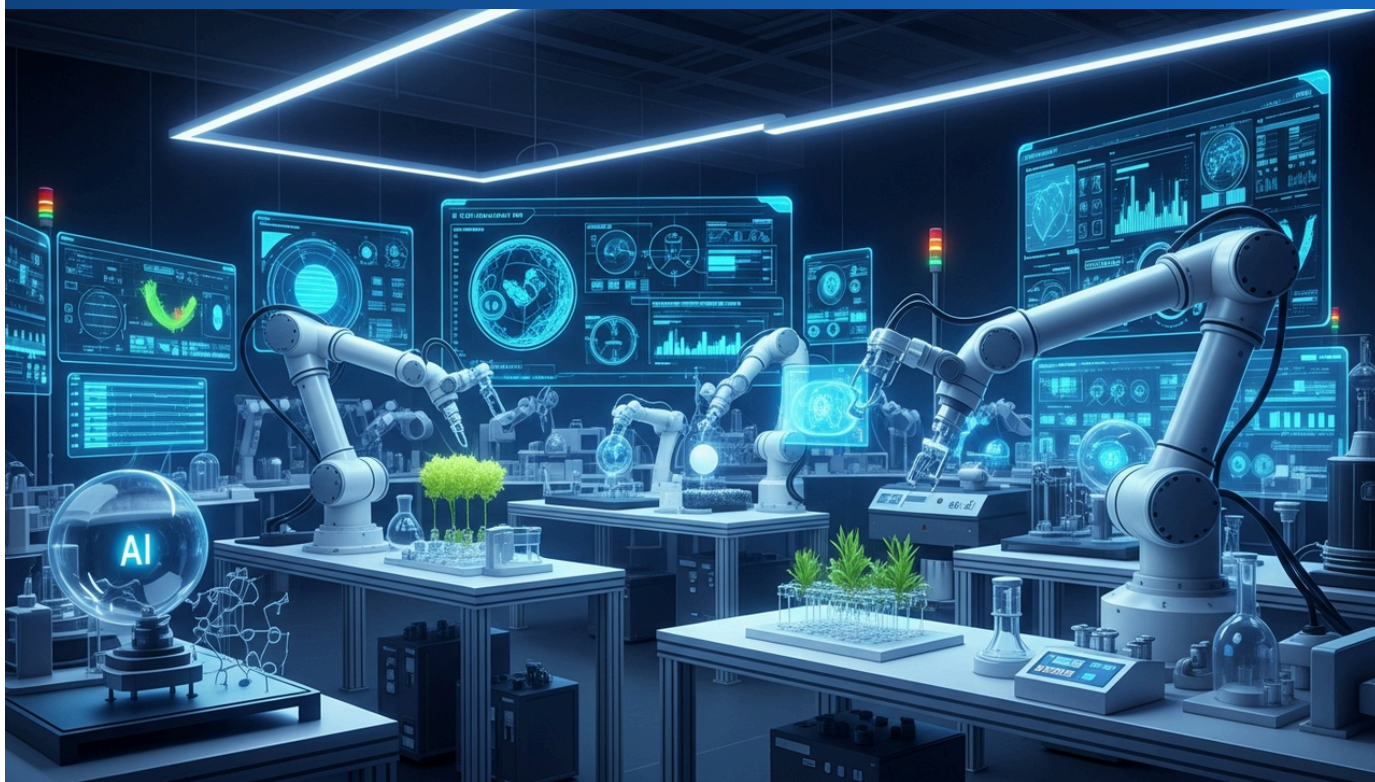
Articles: 16

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AI-Powered Autonomous Labs Accelerate Climate-Critical Materials Discovery

Published June 11, 2026 The World Economic Forum Switzerland



OVERVIEW

The World Economic Forum highlights the transformative impact of AI and 'self-driving labs' in rapidly advancing materials innovation, especially for climate crisis mitigation. These closed-loop systems leverage AI to propose novel material candidates and then employ automated experiments for rapid synthesis and characterization, drastically shortening development cycles. This accelerated approach is crucial for bringing next-generation functional materials to market faster, addressing urgent needs in sustainable energy and emissions reduction.

IN DEPTH

Key Findings

The integration of Artificial Intelligence (AI) and autonomous laboratories is revolutionizing the pace of functional materials discovery, offering a critical pathway to address the escalating climate crisis. This innovative approach establishes 'closed-loop systems' where AI algorithms propose potential material candidates, and robotic systems automatically synthesize and test them. This significantly reduces the bottlenecks inherent in traditional materials development, compressing timelines that would typically span months or years into mere weeks.

Technical Details

At the core of this breakthrough is the convergence of computational science, machine learning, and advanced robotics. The AI component predicts optimal chemical compositions and structural architectures for materials tailored to specific performance targets. These predictions then guide robotic platforms in executing automated experiments, with results fed back to the AI in real-time. This continuous feedback loop allows the AI to learn, refine its models, and propose increasingly optimized candidates with minimal human intervention, maximizing both efficiency and precision in material synthesis and characterization.

Background & Context

Historically, materials discovery has been a labor-intensive, trial-and-error process, ill-suited for the urgent demands of the climate crisis. There is a pressing need for high-performance materials in areas such as greenhouse gas emission reduction, advanced renewable energy storage, and carbon capture technologies. AI-driven autonomous labs emerge as a powerful solution, with their efficacy already demonstrated in research published in 'Nature.' Companies like Pheno are at the forefront, developing integrated high-throughput experimentation and AI platforms that are propelling a paradigm shift in materials science.

Strategic Significance & Outlook

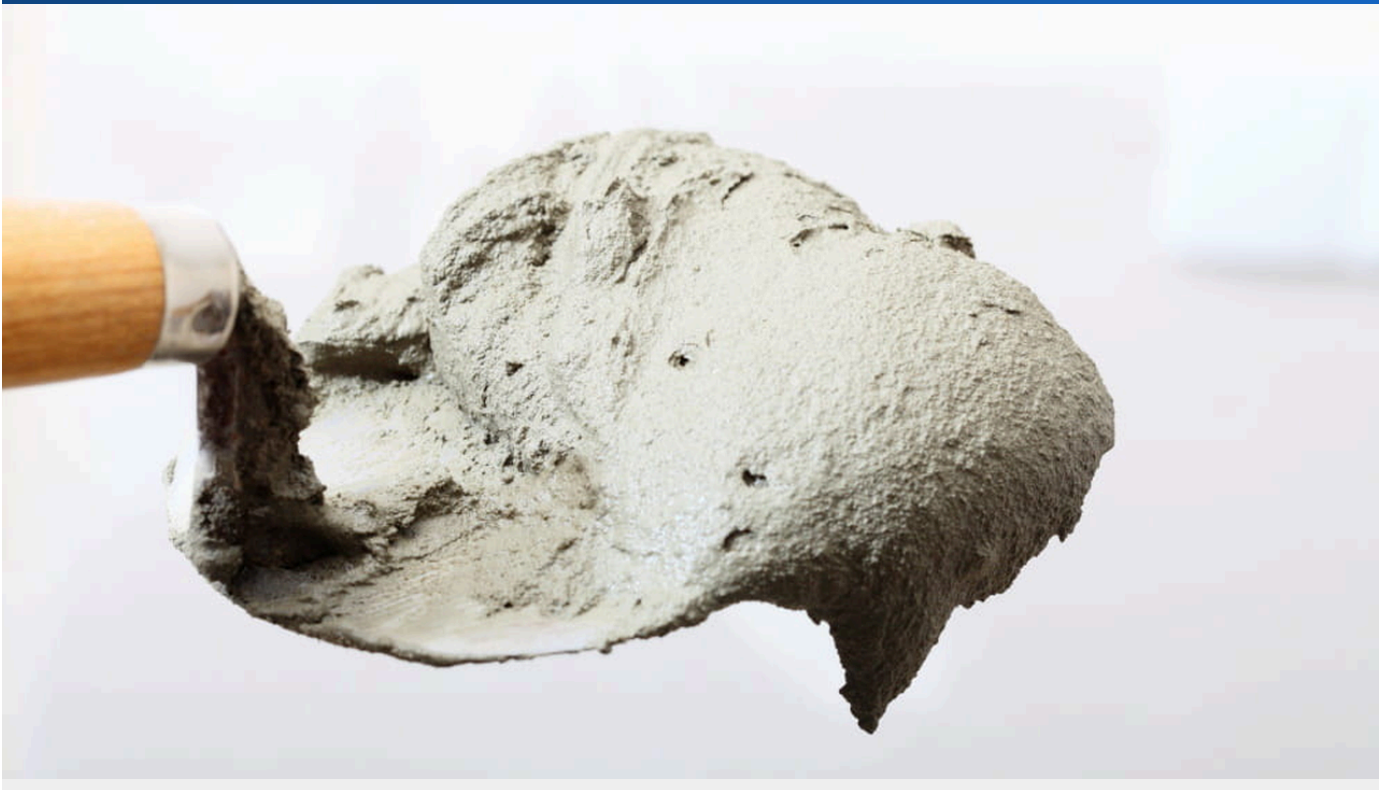
The implementation of AI and autonomous laboratories promises to drastically cut the lead time and cost associated with new material development. This acceleration will drive innovations across diverse sectors, including enhanced solar cell efficiency, the creation of high-capacity batteries, and the development of lightweight yet highly durable structural materials. Ultimately, this technology is poised to become an indispensable component in achieving a sustainable society and mitigating climate change, delivering substantial economic and societal impact across industries globally.

Source: <https://www.weforum.org/stories/2026/06/the-next-climate-breakthrough-may-come-from-materials-too-small-to-see/>

Collected: June 19, 2026 | Automated Research System (Gemini API)

Novel Organosilane Sol-Gel Coating Sustains Superhydrophobicity on Concrete for 21 Months in Field Test, Enhancing Durability

Published June 19, 2026 European Coatings Germany



OVERVIEW

Researchers have developed an advanced organosilane-based sol-gel coating that penetrates concrete pores and chemically bonds with the cement matrix, creating a highly durable superhydrophobic surface. A 21-month field validation on concrete monuments in Lithuania confirmed the coating's sustained performance, demonstrating static contact angles of 160° and sliding angles below 5° . This breakthrough offers superior water and corrosive liquid repellency across a wide pH range, promising significantly extended lifespan and reduced maintenance for concrete structures.

IN DEPTH

Scientists have engineered a groundbreaking superhydrophobic organosilane sol-gel coating that dramatically extends the durability of concrete structures, with real-world validation showing sustained performance over 21 months on monuments in Lithuania. This innovative coating achieves exceptional superhydrophobicity, characterized by a static contact angle of 160° and a sliding angle below 5° , setting a new benchmark for long-term efficacy compared to conventional coating technologies.

Technical / Clinical Details

- The developed organosilane sol penetrates deep into the microscopic pores of concrete, forming robust chemical bonds with the cement matrix. This mechanism ensures extraordinary durability and enhanced resistance against surface abrasion and delamination, effectively sealing the concrete from environmental degradation.
- Beyond water, the coating demonstrates superior repellency against corrosive liquids across a broad pH spectrum. This is crucial for protecting concrete from acidic rain, alkaline contaminants, and other chemical attacks, thereby preserving structural integrity.
- The extended field test on Lithuanian monuments provided critical data on performance under genuine climatic conditions. The maintenance of the initial superhydrophobic properties after 21 months underscores the material's high practical utility and reliability in harsh outdoor environments.

Background & Context

Concrete, the most widely used construction material globally, faces significant challenges from moisture penetration, freeze-thaw cycles, and chemical corrosion, which severely compromise its durability. These issues lead to shorter infrastructure lifespans and substantial repair and maintenance costs. Existing hydrophobic coatings have often suffered from short effective durations or performance degradation under specific environmental conditions.

Strategic Significance & Outlook

This organosilane sol-gel coating technology holds immense potential for application across various concrete structures, including buildings, bridges, tunnels, and water treatment facilities, promising to significantly extend their operational life and reduce maintenance expenses. It offers a sustainable and economically viable solution, particularly vital for preserving historical structures and addressing aging infrastructure globally. The research team is committed to further optimizing the material and developing large-scale production techniques to accelerate its practical implementation.

Source: <https://www.european-coatings.com/news/coatings-technologies/reactive-sol-creates-durable-superhydrophobic-concrete-coating/>

Collected: June 19, 2026 | Automated Research System (Gemini API)

Programmable Shape Memory Alloy Metamaterial Device Enables Multi-Axial Wound Closure, Accelerating Healing

Published June 11, 2026 EurekAlert! China



OVERVIEW

A research team from China's Army Medical University has developed an innovative wound closure device using shape memory alloy metamaterials, capable of multi-axial stretching and smartphone-controlled mechanical contraction. This "multi-axis stretchable zipper" adapts to complex wound geometries, overcoming limitations of traditional unidirectional methods for faster, more robust healing. The technology promises to reduce patient discomfort and significantly accelerate the healing process in future wound care.

IN DEPTH

A research team at China's Army Medical University has unveiled a groundbreaking multi-axial stretchable wound closure device. Constructed from shape memory alloy (SMA) metamaterials, this device can freely stretch in six directions and achieve precise, programmable mechanical contraction via a smartphone application. It overcomes the unidirectional constraints of traditional wound closure techniques, adapting to complex wound geometries to facilitate faster and more robust healing.

Technical / Clinical Details

- At the core of this device are thermally responsive Nitinol (nickel-titanium) SMA actuators integrated into an elastic polymer metamaterial structure. This combination allows the device to precisely pull wound edges together by changing shape in response to temperature variations.
- Traditional wound closure methods (sutures, staples, adhesives) apply tension in only one direction, making it challenging to effectively manage irregular wound shapes and depths. This new device applies uniform contractile force from six different directions, promoting closure from all sides of the wound, expected to accelerate healing and minimize scar formation.
- Smartphone app control empowers medical professionals to fine-tune the contractile force and speed according to the patient's wound condition. This enables individualized treatment plans, reduces the risk of tissue damage from excessive tension, and enhances patient comfort.

Background & Context

Wound healing has long been a challenge in medicine, with the closure of large or irregularly shaped wounds often being a complex and time-consuming process. Traditional techniques have left issues such as infection risk, scar size, and patient discomfort. While shape memory alloys have gained attention for medical device applications due to their unique properties (superelasticity, shape memory effect), this marks the first device to achieve precise multi-directional control in wound closure.

Strategic Significance & Outlook

This innovative wound closure device has the potential to revolutionize a wide range of medical fields, including emergency medicine, battlefield trauma care, chronic wound management, and even aesthetic plastic surgery. Significant applications are also anticipated in telemedicine and self-manageable wound care systems, offering substantial benefits for regions with limited medical resources or patients requiring home care. Following further clinical trials and regulatory approvals, this technology could soon become an integral part of standard wound care protocols.

Source: <https://www.eurekalert.org/news-releases/1131333>

Collected: June 19, 2026 | Automated Research System (Gemini API)

Rice-Inspired Granular Metamaterial Achieves Instantaneous Stiffening on Impact, Enabling Passive Adaptive Protection

Published June 11, 2026 ScienceDaily USA



OVERVIEW

Scientists discovered a unique property in rice: it weakens under rapid compression but strengthens under slow pressure. Leveraging this, they developed a smart granular metamaterial that stiffens instantly on impact without electronics or sensors. This passively adaptive material can bend, buckle, or harden in response to external stimuli, paving the way for safer soft robotics and immediate-response protective gear.

IN DEPTH

Scientists have uncovered a previously unknown, peculiar mechanical property of rice: it weakens under rapid compressive loads while becoming stronger when pressure is applied slowly. Harnessing this phenomenon, the research team developed a smart granular metamaterial that stiffens instantaneously during impact, operating entirely without the need for electronics or external sensors. This passively adaptive material can autonomously alter its rigidity in response to external forces, representing a significant breakthrough in material science.

Technical / Clinical Details

- The research focused on the microscopic behavior of granular materials, specifically rice. It was observed that as individual rice grains are compressed, changes in friction and interaction cause their overall strength characteristics to vary non-linearly. Rapid compression reduces inter-particle contacts, making the overall material "weaker," whereas slow compression allows particles to rearrange, forming a denser, stronger structure.
- The metamaterial developed based on this discovery is an assembly of particles with specific geometric shapes. These particles are engineered to control the density and interactions within the granular system under stress, allowing them to autonomously exhibit an immediate increase in stiffness (a "hardening" behavior) in response to external energy input (impact).
- Conventional smart materials often require sensors, actuators, and complex electronic control systems. However, this rice-inspired granular metamaterial functions without these active components, significantly simplifying design and reducing costs.

Background & Context

The development of passively responsive smart materials has been a long-standing goal in achieving lightweight, robust, and reliable protective systems and robotics. Especially in environments where complex electronic systems are prone to failure or difficult to deploy (e.g., extreme temperatures, underwater, remote locations), the ability of a material to adapt to circumstances itself is essential. Understanding the dynamic behavior of granular materials offers new perspectives for designing such self-adaptive systems.

Strategic Significance & Outlook

This smart granular metamaterial is expected to have wide-ranging applications that enhance safety and diversify functionality. For instance, as impact absorbers in sports protective gear or military body armor, it can provide higher protection by instantaneously stiffening upon collision. Also, applications in soft robotics, such as joints that can switch between flexibility and rigidity based on context, and in sensors or actuators that adapt to complex environments without electronics, are also envisioned. This research opens new doors in bio-inspired material design, hinting at the next frontier in material science.

Source: <https://www.sciencedaily.com/releases/2026/06/260611024621.htm>

Collected: June 19, 2026 | Automated Research System (Gemini API)

Dual Thermo-Photo Curing Yields Fluorine-Free Superhydrophobic Coating Retaining Efficacy After 66m Abrasion at 9.8 kPa

Published June 11, 2026 PubMed Japan



OVERVIEW

A highly durable, fluorine-free superhydrophobic polymer coating was developed using a thermo-photo dual-curing mechanism. This dual-network design rigidly anchors micro/nanofillers, allowing the coating to maintain superhydrophobicity even after 66 meters of abrasion under 9.8 kPa pressure. It also demonstrates excellent chemical and thermal resistance, offering a significant environmentally friendly alternative to fluorinated materials.

IN DEPTH

This study successfully synthesized a novel fluorine-free polymer coating that combines unprecedented durability with superhydrophobic properties, achieved through a thermo-photo dual-curing mechanism. The dense polymer network formed by this innovative approach rigorously encapsulates micro- and nanoscale fillers, enabling the coating to maintain its functionality even under severe physical and chemical stresses.

Technical / Clinical Details

- **Dual-Curing Mechanism:** The key to this technology lies in combining two distinct energy sources, heat and light, to form the polymer network. Photo-curing facilitates rapid initial cross-linking, while subsequent thermal curing promotes further bonding and densification of polymer chains. This synergistic effect constructs a uniform and robust dual-network structure.
- **Anchoring of Micro/Nanofillers:** The developed coating incorporates specific micro/nanofillers. The dual-cured network tightly entraps these fillers within the polymer matrix, effectively preventing their detachment due to abrasion or erosion, thereby ensuring long-term superhydrophobicity.
- **Durability Assessment:** The coating's abrasion resistance was evaluated using 1000-grit sandpaper. Even after 66 meters of abrasion under a pressure of 9.8 kPa, the water contact angle remained above 150°, consistently demonstrating superhydrophobicity. This significantly addresses the mechanical fragility issues often associated with conventional fluorine-free superhydrophobic coatings.
- **Chemical and Thermal Stability:** The coating exhibited high chemical and thermal stability, maintaining structural integrity and water repellency after exposure to a wide range of pH environments (e.g., pH 1 to 14) and organic solvents, as well as high temperatures (e.g., above 200°C).

Background & Context

Fluorinated compounds have been widely used for their excellent water and oil repellency, but environmental concerns (particularly the PFAS issue) have made the development of alternative materials a pressing need. Traditional fluorine-free superhydrophobic coatings generally suffer from poor mechanical durability, presenting a significant barrier to practical application. This research represents a crucial step in resolving this durability challenge and developing high-performance, environmentally friendly materials.

Strategic Significance & Outlook

This fluorine-free superhydrophobic coating technology is anticipated to find diverse industrial applications, including automotive body protection, waterproof treatment for construction materials, moisture protection for electronic devices, and water-repellent finishing for textiles. Especially for products exposed to harsh environments, this solution will offer strong market competitiveness by balancing long-term performance with compliance to environmental regulations. The research team is pursuing further studies aimed at cost reduction and establishing large-scale production techniques, aspiring to contribute to a sustainable society.

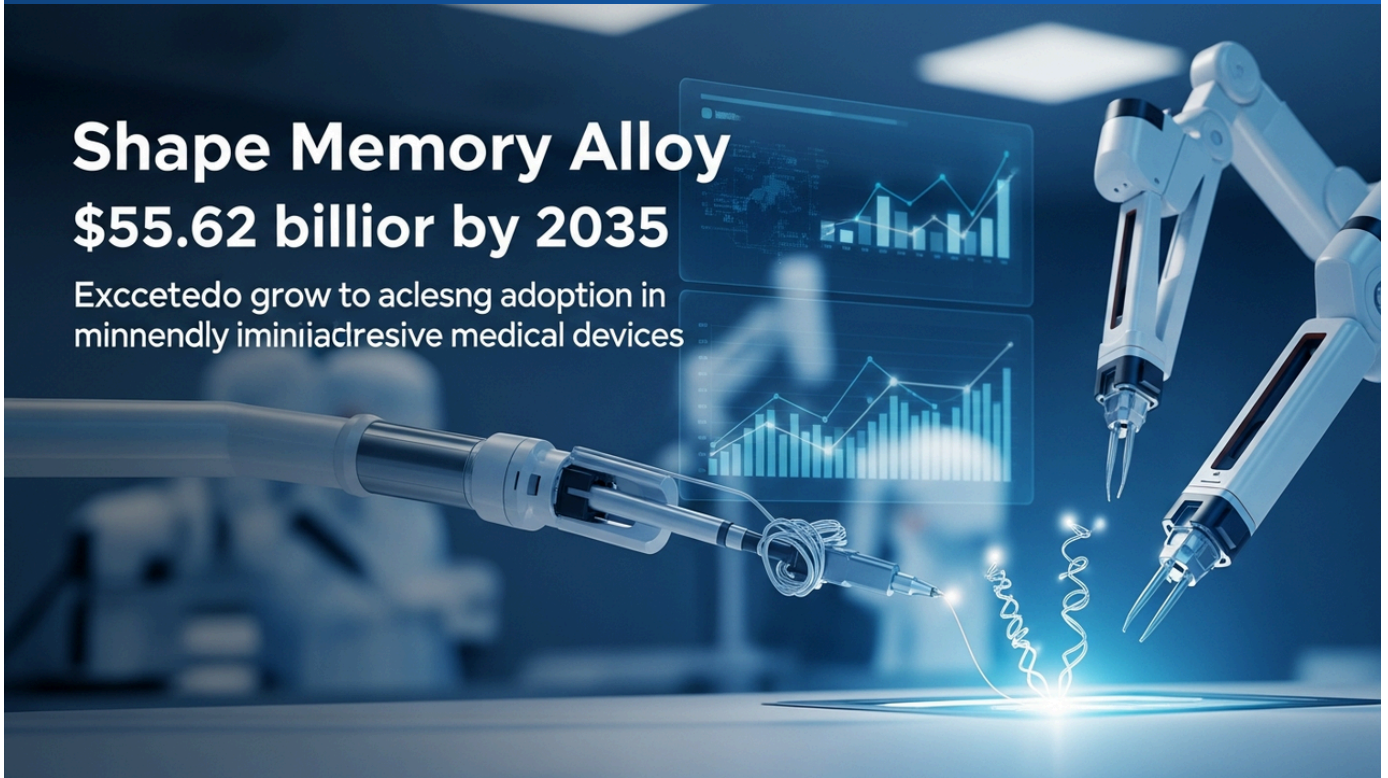
Source: <https://pubmed.ncbi.nlm.nih.gov/42272288/>

Shape Memory Alloy Market Projected to Reach \$35.62 Billion by 2035 Driven by Minimally Invasive Medical Devices

Published June 11, 2026 openPR.com Global

Shape Memory Alloy \$55.62 billion by 2035

Excetedo grow to aclesng adoption in minnendly iminiiacresive medical devices



OVERVIEW

This article provides an overview of a market research report published by openPR.com. The Shape Memory Alloy (SMA) market is projected to grow from \$16.84 billion in 2025 to \$35.62 billion by 2035, driven by increasing demand for lightweight design, high durability, and controlled actuation capabilities across various sectors. The medical device segment, particularly with nickel-titanium alloys, is expected to exhibit the fastest growth due to its adoption in minimally invasive applications like stents and guide wires.

Report Overview

This article provides an executive summary of a market research report on the Shape Memory Alloy (SMA) market, distributed via openPR.com. The report analyzes the current state and future projections of the global SMA market, detailing key growth drivers, market segmentation, and regional trends. It highlights the escalating demand for SMAs across diverse applications, including medical, aerospace, automotive, and industrial sectors.

Key Findings

- The global shape memory alloy market is forecast to expand from \$16.84 billion in 2025 to \$35.62 billion by 2035, demonstrating robust growth over the decade.
- Primary drivers for this market expansion include the increasing need for lightweight designs, superior durability, and precise, controlled actuation capabilities inherent to SMAs. These characteristics are particularly valued in high-performance industries such as medical devices, aerospace, and automotive.
- Within the various application segments, the medical device sector is anticipated to experience the most rapid growth. This accelerated adoption is largely due to the exceptional biocompatibility and superelastic properties of nickel-titanium (Nitinol) alloys, making them ideal for minimally invasive devices like stents, guidewires, orthodontic products, and surgical instruments.
- Geographically, North America held a significant market share in 2024, attributed to its robust aerospace manufacturing base and advanced healthcare infrastructure, which foster high demand for advanced materials.

Future Outlook

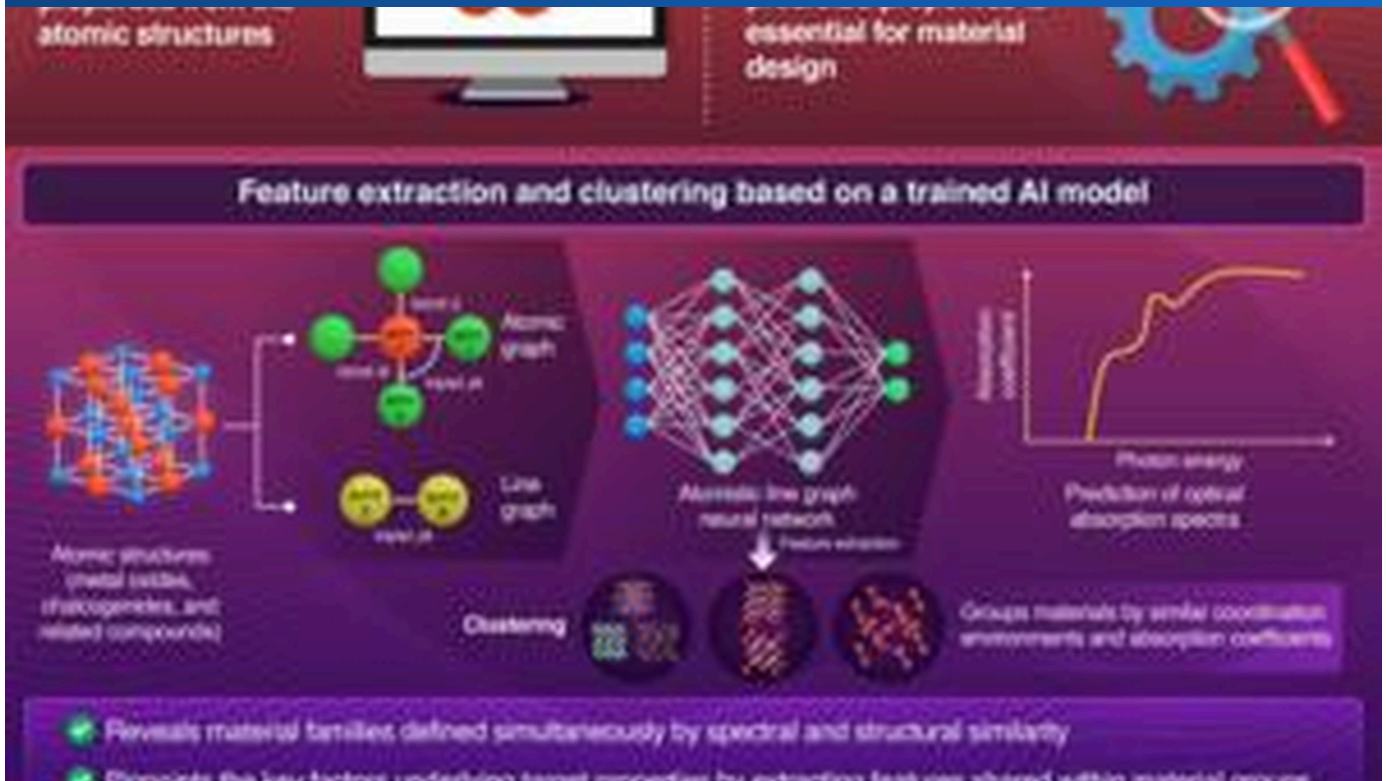
The SMA market is poised for sustained expansion due to its unique functional properties and broad application potential. The escalating demand for minimally invasive treatments, driven by advancements in medical technology and an aging global population, will further amplify the importance of SMAs. Additionally, the continuous pursuit of lightweight and high-performance components in the aerospace and defense industries will serve as a significant catalyst for SMA technology evolution. These materials, renowned for their shape memory effect (returning to a predetermined shape upon heating) and superelasticity (recovering shape after substantial deformation), enable the development of groundbreaking products. Continued advancements in materials science and engineering are expected to unlock even more innovative applications for SMAs in the coming years, potentially redefining capabilities across multiple high-tech sectors.

Source: <https://www.openpr.com/news/4545786/shape-memory-alloy-adoption-expands-across-medical-devices>

Collected: June 19, 2026 | Automated Research System (Gemini API)

Tokyo University of Science Unveils Interpretable AI to Decipher Material Property Predictions, Accelerating Novel Material Design

Published June 15, 2026 Institute of Science Tokyo (Science Tokyo) via Advanced Intelligent Discovery Japan



OVERVIEW

Researchers at Tokyo University of Science have developed a novel technique to interpret how AI models predict the relationship between material structures and properties. This approach extracts key features from AI-learned correlations between crystal structures and optical spectra, enabling the grouping of materials with similar structural and spectral characteristics. The method provides crucial insights into how atomic arrangements influence other material properties, paving the way for significantly more efficient material design.

Key Findings

A research team at Tokyo University of Science has developed a groundbreaking method to explain how artificial intelligence (AI) models learn and predict the relationships between material structures and their properties. This 'interpretable AI' approach allows material scientists to peer inside the AI's black box, fostering a deeper understanding of its predictive reasoning. Specifically, the ability to clearly extract key features that AI prioritizes when correlating complex crystal structures with optical spectra, and then to efficiently classify and group materials based on similar structural and spectral characteristics, holds the potential to fundamentally transform the paradigm of novel material development.

Technical Details

The newly developed technique focuses not only on the prediction results generated by AI models but also on visualizing the underlying mechanisms. It automatically identifies crucial features from vast datasets of material information that indicate how specific crystal structures influence particular optical spectra. This empowers researchers to understand 'why' the AI predicted a material would possess certain properties. For instance, if certain interatomic distances or bond angles significantly contribute to optical characteristics, the AI recognizes these as important features and presents them in an intuitively understandable manner. This approach classifies materials by considering both structural and spectral similarities, offering more precise insights than conventional methods relying on a single property. The research leverages advanced machine learning algorithms combined with large-scale data analysis to provide a new interpretive tool for complex problems in materials science.

Background & Context

In contemporary materials science, the discovery of materials with novel functionalities is crucial across diverse fields, from environmental solutions to medicine and electronics. However, traditional methods for identifying optimal materials from a vast number of candidates have historically incurred immense time and cost. While AI has emerged as a powerful tool to accelerate material discovery, the 'black box problem'—where the reasoning behind AI's predictions remains opaque—has been a persistent challenge. This research addresses this black box problem, enhancing the transparency and trustworthiness of AI predictions, thereby promoting broader adoption and utilization of AI in materials science research. In the future, based on the 'interpretations' provided by AI, researchers can formulate more precise experimental designs and devise more efficient material synthesis pathways.

Strategic Significance & Outlook

This interpretable AI technology has the potential to revolutionize the discovery and design of new materials. Researchers will be able to efficiently search for materials with specific optical properties or precisely design atomic arrangements to achieve desired characteristics, all guided by AI's insights. This is expected to lead to breakthroughs in areas such as enhancing solar cell efficiency, improving LED performance, developing novel catalysts, and designing advanced quantum materials. Furthermore, the methodology is applicable beyond crystal structures and optical spectra, potentially extending to the design of all types of functional materials. This achievement by Tokyo University of Science represents a critical step towards increasing the reliability and efficiency of AI-driven materials science, thereby accelerating material innovation for a sustainable future on a global scale.

Source: <https://www.eurekalert.org/news-releases/1131777>

Rare Earth-Free Magnet Development Accelerates: Niron Magnetics Targets 1,500 Tons/Year by 2028 Amid Push to Diversify Supply Chains from China

Published June 12, 2026 TrendForce Taiwan



Niron Magnetics

NEW

OVERVIEW

Global efforts to develop rare earth-free magnets and diversify supply chains are intensifying due to China's tighter export controls. Niron Magnetics aims to produce 1,500 tons of iron-nitrogen based rare earth-free magnets annually by 2028, with commercial deployment in high-end European speakers expected this year. Concurrently, ZF Friedrichshafen is developing magnet-free EV motors for mass production within years, while Japan's Daido Steel has commercialized high-performance permanent magnets using only light rare earths, already adopted in Honda hybrid vehicles.

Key Findings

Intensified export restrictions on rare earth elements by China are accelerating global efforts to reduce reliance on these critical materials and establish alternative supply chains. Significant advancements in rare earth-free magnet development and commercialization are reported across the US, Europe, and Japan. Niron Magnetics, for instance, has established the capability to manufacture high-performance rare earth-free magnets from iron and nitrogen, targeting an annual production of 1,500 tons by 2028. Commercial deployment in high-end European speakers is anticipated within the year, marking a revolutionary step towards achieving comparable performance to traditional magnets using abundant and environmentally benign materials.

Technical Details

Technological development in rare earth-free magnets is progressing on multiple fronts. Niron Magnetics' iron-nitrogen based technology not only mitigates geopolitical supply risks but also contributes to reduced manufacturing costs. This technology is expected to find applications in sectors demanding high performance, such as audio equipment and automotive components. Concurrently, German automotive supplier ZF Friedrichshafen is advancing the development of magnet-free motors for electric vehicles (EVs), aiming for mass production within a few years. This approach is significant as it fundamentally addresses concerns about magnet supply instability. In Japan, Daido Steel has developed high-performance permanent magnets that utilize only more readily available light rare earths while maintaining performance equivalent to conventional rare earth magnets. These magnets are already integrated into Honda's hybrid vehicle motors, indicating successful practical implementation. Each of these technological pathways offers distinct solutions to the rare earth challenge, contributing to the establishment of more sustainable supply chains.

Background & Context

Rare earth elements are indispensable for modern high-tech industries, powering EV motors, wind turbines, smartphones, and defense systems. However, their production and refining are heavily concentrated in a few specific countries, with China dominating global supply, making the supply chain vulnerable to geopolitical tensions and export restrictions. Recognizing this, nations like the US and those in Europe have heavily invested in bolstering domestic rare earth production capabilities and fostering rare earth-free technological innovations. The recent announcements from these companies underscore that these strategic initiatives are beginning to yield tangible results, heralding a future of more stable material supply for global industries. The accelerating electrification of the automotive sector, in particular, is driving a dramatic increase in magnet demand, further elevating the criticality of rare earth-free technologies.

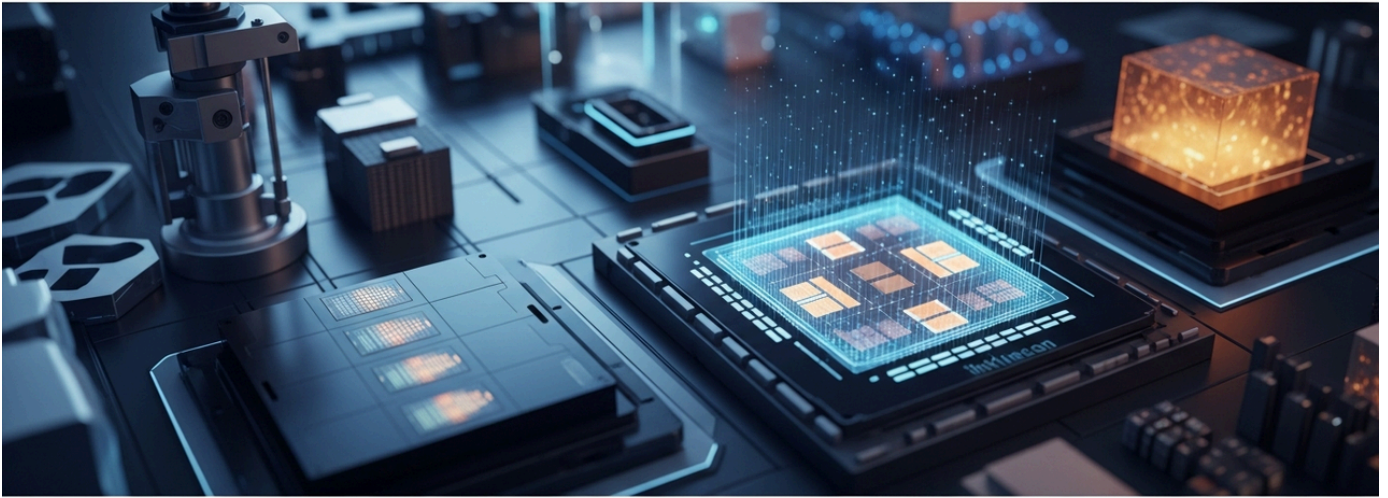
Strategic Significance & Outlook

The progression of rare earth-free magnet technology is poised to significantly impact future industrial structures. Firstly, stabilizing the supply chain will reduce raw material price volatility, ensuring more consistent product availability, which is a substantial benefit for automotive and consumer electronics manufacturers. Secondly, these technologies contribute to mitigating the environmental impact associated with rare earth mining, often linked to severe pollution. Adopting alternative technologies promises more sustainable material sourcing. Furthermore, increased competition will spur continued innovation in rare earth-free technologies, potentially leading to the development of even higher-performance and cost-effective magnets. In the long term, this will accelerate innovation across global high-tech industries and facilitate the broader adoption of clean energy technologies. The production targets of Niron Magnetics, the mass production goals of ZF Friedrichshafen, and the commercial deployment by Daido Steel are clear indicators that these promising outlooks are rapidly becoming a reality.

Source: <https://www.trendforce.com/news/2026/06/12/news-from-rare-earth-free-magnets-to-new-supply-chains-the-push-to-break-chinas-grip-accelerates/>

Infineon Emphasizes Built-In Confidence Through Advanced Embedded Memory and Material Technologies in EE Times Article

Published June 17, 2026 EE Times USA



OVERVIEW

Morten Block of Infineon, in an EE Times article titled 'Built-In Confidence,' highlighted the critical role of embedded memory in ensuring system reliability for advanced semiconductor designs. The article emphasizes how the evolution of functional materials and technologies is paramount for the performance and long-term stability of next-generation electronic systems, particularly in automotive and IoT applications. These material advancements are key to addressing data retention, processing speed, and security requirements.

Key Findings

In his article 'Built-In Confidence,' featured in the June issue of EE Times, Morten Block of Infineon underscored the paramount role of embedded memory in establishing the foundation of reliability for modern system designs. Block argued that advancements in materials science and technology are indispensable for ensuring the overall performance and long-term stability of products, especially within advanced semiconductor architectures. This discourse deepens the understanding that functional materials are not merely components but strategic elements dictating the total reliability and efficiency of an entire system.

Technical Details

Embedded memory technology plays a central role not only in data storage but also in system boot-up, firmware execution, and securing critical functionalities. Particularly for mission-critical applications such as automotive autonomous driving systems and industrial IoT devices, memory demands high speed, low power consumption, and above all, exceptional reliability and durability. Block states that to meet these rigorous requirements, the adoption of novel memory materials, such as next-generation non-volatile memories like Resistive Random-Access Memory (RRAM) and Phase-Change Memory (PCM), is crucial. These materials offer properties surpassing conventional flash memory, including superior data retention in high-temperature environments and resistance to immense write-cycle demands. As semiconductor manufacturing processes push towards further miniaturization, the selection and optimization of materials become key to enhancing both design flexibility and reliability in terms of device physical characteristics and electrical performance.

Background & Context

The semiconductor industry faces two major challenges: improving data processing capabilities and reducing power consumption. With the proliferation of edge AI and high-performance computing, on-device data processing has surged, elevating the importance of embedded memory. Furthermore, the increasing stringency of functional safety standards in the automotive industry (e.g., ISO 26262) mandates the highest levels of reliability for all components, including memory. Leading semiconductor manufacturers like Infineon are actively investing in materials science R&D to meet these requirements. Block's contribution not only showcases product advantages but also offers deep insights into industry-wide technological trends and challenges, suggesting that embedded memory and its associated material technologies are core competencies that will define competitiveness in the future semiconductor industry.

Strategic Significance & Outlook

The evolution of embedded memory will profoundly influence the design of future electronic systems. Safer, faster, and more energy-efficient devices will be made possible through the introduction of new functional materials. This is expected to accelerate innovation across a wide range of applications, including AI accelerators, next-generation automotive systems, smart factories, and advanced wearable devices. By continuing to invest in material technologies, companies like Infineon will provide products with higher reliability and performance, further driving digital transformation. The theme of 'Built-In Confidence' raised by Block underscores the importance of trust in technology's societal impact, making the convergence of materials science and semiconductor technology a highly scrutinized and critical area moving forward. This convergence will enable advanced capabilities and ensure the robustness required for complex, interconnected systems in an increasingly digital world, solidifying market leadership for those who innovate effectively in this domain.

Source: <https://www.eetimes.com/>

Reports and Data: North America Leads Functional Advanced Materials Market Driven by Healthcare Materials and Research Hubs

Published June 15, 2026 Reports and Data Global



OVERVIEW

This article provides an overview of a market research report published by Reports and Data. The Functional Advanced Materials market is undergoing rapid transformation, fueled by increasing demand for high performance, sustainability, and miniaturization. North America is leading this market, owing to its high density of research institutions, technology transfer offices, and manufacturing facilities capable of nanofabrication and additive manufacturing workflows. A particular focus on healthcare-related materials, such as biocompatible polymers and implantable sensors, further propels this regional growth.

Report Overview

This article provides an executive summary of a comprehensive market research report by Reports and Data on the functional advanced materials market. The report delves into global market trends, growth drivers, regional analyses, and key market segments for advanced functional materials, which are continuously evolving at the forefront of materials science. It identifies increasing demands for enhanced performance, sustainability, and miniaturization as key factors driving the market's rapid transformative phase.

Key Findings

- The functional advanced materials market is experiencing significant growth, supported by escalating demand across various industrial sectors. Key growth drivers include improvements in material performance, environmental considerations (sustainability), and the miniaturization of devices.
- Regionally, North America leads this market, with its dominance underpinned by several factors. The region boasts a high concentration of world-class research institutions and universities, fostering vigorous R&D activities.
- Furthermore, numerous Technology Transfer Offices (TTOs) effectively bridge fundamental research findings to commercialization. The presence of abundant manufacturing facilities capable of advanced production workflows, such as nanofabrication and additive manufacturing (3D printing), enables rapid production and market introduction of new materials.
- A specific focus on functional advanced materials in the healthcare sector is a strong growth catalyst for the North American market. Biocompatible polymers are increasingly adopted in medical implants and drug delivery systems, while implantable sensors are becoming indispensable for diagnostics and monitoring.

About the Publisher

Reports and Data is a global market intelligence and consulting firm that provides market research reports and consulting services across various industries. The company offers insights to clients for strategic decision-making through detailed market analysis, forecasts, and competitive landscape assessments.

Future Outlook

The functional advanced materials market is projected to continue its growth, driven by ongoing technological innovation and expanding industrial applications. Demand from high-growth sectors such as healthcare, electronics, aerospace, and automotive will particularly steer this market. The acceleration of AI and data science in materials design, coupled with the digitalization of manufacturing processes, is expected to shorten new material development cycles and expedite market entry. North America's robust R&D ecosystem and manufacturing capabilities are anticipated to maintain its status as a global hub for innovation. A growing emphasis on sustainability will further drive the development of bio-based and recyclable materials, diversifying the market landscape.

Source: <https://www.24chemicalresearch.com/reports/312205/functional-advanced-materials-market>

Collected: June 19, 2026 | Automated Research System (Gemini API)

EU Funds Advanced Materials: Driving Recycled Carbon Fiber & Next-Gen Li-Ion Battery Scaling

Published June 11, 2026 EU Grants Funding Europe 聯合



OVERVIEW

The European Union has launched a new grant program for SMEs, startups, research groups, and universities to accelerate innovation in advanced materials. The initiative targets two critical areas: developing sustainable applications for recycled carbon fiber produced via innovative pyrolysis, and scaling up next-generation lithium-ion battery technologies, including semi-solid and all-solid-state designs. This strategic funding aims to bolster European materials science and clean energy sectors.

Background

Advanced materials form the foundation of nearly all modern technological innovations. The EU recognizes the imperative to strengthen its leadership in materials science to enhance autonomy in strategic industrial sectors such as clean energy, digitalization, aerospace, defense, and healthcare. The use of recycled CF not only contributes to achieving sustainability targets but also boosts the resilience of material supply chains. Investments in advanced lithium-ion battery technology are vital for the widespread adoption of electric vehicles (EVs), the development of renewable energy storage systems, and grid stabilization, forming a cornerstone of the EU's 'Green Deal' policy. This grant program provides a crucial incentive for research institutions and companies to pursue innovation in these high-risk, high-reward areas, strengthening the foundation for Europe to establish a competitive edge in global technological competition.

Key Findings

The European Union (EU) has announced a new grant program specifically targeting small and medium-sized enterprises (SMEs), startups, research groups, and universities within the advanced materials sector to accelerate innovation. This program is sharply focused on two critical areas: first, developing new sustainable industrial applications and advanced products that utilize recycled carbon fiber (CF) produced through innovative pyrolysis processes; and second, supporting the scaling-up of next-generation lithium-ion battery technologies, particularly semi-solid and all-solid-state batteries. This funding is strategically positioned as a core component of the EU's drive to lead the transition towards sustainable industries and clean energy solutions.

Technical Details

The utilization of recycled carbon fiber (CF) is crucial for promoting a circular economy, transforming waste into high-value materials. Pyrolysis offers an efficient method for recovering carbon fibers from end-of-life composite materials, thereby reducing the high costs and environmental footprint associated with virgin carbon fiber production. This grant will support the development of novel products using recycled CF, such as lightweight structural components, high-performance filters, or advanced energy storage systems. Simultaneously, next-generation lithium-ion battery technologies, especially semi-solid and all-solid-state batteries, offer significant advantages over current liquid-electrolyte lithium-ion batteries in terms of safety, energy density, and charge/discharge rates. Semi-solid batteries use gel or polymer electrolytes, while all-solid-state batteries employ entirely solid electrolytes, eliminating the risk of leakage and substantially reducing fire hazards. The EU's grant aims to overcome barriers to transitioning these technologies from laboratory scale to commercial production, facilitating investment in material development, process optimization, and manufacturing equipment necessary for mass production.

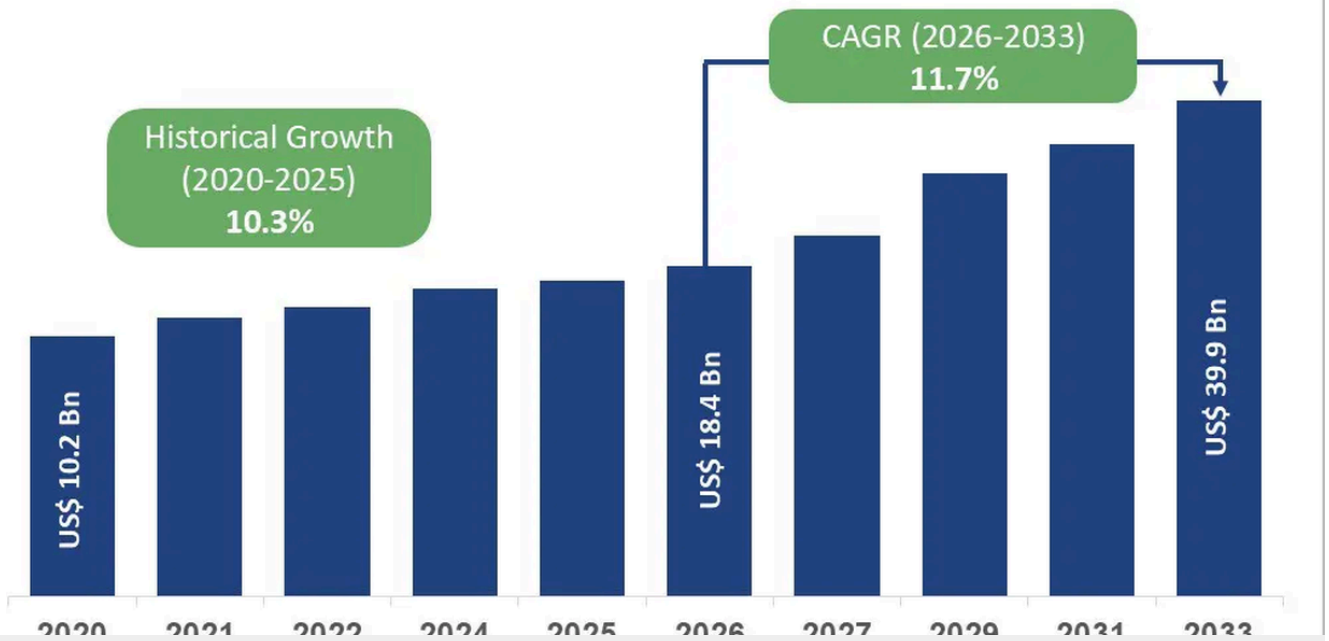
Strategic Significance & Outlook

This EU grant program is expected to significantly accelerate research, development, and commercialization in the advanced materials sector. Advances in recycled CF technology will contribute to improving resource efficiency and reducing carbon emissions in manufacturing, enabling more sustainable product designs. Should next-generation lithium-ion battery technologies, particularly all-solid-state batteries, achieve commercial success, they could bring about revolutionary changes such as extended EV driving ranges, faster charging times, and enhanced battery safety. This is critically important for strengthening the European automotive industry and accelerating the build-out of clean energy infrastructure. The technologies and innovations fostered through this program will also lead to the creation of high-value jobs within the EU, potentially positioning Europe as a global hub for advanced materials and clean energy technologies. In the long term, this represents a strategic investment that contributes to both the EU's economic prosperity and its ambitious environmental goals.

Custom Market Insights: Shape Memory Alloys Market to Reach \$39.9 Billion by 2033, Driven by Medical, Aerospace, and Automotive Demand

Published June 19, 2026 Custom Market Insights Global

Shape Memory Alloys Market Size, 2026 – 2033



OVERVIEW

This article provides an overview of a market research report published by Custom Market Insights. The global Shape Memory Alloys (SMA) market is projected to reach \$39.9 billion by 2033 from \$18.4 billion in 2026, growing at a CAGR of 11.7%. This significant growth is primarily driven by increasing demand for high-performance materials in the biomedical, aerospace, and automotive industries. Nitinol, with its excellent biocompatibility, corrosion resistance, and superelasticity, is reported to dominate the medical device sector.

Report Overview

This article presents an executive summary of a market research report by Custom Market Insights on the global Shape Memory Alloys (SMA) market. The report provides a comprehensive analysis of the SMA market for the forecast period from 2026 to 2033, focusing on market size, growth drivers, key segments, and regional trends. It identifies the escalating demand for high-performance materials as the primary catalyst for market growth.

Key Findings

- The global Shape Memory Alloys (SMA) market is projected to grow from an estimated value of \$18.4 billion in 2026 to \$39.9 billion by 2033, expanding at a high Compound Annual Growth Rate (CAGR) of 11.7% during the forecast period.
- This robust market growth is predominantly driven by increasing demand for high-performance materials across several sectors, including biomedical, aerospace, and automotive industries. In these industries, the unique properties of SMAs are essential for enhancing product performance and enabling new functionalities.
- By product type, Nitinol (nickel-titanium alloy) is positioned as the dominant product within the SMA market. Nitinol is widely adopted, particularly in the medical device sector, owing to its superior biocompatibility, high corrosion resistance, and distinctive superelastic properties.
- Nitinol's applications in medical devices are extensive, encompassing cardiovascular stents, orthopedic implants, guidewires, and orthodontic wires, with demand surging alongside the widespread adoption of minimally invasive surgical techniques.

About the Publisher

Custom Market Insights is a global market research firm that provides market intelligence reports and customized insights for various industries. The company assists clients in making strategic business decisions through detailed market analysis and strategic recommendations.

Future Outlook

The Shape Memory Alloys market is anticipated to continue its robust growth, fueled by the exploration of innovative application areas and the maturation of existing technologies. In the medical sector, the aging global population and advancements in minimally invasive medical technologies are expected to further drive demand for Nitinol-based devices. In the aerospace industry, the adoption of SMAs will expand for components requiring lightweight and high reliability, while in the automotive sector, demand will increase for more efficient actuators and smart functional components. Continued R&D investments across these industries and the discovery of new SMA materials will guarantee the market's long-term growth. Furthermore, the integration with composite materials and applications as smart sensors hold potential to unlock new growth avenues for the SMA market in the coming years, signifying a transformative era for advanced functional materials.

Source: <https://www.persistencemarketresearch.com/market-research/shape-memory-alloys-market.asp>

Collected: June 19, 2026 | Automated Research System (Gemini API)

The Insight Partners: Shape Memory Alloys Market to Hit \$29.13 Billion by 2034, Fueled by Medical Device Adoption and Aerospace-Defense Demand

Published June 19, 2026 The Insight Partners Global



OVERVIEW

This article provides an overview of a market research report published by The Insight Partners. The global Shape Memory Alloys (SMA) market is projected to reach \$29.13 billion by 2034 from \$17.09 billion in 2025, growing at a CAGR of 6.89% during the 2026-2034 forecast period. Expanded adoption of SMAs in medical devices, particularly for minimally invasive surgical tools, implants, and stents, is creating significant opportunities. Additionally, demand for lightweight, corrosion-resistant components in the aerospace and defense industries is strongly propelling market growth.

Report Overview

This article provides an executive summary of a market research report by The Insight Partners on the global Shape Memory Alloys (SMA) market. The report offers a comprehensive analysis of the SMA market for the forecast period from 2025 to 2034, delving into market size, growth drivers, key application areas, and regional trends. It highlights the escalating demand for high-performance materials within the medical device and aerospace & defense industries as a primary factor driving market expansion.

Key Findings

- The global Shape Memory Alloys (SMA) market, valued at \$17.09 billion in 2025, is projected to reach \$29.13 billion by 2034, demonstrating stable growth at a Compound Annual Growth Rate (CAGR) of 6.89% during the forecast period from 2026 to 2034.
- One of the most significant drivers of this market growth is the expanding adoption of SMAs in the medical device sector. Due to their unique superelasticity, shape memory effect, and biocompatibility, SMAs have become indispensable materials for the development of innovative medical devices such as minimally invasive surgical tools, vascular stents, orthopedic implants, and orthodontic appliances.
- Demand for SMA-based medical devices is expected to continue increasing, particularly as the need for safer and more effective treatments for cardiovascular diseases (e.g., stents) and cerebral aneurysms (e.g., coils) grows.
- Demand from the aerospace and defense industries also serves as a powerful impetus for market growth. This sector requires components that are lightweight yet possess high strength, fatigue resistance, and corrosion resistance. SMAs are being adopted in actuators, connectors, and dampers as ideal materials that meet these stringent requirements.
- Ongoing investment in research and development across these industries, coupled with the discovery of new SMA materials and application technologies, will ensure the market's long-term growth.

About the Publisher

The Insight Partners is a global market research firm that provides market research reports and business intelligence across a wide range of industry sectors, including technology, healthcare, and manufacturing. They support clients' strategic decision-making through data-driven analysis and insights.

Strategic Significance & Outlook

The Shape Memory Alloys market is anticipated for robust growth, driven by continuous technological innovation and expanding demand in strategically critical sectors like medical, aerospace, and defense. In the medical field, advancements in personalized medicine and the emergence of new surgical systems combining AI and robotics are expected to further broaden the application scope of SMAs. In aerospace, more advanced SMA-based components, such as smart actuators and self-healing structures, may be developed. These technological advancements will lead to improved manufacturing processes, cost reductions, and the opening of new markets. Accelerated R&D investments and breakthroughs in materials science are poised to propel the SMA market into its next phase of growth, meeting the diverse needs of industries seeking sustainable and high-performance solutions. The critical role of SMAs in these sectors ensures their continued strategic importance on a global scale.

Source: <https://www.theinsightpartners.com/reports/shape-memory-alloys-market>

Collected: June 19, 2026 | Automated Research System (Gemini API)

Superscout Reports Over \$10.3 Billion in VC Investment for Advanced Materials Sector Over Last Decade; De-risked Manufacturing and Scale-up Critical for Funding

Published June 19, 2026 Superscout Global



OVERVIEW

This article provides an overview of investment trends in the advanced materials sector reported by Superscout. The sector encompasses the development of new materials enabling breakthroughs across computing, energy, aerospace, healthcare, and manufacturing. Over \$10.3 billion in venture capital has been invested by deep tech VC funds, corporate VCs, government funds, and specialized materials investors over the past decade. The 2025-2026 funding landscape favors companies with de-risked manufacturing processes, strategic partnerships with end customers, and clear pathways to mass production.

Report Overview

This article provides an executive summary of investment trends in the advanced materials sector, as reported by Superscout. The report analyzes historical trends and the current state of venture capital (VC) investment in advanced materials, a particularly noteworthy area within deep tech investment. This sector focuses on developing new materials that drive innovation across a wide range of fields, including next-generation computing, clean energy solutions, advanced aerospace systems, groundbreaking healthcare technologies, and efficient manufacturing processes.

Key Findings

- Over the past decade, the advanced materials sector has attracted over \$10.3 billion in cumulative venture capital from deep tech-focused VC funds, corporate venture capital (CVC) arms of large corporations, government funds, and specialized materials investors. This underscores a growing recognition that materials science innovation is a critical driver of economic growth and technological progress.
- In the current funding environment spanning 2025 to 2026, investors show a clear preference for companies exhibiting specific characteristics. These include:
 - **De-risked Manufacturing Processes:** Investment is concentrated in technologies where the risks of scaling up from laboratory success to mass production are well-managed or have been overcome. This is driven by an emphasis on scalability and cost-efficiency.
 - **Strategic Partnerships with End Customers:** Companies with clear alignments and partnerships with key end customers (e.g., large corporations) from the development phase are attractive to investors due to a demonstrated path to market.
 - **Clear Pathways to Mass Production:** Companies that not only demonstrate technical feasibility but also possess clear market strategies and efficient mass production plans are more successful in securing significant funding.
- These investment criteria aim to accelerate the transition from early-stage R&D to commercialization, thereby shortening the lead time for material innovations to reach market adoption.

About the Publisher

Superscout is a platform that provides investment intelligence and analytics focused on deep tech companies, specializing in areas such as advanced materials, quantum computing, and biotechnology. It offers data-driven insights to help investors identify suitable opportunities and support promising ventures.

Strategic Significance & Outlook

Investment in the advanced materials sector is projected to experience sustained growth. Global megatrends such as climate change mitigation, energy transition, and accelerated digitalization will further amplify the demand for high-performance and sustainable new materials. Advances in AI and computational materials science, which enhance material design efficiency and reduce development risks, also make the sector more appealing to investors. Moreover, strategic government investments and policy support are crucial factors bolstering growth in this sector. Companies that effectively manage risks and possess clear commercialization strategies will continue to secure substantial funding, pushing the frontiers of materials science and bringing breakthroughs to fruition across various industrial sectors. This pivotal role ensures continued global strategic interest and investment in advanced functional materials.

Source: <https://superscout.co/sector/advanced-materials>

Collected: June 19, 2026 | Automated Research System (Gemini API)

USA Rare Earth Secures \$3.5 Billion to Accelerate Domestic 'Mine-to-Magnet' Supply Chain, Targeting 2028 Commercial Production

Published June 18, 2026 The Motley Fool USA



OVERVIEW

USA Rare Earth has secured approximately \$3.5 billion, including federal funding, to aggressively accelerate the establishment of a fully integrated 'mine-to-magnet' rare earth supply chain within the United States. Centered on the development of the Round Top mine in Texas, the company plans to commence commercial production by 2028. This substantial funding is allocated for strategically critical initiatives to enhance high-performance permanent magnet production capabilities, essential for national security and reducing reliance on foreign sources.

IN DEPTH

Key Findings

USA Rare Earth has secured a substantial investment of approximately \$3.5 billion, including federal support, to vigorously advance the establishment of a fully integrated 'mine-to-magnet' rare earth supply chain within the United States. This significant funding accelerates the company's efforts towards achieving critical strategic objectives for national security. The company has positioned its Round Top mine development in Texas as a core operation, announcing plans to commence commercial production of high-performance permanent magnets as early as 2028. This represents a groundbreaking step towards reducing excessive reliance on specific countries within the globally critical rare earth supply network, enabling domestic self-sufficiency.

Technical Details

USA Rare Earth's business strategy involves establishing a vertically integrated supply chain, from rare earth ore extraction to refinement, separation, and the manufacturing of final permanent magnets. The Round Top mine in Texas has been confirmed to contain abundant heavy and light rare earth elements, providing a foundation for comprehensive domestic rare earth production. The refining process is expected to incorporate advanced technologies designed for efficient and high-purity rare earth separation while minimizing environmental impact. The permanent magnets produced will be essential for key modern technologies such as electric vehicle (EV) motors, wind turbines, defense systems, and high-performance electronics. Given China's dominance in the global rare earth market, the establishment of an independent US supply chain is critically important for ensuring technological self-reliance and economic security.

Background & Context

Rare earth elements are indispensable strategic resources for the high-tech and defense industries, with their supply heavily dependent on a few specific countries. This concentration has created geopolitical risks and supply chain vulnerabilities, becoming a major concern for leading global powers. To address this issue, the US government has made significant investments in restoring domestic rare earth production and processing capabilities. This funding for USA Rare Earth is part of that policy, demonstrating the strong commitment of the United States to establish autonomy in critical material supply. This will enable the US to advance the development of clean energy technologies and strengthen defense capabilities on a more stable domestic supply foundation. This move is likely to encourage other nations to build similar domestic supply chains, potentially reshaping the structure of the global rare earth market.

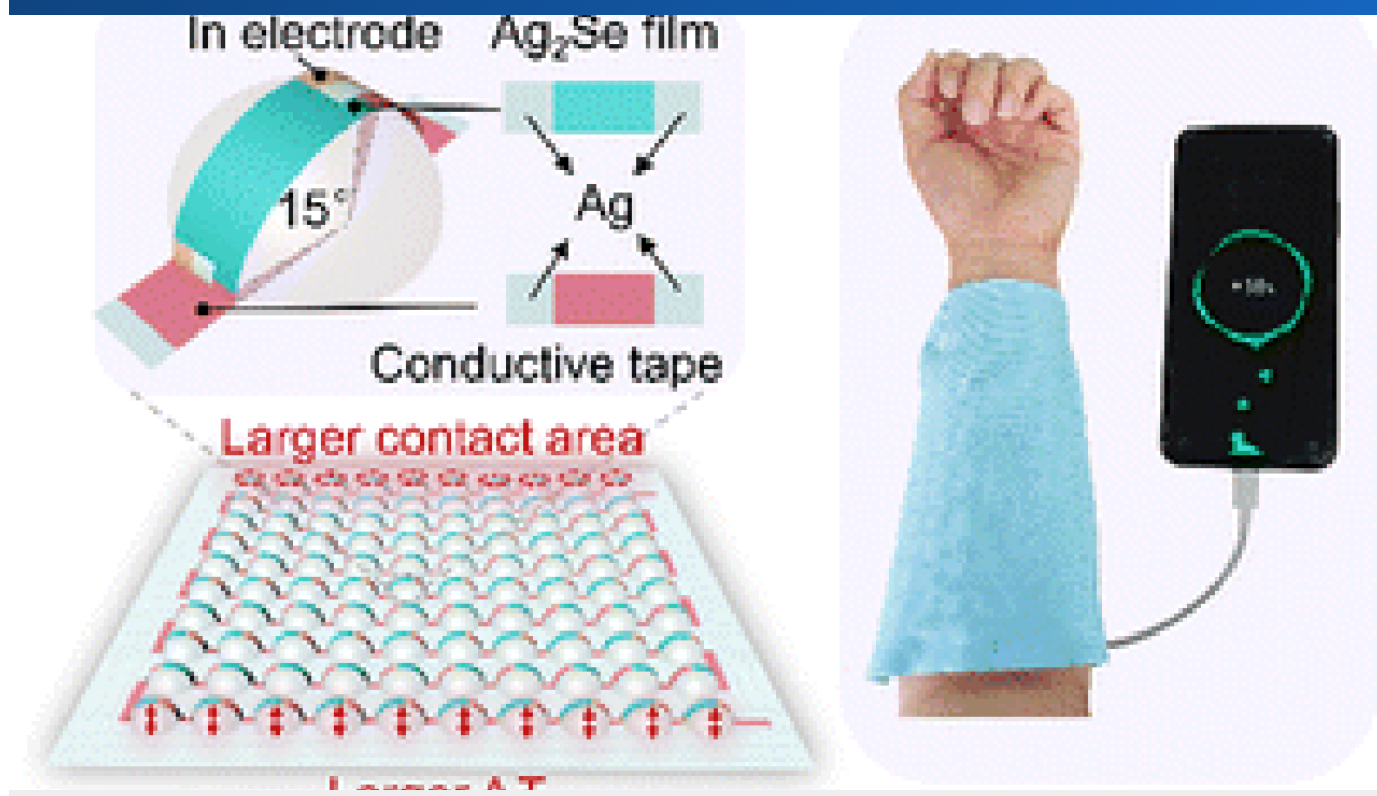
Strategic Significance & Outlook

USA Rare Earth's 'mine-to-magnet' business model is poised to become a new benchmark in the rare earth industry. The planned commencement of commercial production in 2028 will be a critical milestone for the US in restoring its position as a major rare earth supplier. This will allow US manufacturers to procure high-quality rare earth magnets at more stable prices, enhancing the competitiveness of the electric vehicle, renewable energy, and defense industries. Furthermore, domestic mining and processing will be conducted under stricter environmental standards compared to overseas imports, offering significant advantages from a sustainability perspective. This success could further stimulate investment in building domestic supply chains not only for rare earths but also for other strategic mineral resources, potentially reconfiguring the geopolitical balance of material sourcing in the global economy. USA Rare Earth's initiative will be an indispensable factor in strengthening the US industrial base and supporting future technological innovation.

Source: <https://www.fool.com/investing/2026/06/18/usa-rare-earth-now-has-35-billion-to-establish-a/>

Ultra-High-Performance Ag₂Se-Based Flexible Thermoelectric Generator Achieves ZT of 1.15, Paving Way for Wearable Electronics

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OVERVIEW

An ultra-high-performance Ag₂Se-based flexible thermoelectric generator has been developed, significantly advancing its practical application in wearable electronics. This generator achieved a record-high thermoelectric figure of merit (ZT value) of 1.15 at 300K (near room temperature). Demonstrating a remarkable normalized power density of approximately $9.09 \mu\text{W m}^{-1} \text{K}^{-2}$, it can power various portable electronic devices, effectively bridging the gap between laboratory breakthroughs in thermoelectric materials and industrial applications in wearable energy harvesting.

Key Findings

A groundbreaking ultra-high-performance flexible thermoelectric generator based on Ag₂Se has been developed, opening new frontiers for practical application in wearable electronic devices. This innovative generator achieved an astonishing thermoelectric figure of merit (ZT value) of 1.15 at 300K (approximately 27°C), near room temperature. This represents a significant advancement in power conversion efficiency compared to conventional flexible thermoelectric generators. Furthermore, it boasts a record-setting normalized power density of approximately $9.09 \mu\text{W m}^{-1} \text{K}^{-2}$, demonstrating its capability to efficiently convert minute amounts of human body heat or ambient waste heat into electrical energy. This achievement addresses a long-standing challenge in energy harvesting technology: high-efficiency power generation in low-temperature difference environments, holding potential to contribute to the widespread adoption of battery-free wearable devices and IoT sensors.

Technical Details

The flexible thermoelectric generator developed is based on silver selenide (Ag₂Se). Ag₂Se is known for its high thermoelectric performance at relatively low temperatures, but challenges remained in achieving flexibility and high power output. The research team successfully significantly improved the ZT value by precisely controlling the material's microstructure and carrier transport properties. A unique process technology for forming Ag₂Se layers on a flexible substrate enabled the creation of thin-film devices that are resistant to bending and twisting, making them easy to integrate into wearable electronics. This generator can stably supply power even with a temperature difference of just a few Kelvin, utilizing the slight difference between body temperature and ambient temperature in daily life, or minute environmental temperature gradients. Tests have demonstrated its ability to power various portable electronic devices, such as illuminating LED lights, driving watches, and even charging smartphones, underscoring its high practical utility.

Background & Context

In modern society, various portable electronic devices like smartphones, smartwatches, and IoT sensors are prevalent, making battery technology for stable power supply crucial. However, batteries face challenges such as charging frequency, lifespan, environmental impact, and limitations in miniaturization. Thermoelectric generation, which directly converts thermal energy into electrical energy, is gaining attention as a sustainable solution to these battery challenges. Flexible thermoelectric generators, in particular, hold great promise for wearable devices that can be directly attached to clothing or skin. Conventional thermoelectric materials have suffered from low efficiency at small temperature differences, hindering practical application. The Ag₂Se-based generator, however, bridges this gap. This breakthrough accelerates the industrial application of energy harvesting technology, moving closer to realizing 'always-on, anywhere' electronic devices that do not rely on battery power.

Strategic Significance & Outlook

The development of the Ag₂Se-based flexible thermoelectric generator holds the potential to revolutionize wearable electronics, IoT, and medical device fields. Further advancements in this technology could lead to self-powered smartwatches and fitness trackers, eliminating the need for battery replacements or frequent charging. In the medical sector, bio-sensing devices and medical implants could continuously operate by utilizing body heat, enhancing patient convenience and safety. For industrial IoT sensors, it could resolve power wiring issues, facilitating data collection in remote or hazardous environments. Future research will focus on further enhancing Ag₂Se material performance, establishing large-scale production techniques, and integrating multifunctionality (e.g., harvesting energy from multiple heat sources). This thermoelectric generator is expected to play a crucial role in the pursuit of sustainable energy solutions and become an indispensable element in further digitalizing our lives, contributing significantly to a more energy-independent future.

Source: <https://pubs.rsc.org/en/content/articlelanding/2025/ee/d5ee03009a>