Perovskite Solar Cells

Weekly Intelligence Report

2026-08-16 | 29 articles | 9 countries

troy-technical.jp

This Week's Keyword

Perovskite Commercial

Efficiency records meet pilot lines & sales

29	9	35.5	2024
articles	countries	%	year
Total Articles Analyzed	Source Countries/Regions	Record Tandem Efficiency	First Commercial Shipment

All 29 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	LONGi 100MW Pilot Line	Corporate Strategy	●●●●	●●●○	●●●●	●●●●	●●●●	LONGi invests $28M in 100MW Si-perovskite tandem pilot line in China, validating 35.5% NREL record.
#02	JinkoSolar 33.84% Record	Research	●●●●	●●○○	●●●○	●●○○	●●●○	JinkoSolar achieves 33.84% tandem cell record; perovskite-silicon cells surpass 34% lab efficiency.
#03	Yunnan U Inorganic PSCs	Research	●●●●	●○○○	●●○○	●●●●	●●●○	Yunnan University achieves 20.96% efficiency in inorganic PSCs via sulfonamide passivation, boosting stability.
#04	Tandem Hurdles Analysis	Analysis	●○○○	●○○○	●●●○	●●●○	●●●●	Perovskite-silicon tandem modules exceed 34% lab efficiency but face major manufacturing and durability hurdles.
#05	GCL Opto $14M, 30.23%	Corporate Strategy	●●●●	●●●○	●●●●	●●●●	●●●●	GCL Optoelectronics raises $14M, achieves 30.23% for 2042 cm² tandem module and flexible perovskite record.
#06	33.9% Tandem Record	Overview	●●●●	●●○○	●●●○	●●○○	●●●○	Perovskite solar cells hit 33.9% tandem efficiency record, promising low-cost manufacturing for renewables.
#07	Self-Passivation Mech.	Research	●●●●	●○○○	●●●○	●●●●	●●●○	Synergistic self-passivation in perovskites extends carrier lifetime 1000x, enhancing defect tolerance.
#08	Tandem PV Sales Launch	New Product	●●●●	●●●●	●●●●	●●●○	●●●●	US-based Tandem PV launches sales of 4T perovskite-silicon modules this year, targeting 37% by 2030 with 30-year warranty.
#09	KTU Degradation Elim.	Research	●●●●	●●○○	●●●○	●●●○	●●●●	KTU researchers eliminate main cause of PSC degradation, achieving over 29% efficiency in tandem devices.
#10	Blade-Coat 26.60% PSCs	Research	●●●●	●●○○	●●●○	●●●●	●●●○	Researchers blade-coat 26.60% efficient PSCs with thiol molecules, demonstrating 23.31% on 20.9 cm² mini-modules.
#11	LONGi NREL 35.5% Rec.	Research	●●●●	●●○○	●●●●	●●●●	●●●●	LONGi achieves NREL-certified world record 35.5% efficiency with Si-perovskite tandem solar cell.
#12	Thiol Chemistry Durab.	Research	●●●●	●○○○	●●●○	●●●●	●●●○	Thiol chemistry enhances perovskite durability by defect passivation and ion migration suppression.

#	Article Title	Type	Tech Novelty	Market Proximity	Market Impact	Data Reliability	US/EU Relevance	Summary
#13	Perovskite Memristors	Research	●●●●	○○○○	●●○○	●●●●	●●●○	Bifacial interface engineering with CF3–PEAI boosts perovskite memristor performance for neuromorphic systems.
#14	Lead-Free Photodetect.	Research	●●●●	●●○○	●●○○	●●●●	●●●○	FAI-induced defect passivation boosts spray-deposited lead-free Cs3Bi2I9 photodetector performance.
#15	Next-Gen Solar Roadmap	Market Overview	●○○○	●○○○	●●●○	●●○○	●●●○	Perovskite-silicon tandem cells target >37% efficiency; future pipeline includes all-perovskite and quantum dot cells.
#16	Everlight Encapsulation	Corporate Strategy	●●●○	●●●○	●●●○	●●●○	●●●●	Everlight Chemical supports perovskite commercialization with encapsulation materials, manufacturing, and reliability testing.
#17	CAS Scalable Co-Dep.	Research	●●●●	●●○○	●●●○	●●●●	●●●○	CAS develops scalable co-deposition for high-efficiency PSCs (26.60%), boosting long-term stability.
#18	CAS Perovskite-Organic	Research	●●●●	●●○○	●●●●	●●●●	●●●●	CAS team sets 28.04% world record for perovskite-organic tandem cells, showing high stability and R2R compatibility.
#19	US DOE Startup Prize	Corporate Strategy	●●○○	●●●○	●●●●	●●●●	●●●●	U.S. DOE launches $3M Perovskite Startup Prize to accelerate commercialization of tandem/flexible modules for residential market.
#20	Monochrome BIPV Test	Corporate Strategy	●●●○	●●●○	●●○○	●●●○	●●●○	Japanese BIPV manufacturer Monochrome to field-test perovskite PV prototype at 5,000m altitude for durability.
#21	SCAPS-1D Temp Impact	Research	●●○○	●○○○	○○○○	●●●●	●●○○	SCAPS-1D simulation analyzes temperature impact on lead-free CH3NH3SnBr3 PSCs, showing performance decrease due to recombination.
#22	US DOE $71M Funding	Corporate Strategy	●●○○	●●●○	●●●●	●●●●	●●●●	U.S. DOE reallocates $71M congressional funding for perovskite R&D;, focusing on efficiency, reliability, materials.
#23	Nanjing U Meter-Scale	Research	●●●●	●●●○	●●●●	●●●●	●●●●	Nanjing U & Renshine achieve 22% on meter-scale perovskite modules, outperforming silicon in field tests.
#24	CAS 28.04% Perov-Org	Research	●●●●	●●○○	●●●●	●●●●	●●●●	CAS achieves world record 28.04% efficiency in solution-processable perovskite-organic tandem cells, with 90% retention after 625 hours.
#25	LONGi ¥240M Pilot Line	Corporate Strategy	●●●●	●●●○	●●●●	●●●●	●●●●	LONGi invests ¥240M in 100 MW Si-perovskite tandem pilot line, accelerating commercialization after 35.5% efficiency.
#26	DOE/Fraunhofer >33%	Research	●●●●	●●○○	●●●●	●●●○	●●●●	DOE reports small PSC efficiency >26%, tandem near 34%; Fraunhofer ISE achieves >33% on 210mm platform.
#27	Perovskite Connect 2025	Market Overview	●○○○	●●●●	●●●●	●●●○	●●●●	Perovskite Connect 2025 highlights robust industry ecosystem with global players, signaling market maturation.
#28	Oxford PV Commercial	Corporate Strategy	●●●●	●●●●	●●●●	●●●●	●●●●	Oxford PV to detail 2024 commercial shipment and >30% efficiency module roadmap at Perovskite Connect 2026.
#29	Enecoat GREENxEXPO	Corporate Strategy	●●○○	●●●○	●●○○	●●○○	●●○○	Enecoat Technologies to showcase perovskite solar cells in concept exhibition at GREEN×EXPO 2027.

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

Three Questions That Demand Your Decision This Week

❶ Is your PV strategy ready for 35%+ efficiency?

LONGi (35.5%), JinkoSolar (33.84%), Tandem PV (37% target), and Oxford PV (>30% roadmap) are pushing efficiency limits. How will this impact your product roadmap and market positioning against these leaders?

❷ Are you exposed to Asian dominance in perovskite mfg?

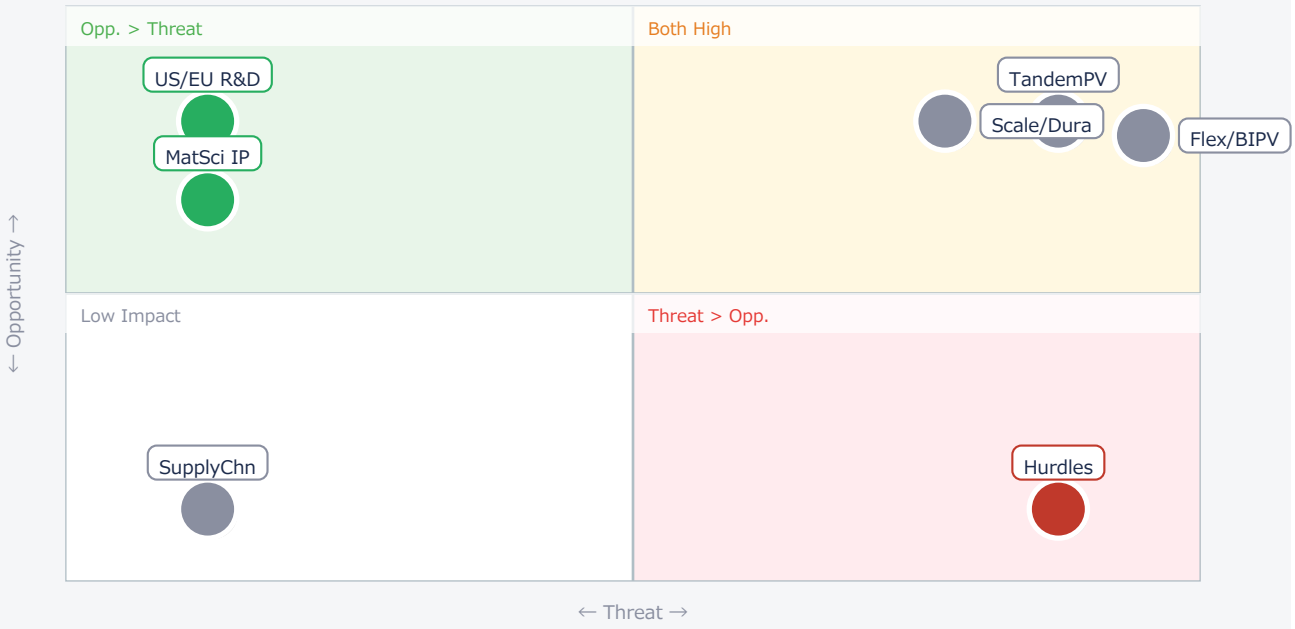
China's LONGi, GCL, CAS, and Nanjing University are investing heavily in pilot lines, large-area modules, and roll-to-roll production. What is your strategy for domestic sourcing or IP licensing to compete?

❸ Have you assessed perovskite's potential beyond traditional PV?

Flexible modules for BIPV/EVs (GCL, Monochrome, Enecoat) and neuromorphic computing (memristors, #13) are emerging. Where are your new market opportunities and how will you capture them?

Opportunities vs. Threats for US/European Companies

Opportunity vs. Threat Matrix for US/European Companies



Item	Quadrant	↑ Opportunity	↓ Threat
TandemPV	Critical	High-eff products	Asian market lead
Scale/Dura	Critical	Mass mfg methods	Tech gap widens
Flex/BIPV	Critical	New market entry	China/Japan lead
US/EU R&D;	Opp.	Domestic growth	Global lag risk
MatSci IP	Opp.	Licensing deals	Foundational gap
Hurdles	Threat	R&D; focus	Tech immaturity
SupplyChn	Ref.	Partnering	Material access

Deep Dive ① — Oxford PV's Commercial Launch & Roadmap

#28 | 2026/08/06 | Perovskite-Info | Tech Novelty●●●●○ Proximity●●●●● Market Impact●●●●● Data Reliability●●●●○ US/EU Relevance●●●●●

Oxford PV shipped the world's first commercial perovskite-silicon tandem modules in 2024, a major milestone. They plan to detail their roadmap for modules exceeding 30% efficiency at Perovskite Connect 2026, signaling a rapid transition from lab to market.

This achievement validates perovskite technology's reliability and manufacturability at scale. Their roadmap for >30% efficiency promises revolutionary increases in power output per area, enhancing competitiveness in high-value and space-constrained markets.

▶ Strategic Analyst's Perspective

Strategic Analyst's Perspective: Published numbers are realistic given NREL/ESTI certifications for similar lab cells. The key technical barrier remaining is long-term outdoor stability under diverse conditions, which their 2024 shipment and 30%+ roadmap imply significant progress on. [Opportunity]: US/EU OEMs can license Oxford PV's IP or partner to integrate these high-efficiency cells, gaining a competitive edge. Materials suppliers can develop advanced encapsulation solutions. [Threat]: Asian competitors are also rapidly scaling. US/EU firms risk falling behind in module efficiency and commercial deployment if they don't act quickly. Next Actions: [Strategy] Evaluate partnership/licensing opportunities with Oxford PV by Q4 2026. [R&D;] Benchmark current module efficiency targets against Oxford PV's roadmap. [Procurement] Assess long-term supply chain implications of tandem module adoption.

Deep Dive ② — Tandem PV's Aggressive Market Entry

#08 | 2026/08/14 | PV Magazine | Tech Novelty●●●●○ Proximity●●●●○ Market Impact●●●●● Data Reliability●●●○○ US/EU Relevance●●●●●

US-based Tandem PV will launch revenue-generating sales of its 4T perovskite-silicon modules this year, having secured nearly $1B in LOIs. They target 37% efficiency by 2030 with an industry-leading 30-year warranty.

The 4T architecture, depositing perovskite on top glass, allows independent silicon cell function, simplifying integration. A 30-year warranty with <1% annual degradation implies significant breakthroughs in stability, crucial for widespread adoption and gigawatt-scale manufacturing by 2028.

▶ Strategic Analyst's Perspective

Strategic Analyst's Perspective: The 37% efficiency target is ambitious but plausible given rapid progress; the 30-year warranty is a strong market signal but needs long-term field validation. Technical barriers include scaling the 4T architecture to GW production with high yield and ensuring stated degradation rates hold in real-world conditions. [Opportunity]: US/EU OEMs can evaluate Tandem PV's modules for integration into their product lines, especially for high-performance applications. IP holders can explore cross-licensing opportunities. [Threat]: If Tandem PV succeeds, it sets a new benchmark for efficiency and warranty, potentially making existing high-end silicon panels less competitive. Asian competitors may quickly replicate or surpass this. Next Actions: [Business Dev] Initiate discussions with Tandem PV for early access to samples and performance data by Q4 2026. [R&D;] Analyze the 4T architecture for potential integration into existing manufacturing lines. [Legal/IP] Review Tandem PV's patent portfolio for competitive intelligence.

Deep Dive ③ — Meter-Scale Perovskite Outperforms Silicon

#23 | 2026/08/13 | Pandaily | Tech Novelty●●●●○ Proximity●●●○○ Market Impact●●●●○ Data Reliability●●●●● US/EU Relevance●●●●○

Nanjing University and Renshine achieved 22% certified efficiency on meter-scale perovskite modules, published in Nature. These modules passed IEC reliability tests and outperformed silicon by 3.42-5.81% monthly in field tests.

This breakthrough uses a novel solvent formulation and vacuum-assisted crystallization, significantly improving uniformity, quality, and stability under humidity, heat, and light. The field test outperformance, especially in low-light, demonstrates practical viability.

▶ Strategic Analyst's Perspective

Strategic Analyst's Perspective: The 22% efficiency on meter-scale modules is a realistic and significant achievement, especially with IEC certification and field test data. The key technical barrier is further scaling to gigawatt production while maintaining cost-effectiveness and long-term stability beyond the initial field test period. [Opportunity]: US/EU OEMs can explore licensing or joint development with Chinese partners for large-area, stable perovskite module technology. Procurement can identify new material suppliers from this research. [Threat]: Chinese research is demonstrating clear leadership in scaling perovskite technology to practical module sizes and proving real-world performance advantages over silicon. US/EU firms risk losing market share in next-gen PV. Next Actions: [R&D;] Investigate novel solvent formulations and vacuum-assisted crystallization techniques for internal perovskite development by Q1 2027. [Strategy] Assess the competitive threat of Chinese meter-scale perovskite modules in key markets. [Procurement] Identify potential new material suppliers emerging from this research.

Other Notable Articles

LONGi Achieves NREL-Certified World Record 35.5% Efficiency (Facebook (LONGi Solar))
Tech Novelty●●●●○ Proximity●●○○○ Market Impact●●●●○

LONGi's NREL-certified 35.5% efficiency confirms global leadership in tandem cell performance, setting a new benchmark.

Everlight Chemical Supports Perovskite Commercialization with Encapsulation Materials and Expertise (Perovskite-Info)
Tech Novelty●●●○○ Proximity●●●○○ Market Impact●●●○○

Materials suppliers like Everlight are crucial for addressing perovskite's stability issues, enabling commercialization through advanced encapsulation.

Chinese Academy of Sciences Team Sets New World Record with 28.04% Certified Efficiency for Perovskite-Organic Tandem Solar Cells (Pandaily.com)
Tech Novelty●●●●○ Proximity●●○○○ Market Impact●●●●○

This record for flexible, roll-to-roll compatible perovskite-organic cells highlights potential for new applications and low-cost manufacturing.

Synergistic Self-Passivation Mechanism in Perovskites Dramatically Extends Carrier Lifetime by Three Orders of Magnitude (ACS Publications)
Tech Novelty●●●●● Proximity●○○○○ Market Impact●●●○○

Fundamental discovery of intrinsic self-healing in perovskites offers new pathways for designing inherently more stable and efficient devices.

DOE Reports Small Perovskite Solar Cell Efficiency Exceeds 26%, Tandem Near 34% in 2026; Fraunhofer ISE Achieves Over 33% on 210mm-Compatible Platform (Market.us)

Tech Novelty●●●●○ Proximity●●○○○ Market Impact●●●●○

US DOE and German Fraunhofer ISE advancements on industrial-scale platforms signal strong Western R&D; in high-efficiency perovskites.

Recommended Actions This Week

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

Immediate (this week)

- [Executive] Review competitive landscape for perovskite tandem PV, especially Chinese and US players, to identify immediate threats/opportunities.
- [R&D;] Initiate internal benchmarking of current perovskite efficiency and stability targets against new world records (35.5%, 30.23% module, 28.04% flexible).

Short-term (1 month)

- [Strategy] Assess the impact of Oxford PV's commercial shipment and Tandem PV's sales launch on existing product roadmaps and market share projections.
- [Procurement] Begin scouting for advanced encapsulation materials and scalable manufacturing equipment suppliers to address perovskite durability and production challenges.
- [Business Dev] Explore potential partnerships or licensing opportunities with US/EU perovskite innovators (e.g., Tandem PV, Oxford PV) to accelerate market entry.

Medium-long term (quarter+)

- [R&D;] Invest in fundamental research on defect passivation and ion migration suppression, leveraging insights from academic breakthroughs, to enhance long-term device stability.
- [Strategy] Develop a comprehensive strategy for flexible and BIPV perovskite applications, considering emerging Asian leadership in these niche markets.
- [Legal/IP] Conduct a thorough IP landscape analysis of perovskite technology, focusing on tandem architectures, scalable manufacturing, and stability solutions, to protect and expand market position.

PerovskiteSolarCells — Selected Articles

Date: 2026-08-16

Articles: 29

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#21 Chinese Academy of Sciences Team Sets New World Record with 28.04% Certified Efficiency for Perovskite-Organic Tandem Solar Cells, Demonstrates High Stability and Roll-to-Roll Compatibility

#22 U.S. DOE Launches $3M Perovskite Startup Prize to Accelerate Commercialization of High-Efficiency Tandem and Flexible Modules for Residential Market

#23 Japanese BIPV Manufacturer Monochrome to Field-Test Perovskite PV Prototype at Over 5,000m Altitude to Assess Performance and Durability

#24 SCAPS-1D Simulation Analyzes Temperature Impact on Lead-Free CH3NH3SnBr3 Perovskite Solar Cells, Highlighting Performance Decrease Due to Increased Recombination

#25 U.S. DOE Strategically Reallocates $71M in Congressional Perovskite Funding to Drive Efficiency, Reliability, and Material Development

#26 Nanjing University & Renshine Achieve 22% Certified Efficiency on Meter-Scale Perovskite Modules, Demonstrating Up to 5.81% Monthly Power Gain Over Silicon in Field Tests, Published in Nature

#27 Chinese Academy of Sciences Achieves World Record 28.04% Efficiency in Solution-Processable Perovskite-Organic Tandem Solar Cells, Demonstrating 90% Retention After 625 Hours

#28 LONGi Invests ¥240 Million in 100 MW Silicon-Perovskite Tandem Solar Cell Pilot Line, Accelerating Commercialization After Achieving 35.5% Efficiency

#30 DOE Reports Small Perovskite Solar Cell Efficiency Exceeds 26%, Tandem Near 34% in 2026; Fraunhofer ISE Achieves Over 33% on 210mm-Compatible Platform

#31 Perovskite Connect 2025 Illuminates Robust Industry Ecosystem with Key Global Players

#32 Oxford PV to Detail 2024 World-First Commercial Shipment and >30% Efficiency Module Roadmap at Perovskite Connect 2026

#33 Enecoat Technologies to Showcase Perovskite Solar Cells in Concept Exhibition at GREEN×EXPO 2027

#01 LONGi Commits $28M to 100MW Silicon-Perovskite Tandem Pilot Line in China, Validating 35.5% World Record Efficiency

Published August 12, 2026 Perovskite-Info China

OVERVIEW

LONGi Green Energy is investing 204 million yuan ($28 million) to establish a 100 MW pilot production line for high-efficiency silicon-perovskite tandem solar cells in Xixian New Area, Shaanxi Province, China. This initiative will leverage LONGi's recently certified world record of 35.5% conversion efficiency for two-terminal silicon-perovskite tandem cells, moving the technology from laboratory achievement to pilot-scale manufacturing. The project signifies a critical step towards commercializing advanced perovskite technology, aiming to accelerate its market deployment and enhance renewable energy capabilities.

IN DEPTH

Key Findings

LONGi Green Energy has announced a significant investment of 204 million yuan (approximately $28 million USD) to construct a 100 MW pilot production line for high-efficiency silicon-perovskite tandem solar cells in Xixian New Area, Shaanxi Province, China. This strategic move aims to translate LONGi's recently certified world record of 35.5% power conversion efficiency for two-terminal silicon-perovskite tandem cells, verified by the U.S. National Renewable Energy Laboratory (NREL), into a viable commercial manufacturing process.

Technical and Manufacturing Details

- The pilot line will integrate advanced equipment for perovskite thin-film deposition and rapid crystallization within existing factory infrastructure. This approach is designed to optimize the manufacturing process for large-scale application while maintaining high efficiency.
- Perovskite-silicon tandem cells represent a next-generation solar technology where a perovskite layer is stacked atop a conventional silicon cell. This configuration enables the capture of a broader spectrum of sunlight, pushing combined efficiencies significantly beyond the theoretical limits of single-junction silicon cells.
- LONGi has a history of setting efficiency benchmarks, including 26.81% for silicon heterojunction cells and 33.5% certified by ESTI for tandem cells, underscoring its robust R&D capabilities.

Background and Context

The global solar industry is in a continuous pursuit of higher efficiency and lower manufacturing costs. Perovskite solar cell technology has emerged as a frontrunner due to its exceptional power conversion efficiency potential and solution-processable manufacturing advantages. The tandem configuration with silicon is particularly attractive as it allows for an incremental upgrade to existing silicon PV infrastructure, offering a practical pathway to enhanced performance without necessitating a complete overhaul of established manufacturing processes. This commercialization push by a major player like LONGi indicates a maturing of the technology from research to industrial readiness.

Strategic Significance and Outlook

The establishment of this 100 MW pilot line is a strong indicator of LONGi's commitment to leading the next wave of solar energy innovation. By successfully scaling up production, the company aims to reduce the levelized cost of electricity (LCOE) and make high-efficiency solar modules more accessible. This development will not only solidify China's position in advanced solar manufacturing but also contribute significantly to global renewable energy targets by introducing more efficient and potentially cost-effective solar solutions. Successful deployment of such a line could pave the way for gigawatt-scale production, fundamentally altering the competitive landscape of the solar PV market.

Source: https://www.perovskite-info.com/longi-build-100-mw-silicon-perovskite-tandem-pilot-production-line-shaanxi

Collected: August 14, 2026 | Automated Research System (Gemini API)

#03 JinkoSolar Achieves 33.84% Tandem Solar Cell World Record as Perovskite-Silicon Cells Surpass 34% Lab Efficiency

Published August 11, 2026 Facebook International

OVERVIEW

Perovskite-silicon tandem solar cells are rapidly advancing, with multiple breakthroughs pushing laboratory efficiencies beyond 34%. JinkoSolar has announced a new world record, achieving 33.84% conversion efficiency for its tandem solar cells. These innovative cells leverage a perovskite layer atop silicon to capture a broader light spectrum, dramatically increasing combined efficiency over conventional silicon panels. A Swiss team also reported silicon-based cells exceeding 30% efficiency, underscoring the swift progress in this transformative technology.

IN DEPTH

Key Findings

The field of perovskite-silicon tandem solar cells is experiencing unprecedented progress, with laboratory efficiencies consistently surpassing the 34% mark. Leading solar manufacturer JinkoSolar recently announced a new world record, achieving 33.84% power conversion efficiency for its tandem solar cell. Concurrently, a Swiss research team reported silicon-based cells exceeding 30% efficiency, highlighting the intense and successful research efforts in this critical next-generation photovoltaic technology.

Technical and Clinical Details

- Perovskite-silicon tandem cells work by layering a perovskite thin film on top of a traditional silicon solar cell. The perovskite layer efficiently absorbs the blue and green parts of the solar spectrum, while the underlying silicon cell captures the red and infrared light. This complementary absorption allows for a more comprehensive utilization of the solar spectrum, significantly boosting the overall conversion efficiency beyond the single-junction theoretical limits of silicon.
- JinkoSolar's 33.84% record, while a laboratory achievement, reflects sophisticated material engineering and interface optimization. Achieving such high efficiencies typically involves precise control over perovskite film quality, effective defect passivation, and optimized charge extraction layers.
- The Swiss team's achievement of over 30% efficiency further validates the potential of this tandem architecture. These records are often achieved under standard test conditions (STC) using small-area research cells, and the challenge lies in translating these efficiencies to larger modules with long-term stability.

Background and Context

Conventional silicon solar cells are approaching their theoretical efficiency limit of around 26-27%. Perovskite-silicon tandem technology offers a compelling pathway to surpass this barrier, with theoretical efficiencies potentially exceeding 35%. This dramatic increase in efficiency per unit area is crucial for reducing the levelized cost of electricity (LCOE), making solar power more competitive, especially in regions with high land costs or limited space for installation. The rapid succession of efficiency records indicates a maturing technology poised for commercialization.

Strategic Significance and Outlook

The continuous breaking of efficiency records by industry leaders like JinkoSolar and prominent research institutions underscores the immense potential and rapid development of perovskite-silicon tandem solar cells. The next phase will focus on scaling these laboratory efficiencies to large-area modules, ensuring long-term stability and reliability under real-world operating conditions, and reducing manufacturing costs for mass production. Successful commercialization of this technology would represent a significant leap forward for the renewable energy sector, accelerating the global transition to clean energy and potentially reshaping the solar PV market landscape.

Source: https://www.facebook.com/groups/1008908201222470/posts/1273709794742308/

Collected: August 14, 2026 | Automated Research System (Gemini API)

#04 Yunnan University Team Achieves Record 20.96% Efficiency in Inorganic Perovskite Solar Cells via Sulfonamide Surface Passivation

Published August 12, 2026 Perovskite-Info China

OVERVIEW

A research team at Yunnan University has achieved a record 20.96% power conversion efficiency (PCE) for a CsPbI3-xBrx inorganic perovskite solar cell (IPSC) by employing a novel sulfonamide-based surface passivation molecule, 4-aminomethylbenzenesulfonamide (4-AMBSA). This efficiency is the highest reported for SnO2-based IPSCs. Unencapsulated devices demonstrated robust long-term stability, retaining over 93% of their initial efficiency after 1100 hours under a nitrogen atmosphere, attributed to significant reductions in defect density and suppression of ion migration.

IN DEPTH

Key Findings

Researchers at Yunnan University have made a significant leap in inorganic perovskite solar cell (IPSC) technology, achieving a remarkable 20.96% power conversion efficiency (PCE) for a CsPbI3-xBrx-based device. This new benchmark was realized through the implementation of a novel sulfonamide-based surface passivation molecule, 4-aminomethylbenzenesulfonamide (4-AMBSA). Notably, this efficiency represents the highest reported value for IPSCs utilizing a SnO2 electron transport layer, pushing the boundaries of what is achievable with this material system.

Technical and Experimental Details

- The core of this breakthrough lies in the targeted defect passivation enabled by 4-AMBSA. The molecule effectively interacts with undercoordinated lead ions and other defects present at the perovskite film's surface and grain boundaries, which are common culprits for non-radiative recombination and device degradation.
- By introducing 4-AMBSA, the team successfully reduced the defect density within the perovskite layer and suppressed undesirable ion migration. This dual action leads to improved charge carrier extraction and transport, contributing directly to the higher PCE.
- Beyond efficiency, the strategy demonstrated exceptional stability. Unencapsulated devices maintained over 93% of their initial efficiency after 1100 hours of continuous operation under a nitrogen atmosphere. This level of stability is crucial for practical applications, as inorganic perovskites are often sought for their enhanced thermal resilience compared to their organic-inorganic hybrid counterparts.
- The use of SnO2 as an electron transport layer is advantageous due to its high electron mobility, excellent transparency, and low-temperature processability, making it suitable for scalable manufacturing.

Background and Context

Inorganic perovskite solar cells are garnering increasing attention for their intrinsic thermal stability, making them ideal for high-temperature operating environments. However, achieving high efficiencies comparable to hybrid perovskites while maintaining structural stability, particularly for CsPbI3-based systems, has been a persistent challenge. Previous efforts often struggled with balancing high PCE with long-term operational robustness. This research addresses these critical limitations by providing an effective chemical route to enhance both performance and durability simultaneously.

Strategic Significance and Outlook

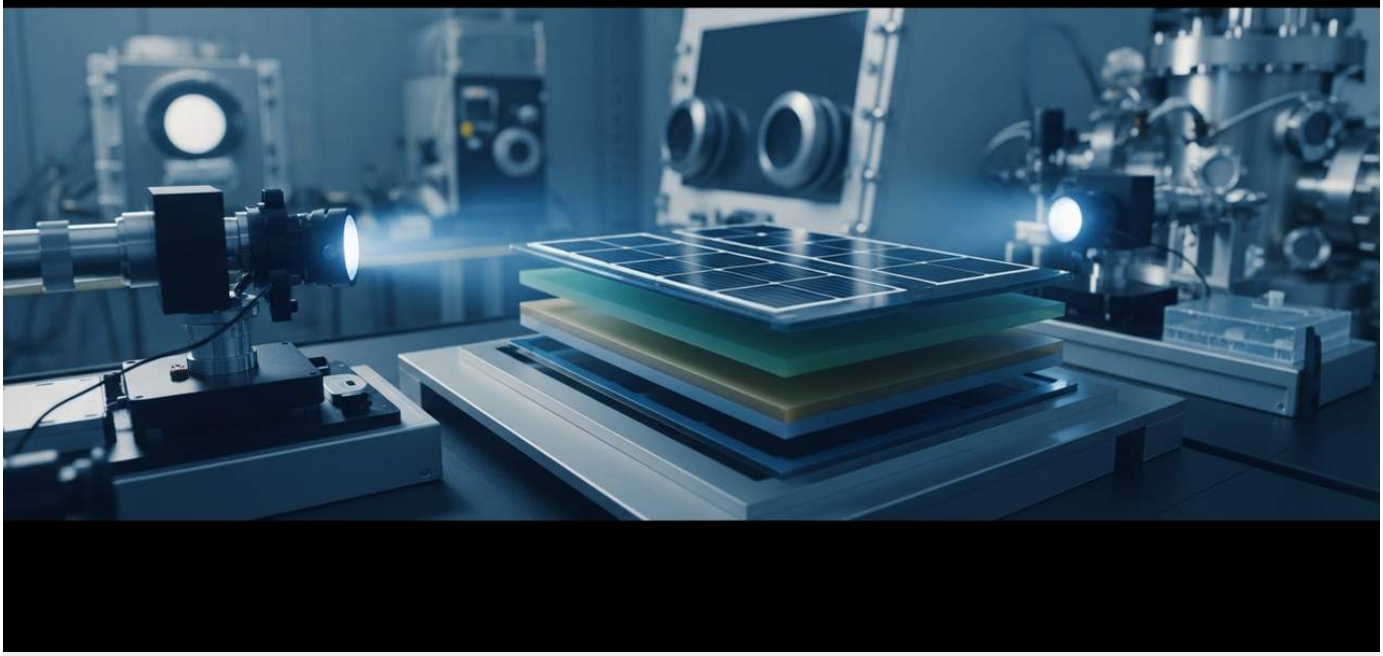
This achievement by the Yunnan University team marks a significant milestone in the development of inorganic perovskite solar cells. The record-breaking efficiency for SnO2-based IPSCs, coupled with impressive long-term stability, opens new avenues for the commercialization of this technology. Future work will likely focus on scaling this passivation strategy to larger area devices and evaluating its performance under more rigorous outdoor conditions. The success in enhancing the reliability and efficiency of inorganic PSCs moves the industry closer to deploying perovskite technology in a wider array of solar energy applications, especially in challenging environments where robust thermal performance is paramount.

Source: https://www.perovskite-info.com/researchers-reach-2096-efficiency-inorganic-perovskite-solar-cells-using

Collected: August 14, 2026 | Automated Research System (Gemini API)

#05 Perovskite-Silicon Tandem Modules: Lab Efficiencies Exceed 34%, But Face Major Manufacturing and Durability Hurdles for Commercialization

Published August 06, 2026 Rayzon Solar International



OVERVIEW

Perovskite-silicon tandem solar modules show immense promise with laboratory efficiencies surpassing 34%, yet their commercial success hinges on overcoming significant challenges in long-term stability, manufacturability, and gigawatt-scale scalability. Perovskite materials degrade faster than silicon when exposed to environmental stressors, necessitating advanced encapsulation techniques. Key engineering hurdles include achieving uniform coating, precise layer deposition, and high manufacturing yields at industrial volumes, which companies must address for widespread deployment.

IN DEPTH

Key Findings

Perovskite-silicon tandem solar modules have demonstrated remarkable potential, achieving power conversion efficiencies exceeding 34% in laboratory settings. This breakthrough positions them as a leading candidate for next-generation photovoltaics. However, the path to commercial success is fraught with significant challenges, primarily concerning long-term stability, manufacturing feasibility, and scalability to gigawatt (GW) production levels. The inherent instability of perovskite materials in environmental exposure, which leads to faster degradation compared to silicon, demands the urgent development of highly robust encapsulation strategies.

Technical and Manufacturing Details

- **Durability:** Perovskite compounds are highly susceptible to degradation from moisture, oxygen, heat, and UV light. This susceptibility means that achieving a standard solar module lifespan of 25 years or more requires innovative material formulations and advanced encapsulation techniques that effectively isolate the perovskite layers from the external environment. Current research focuses on more stable perovskite compositions, multi-layer encapsulation, and high-performance barrier films.
- **Manufacturability:** Translating high laboratory efficiencies to industrial-scale production requires transitioning from small-scale research methods like spin coating to large-area, high-throughput techniques such as blade coating, slot-die coating, or vacuum deposition. Maintaining uniform film quality, precise layer thickness, and defect-free crystal structures across large module areas at high speeds is a substantial engineering challenge. Achieving high yields for complex multi-layer tandem structures is also significantly more difficult than for single-junction silicon cells.
- **Scalability:** Gigawatt-scale production necessitates a reliable supply chain for raw materials, highly efficient and automated manufacturing equipment, and robust quality control systems. Current module yields for high-efficiency tandem cells are typically lower than mature silicon technologies, requiring significant process optimization to improve production economics.

Background and Context

The global demand for solar energy is continuously growing, driving the need for more efficient and cost-effective technologies. Perovskite-silicon tandem cells are seen as the most promising technology to break through the theoretical efficiency limits of single-junction silicon cells (around 26-27%). However, there is a well-known "valley of death" between laboratory discovery and commercial deployment, where many promising technologies fail. Significant R&D and investment are being channeled into bridging this gap for perovskites.

Strategic Significance and Outlook

Overcoming these challenges is paramount for perovskite-silicon tandem modules to secure a dominant position in the photovoltaic market. Governments and private entities globally are investing heavily to accelerate advancements in materials science, process engineering, and device architecture. As improvements in durability, manufacturing cost reduction, and large-scale production techniques mature, perovskite tandem modules are expected to play a crucial role in the future global energy mix, offering superior performance and potentially lower overall system costs.

Source: https://rayzonsolar.com/blog/perovskite-tandem-modules-breakthrough-or-manufacturing-challenge

Collected: August 14, 2026 | Automated Research System (Gemini API)

#06 GCL Optoelectronics Raises Over $14M, Achieves 30.23% Efficiency for 2042 cm² Tandem Module and World Record for Flexible Perovskite Modules

Published August 07, 2026 Perovskite-Info China

OVERVIEW

GCL Optoelectronics secured over US$14 million in D1 financing and announced multiple certified efficiency records for its perovskite solar cell modules. A large-area 2042 cm² perovskite-crystalline silicon tandem module achieved 30.23% efficiency, certified by the National Institute of Metrology of China. Furthermore, the company set a new world record for flexible perovskite module efficiency, achieving 27.11% for a 625 cm² flexible tandem module, verified by TÜV SÜD, alongside 21.79% for a 900 cm² flexible single-junction module. These milestones solidify GCL's leadership in commercializing high-performance perovskite technology across various applications.

IN DEPTH

Key Findings

GCL Optoelectronics has successfully completed its D1 financing round, securing over US$14 million, while simultaneously announcing several groundbreaking efficiency records for its perovskite solar cell modules. Most notably, a large-area perovskite-crystalline silicon tandem module, measuring 2042 cm^2, achieved a certified power conversion efficiency of 30.23% by the National Institute of Metrology of China (NIM). In addition, the company established a new world record for flexible perovskite module efficiency, attaining 27.11% for a 625 cm^2 flexible tandem module, certified by TÜV SÜD. A 900 cm^2 flexible single-junction module also reached an efficiency of 21.79%.

Technical and Manufacturing Details

- **Large-Area Tandem Modules:** The 30.23% efficiency for a 2042 cm^2 module is a critical achievement, demonstrating the ability to scale high laboratory efficiencies to commercially relevant module sizes. This success indicates GCL's mastery over precise perovskite layer deposition on silicon substrates and ensuring uniformity across large areas.
- **Flexible Perovskite Modules:** The world record of 27.11% for a 625 cm^2 flexible tandem module underscores the potential of perovskite technology for applications requiring lightweight and conformable solar solutions, such as Building-Integrated Photovoltaics (BIPV), portable electronics, and electric vehicles. The balance of flexibility with high efficiency marks a significant technological advancement.
- **Third-Party Certification:** Validation by esteemed institutions like NIM and TÜV SÜD provides crucial credibility to these efficiency claims, reassuring investors and potential customers about the reliability and performance of GCL's technology. These certifications are vital for market acceptance and commercial deployment.

Background and Context

Perovskite solar cells are widely regarded as the most promising next-generation photovoltaic technology, capable of exceeding the theoretical efficiency limits of conventional silicon solar cells. GCL Optoelectronics' achievements in scaling up production and developing flexible formats highlight the industry's rapid transition from research and development to commercialization. China has strategically prioritized the development of renewable energy technologies, with perovskites being a key focus area. This funding and the new efficiency records firmly establish GCL Optoelectronics as a leader in this highly competitive field.

Strategic Significance and Outlook

The successful D1 financing round, combined with these unprecedented efficiency records, provides GCL Optoelectronics with significant momentum for mass production and market entry of its perovskite solar cells. The ability to offer both high-efficiency, large-area tandem modules and record-breaking flexible modules positions the company to address a diverse range of market needs. As these technologies move towards widespread adoption, they are expected to dramatically improve the cost-effectiveness and applicability of solar power, making substantial contributions to the global renewable energy transition.

Source: https://www.perovskite-info.com/gcl-optoelectronics-raises-over-us14-million-d1-financing-round-certifies-3023

#07 Perovskite Solar Cells Achieve 33.9% Tandem Efficiency Record, Offering Low-Cost Manufacturing to Accelerate Renewable Energy Adoption

Published August 13, 2026 Bajaj Finserv India

OVERVIEW

Perovskite solar cells have set a world record of 33.9% conversion efficiency in tandem configurations, boasting advantages like low-cost solution-processing manufacturing and tunable bandgaps. As the fastest-improving solar technology, with single-junction efficiencies up to 26.1%, its widespread adoption hinges on enhancing durability, scalability, and commercial viability. This advancement is particularly crucial for countries like India with ambitious renewable energy targets, promising to accelerate global clean energy transitions.

IN DEPTH

Key Findings

Perovskite solar cells are rapidly emerging as a transformative technology in the renewable energy sector, having achieved a record-breaking 33.9% conversion efficiency in tandem configurations (perovskite-on-silicon). This remarkable efficiency is complemented by other significant advantages, including the potential for low-cost solution-processing manufacturing and the ability to tune their bandgap. Demonstrating efficiencies of up to 26.1% in single-junction form, perovskite technology stands as the fastest-improving solar cell technology to date, poised to revolutionize photovoltaic applications.

Technical and Manufacturing Details

- **High Efficiency:** The superior efficiency of perovskite solar cells stems from their excellent light-absorbing properties across a broad spectrum. In a tandem configuration, a perovskite layer is optimally designed to capture higher-energy photons, while the underlying silicon cell absorbs lower-energy photons. This synergistic approach allows the combined cell to exceed the theoretical efficiency limits of single-junction silicon cells, leading to the 33.9% world record.
- **Low-Cost Manufacturing:** A key economic advantage of perovskites is their compatibility with solution-based manufacturing techniques, such as printing and coating. These processes are inherently less energy-intensive and potentially much cheaper than the high-temperature, vacuum-based methods required for crystalline silicon, offering a pathway to significantly reduced production costs and enhanced scalability.
- **Tunable Bandgap:** The composition of perovskite materials can be precisely engineered to adjust their bandgap, meaning researchers can tailor them to absorb specific wavelengths of light. This tunability is critical for optimizing performance in tandem configurations and for developing specialized solar cells for niche applications, providing design flexibility unmatched by many other photovoltaic materials.

Background and Context

As the world grapples with increasing energy demands and the urgent need to combat climate change, solar energy remains a cornerstone of the global renewable energy strategy. Perovskite solar cells offer an innovative solution to push beyond the current limitations of conventional photovoltaics, promising to enhance both the cost-effectiveness and deployment flexibility of solar power. The rapid pace of development in perovskite technology is particularly vital for nations like India, which has ambitious renewable energy targets and a large, growing energy appetite, seeking sustainable and affordable power generation solutions.

Strategic Significance and Outlook

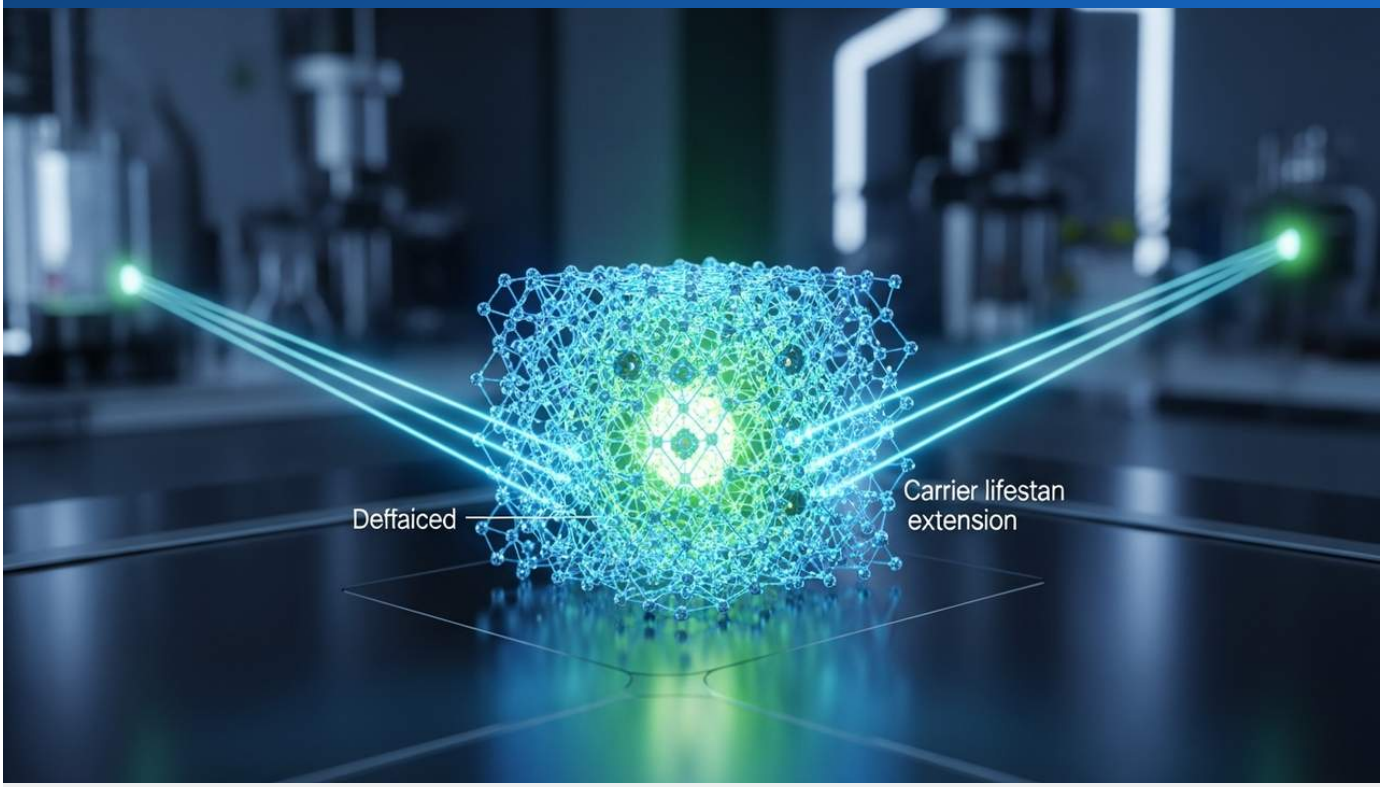
The future widespread adoption of perovskite solar cells critically depends on continued advancements in durability, manufacturing scalability, and overall commercial viability. Current research and industrial efforts are intensely focused on these areas, with a particular emphasis on ensuring long-term stability under diverse environmental conditions and establishing reliable, high-throughput manufacturing processes. Should these challenges be successfully addressed, perovskite solar cells are expected to become an indispensable technology for achieving global renewable energy goals, playing a central role in the energy transition, especially in rapidly developing economies.

Source: https://www.bajajfinserv.in/what-are-perovskite-solar-cell

Collected: August 14, 2026 | Automated Research System (Gemini API)

#08 Synergistic Self-Passivation Mechanism in Perovskites Dramatically Extends Carrier Lifetime by Three Orders of Magnitude, Enhancing Defect Tolerance

Published Published August 11, 2026 ACS Publications International研究



OVERVIEW

Groundbreaking research reveals that defect coupling within perovskite materials can induce favorable structural and electronic reconstructions, leading to an intrinsic self-passivation mechanism. This synergistic process effectively neutralizes deep traps and suppresses detrimental ion migration, dramatically extending charge carrier lifetimes by an unprecedented three orders of magnitude (1000-fold). These findings offer crucial new insights into the inherent defect tolerance of halide perovskite photovoltaics, providing a fundamental basis for designing significantly more robust and efficient solar cells.

IN DEPTH

Background

Perovskite materials have garnered immense attention for their exceptional optoelectronic properties and rapidly advancing power conversion efficiencies, rivaling traditional silicon-based photovoltaics. However, the inherent presence of defects within these materials has been a significant challenge, often leading to reduced device performance and considerable stability issues that hinder their commercialization. Prior research has predominantly focused on external chemical passivation strategies to mitigate these detrimental defects. This study, by contrast, uncovers an intrinsic self-passivation mechanism, revealing that perovskites possess an inherent resilience to defects—a paradigm shift in understanding their fundamental properties and potential.

Key Findings

Groundbreaking research has revealed that defect coupling within perovskite materials can instigate advantageous structural and electronic reconstructions, leading to the intrinsic self-passivation of deep traps and the suppression of ion migration. This synergistic self-passivation mechanism has been shown to extend charge carrier lifetimes by an astonishing three orders of magnitude (1000-fold). This discovery offers profound new insights into the inherent defect tolerance of halide perovskite photovoltaics, suggesting that the material itself possesses a powerful self-healing capability crucial for enhancing device performance and long-term stability.

Technical and Experimental Details

- **Defect Coupling and Structural Reconstruction:** The study elucidates how specific defects, when in close proximity, can induce localized structural rearrangements. These reconstructions alter the electronic states of the defects, effectively transforming them into benign, electrically inactive sites. For instance, the formation of vacancy complexes (clusters of atomic vacancies) was observed to optimize the surrounding lattice structure, leading to a more energetically stable configuration, thereby minimizing their detrimental impact.

- **Passivation of Deep Traps:** A direct consequence of this structural reconstruction is that deep traps, which typically capture charge carriers and lead to non-radiative recombination losses, are rendered electrically inert. This enables more efficient collection of photogenerated carriers, thereby preventing a reduction in power conversion efficiency.
- **Suppression of Ion Migration:** Ion migration, a primary degradation pathway in perovskite solar cells, is also shown to be significantly mitigated by these localized structural changes induced by defect coupling. By restricting the movement of mobile ions, the long-term operational stability of the device is substantially enhanced.
- **Dramatic Extension of Carrier Lifetime:** The cumulative effect of these mechanisms is a phenomenal extension of the charge carrier lifetime. This is a critical parameter for high-efficiency solar cells, as longer carrier lifetimes ensure that more photogenerated charges reach the electrodes before recombining, thus directly improving both power conversion efficiency and long-term device stability.

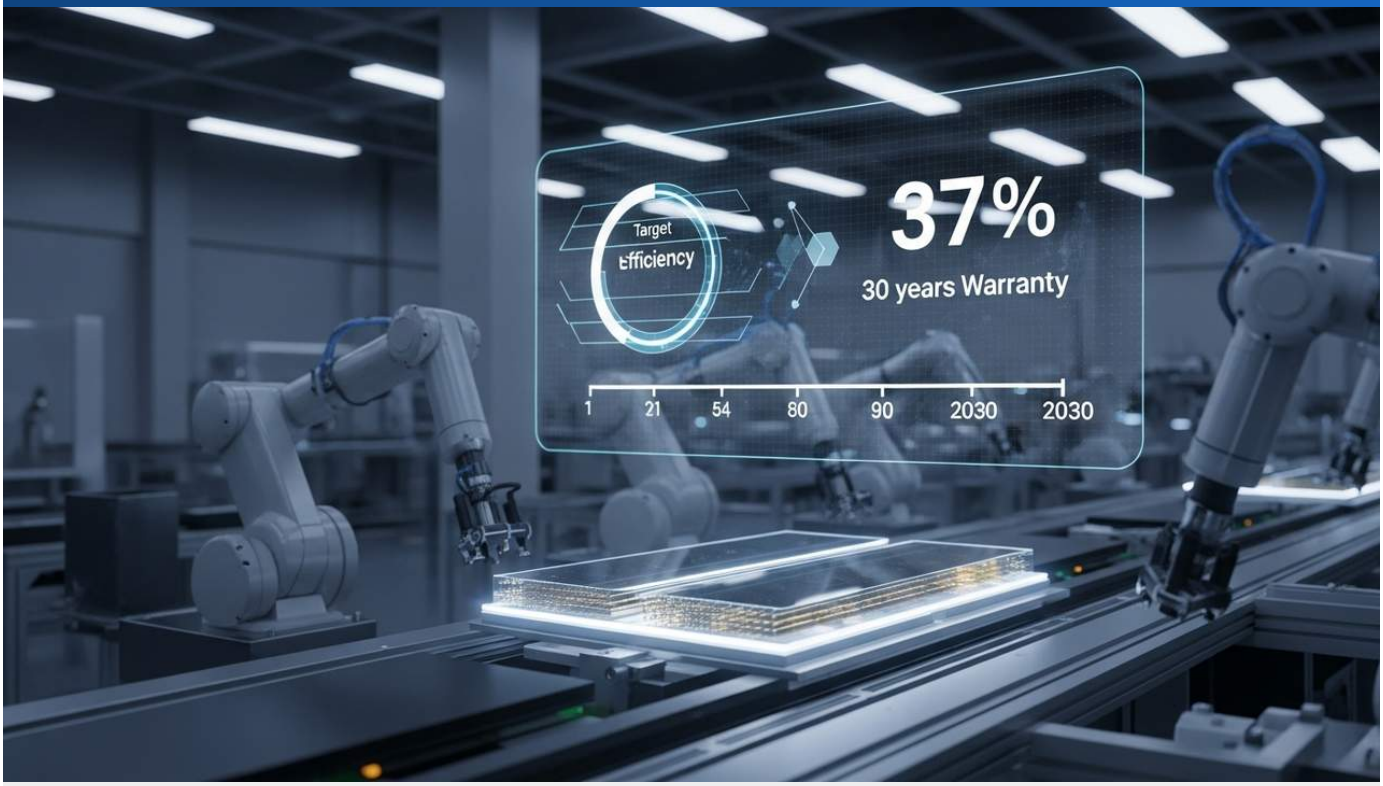
Strategic Significance and Outlook

The discovery of this synergistic self-passivation mechanism provides a novel guiding principle for the rational design of more robust and high-performing perovskite solar cells. Future research can now leverage this insight to develop novel material compositions or optimized processing techniques that inherently enhance these intrinsic defect tolerance capabilities. Critically, reducing reliance on external passivating agents could significantly simplify manufacturing processes and potentially lower production costs, making perovskite technology more economically viable. Ultimately, this fundamental understanding is expected to significantly accelerate the practical deployment and commercialization of highly efficient and exceptionally stable perovskite solar cell technology, solidifying its crucial role in the global renewable energy landscape.

Source: https://pubs.acs.org/ancac3/article/doi/10.1021/acsnano.6c10992/5252996/Synergistic-Self-Passivation-of-Vacancy-Complexes

#09 Tandem PV to Launch Sales of World's Most Efficient Solar Panels This Year, Targeting 37% Efficiency by 2030 with 30-Year Warranty

Published August 14, 2026 PV Magazine USA



OVERVIEW

Tandem PV has secured nearly $1 billion in Letters of Intent for its perovskite-silicon 4T solar modules and plans to initiate revenue-generating sales later this year. The company, having shipped its first production-quality panel two weeks prior, aims to boost module efficiency by 2% annually to reach 37% by 2030, offering a 30-year warranty with less than 1% annual degradation. This design, which deposits the perovskite layer onto the top glass, treats the underlying silicon cell as a pass-through cost, with gigawatt-scale manufacturing targeted by 2028.

IN DEPTH

Key Findings

Tandem PV is set to begin revenue-generating sales of what it claims to be the world's most efficient solar panels later this year, having already secured nearly $1 billion in Letters of Intent (LOI) for its perovskite-silicon 4T (four-terminal) solar modules. The company recently shipped its first production-quality panel, demonstrating its readiness for market entry. Tandem PV has ambitious goals, aiming to increase module efficiency by 2% annually, reaching 37% by 2030, alongside offering an industry-leading 30-year warranty with an annual degradation rate of less than 1%.

Technical and Manufacturing Details

- **4T Tandem Architecture:** Tandem PV's modules employ a unique four-terminal architecture where the perovskite layer is deposited directly onto the top solar panel glass. This design allows the underlying conventional silicon cell to function independently as a pass-through component, optimizing overall efficiency and potentially simplifying integration. This approach also helps manage thermal characteristics and spectral splitting more effectively than two-terminal designs.
- **Aggressive Efficiency Roadmap:** Targeting 37% module efficiency by 2030 represents a significant leap from current high-end silicon panels, which typically peak around 23-24%. This advancement would dramatically increase power output per unit area, making solar installations more productive and space-efficient. The annual 2% efficiency gain indicates a continuous improvement strategy in materials science and manufacturing processes.
- **Durability and Warranty:** Offering a 30-year warranty with less than 1% annual degradation is a strong statement of confidence in the long-term stability of their perovskite technology. Perovskites have traditionally faced challenges with environmental stability, so this warranty implies significant breakthroughs in encapsulation and material durability, which are critical for widespread adoption.
- **Gigawatt-Scale Manufacturing:** Tandem PV aims for gigawatt-scale manufacturing by 2028. This rapid scale-up plan underscores the company's commitment to industrializing perovskite tandem technology and signals a shift from laboratory-based research to high-volume commercial production, which is essential for making a substantial market impact.

Background and Context

The solar photovoltaic industry is continuously seeking higher efficiencies and lower costs. As conventional silicon technology matures, perovskite-silicon tandem cells are widely recognized as the most promising next-generation technology to break through efficiency plateaus. The entry of companies like Tandem PV with clear commercialization roadmaps, ambitious efficiency targets, and long-term warranties indicates a significant maturation of the technology. This is particularly relevant in markets where domestic manufacturing and high-performance solar solutions are increasingly valued.

Strategic Significance and Outlook

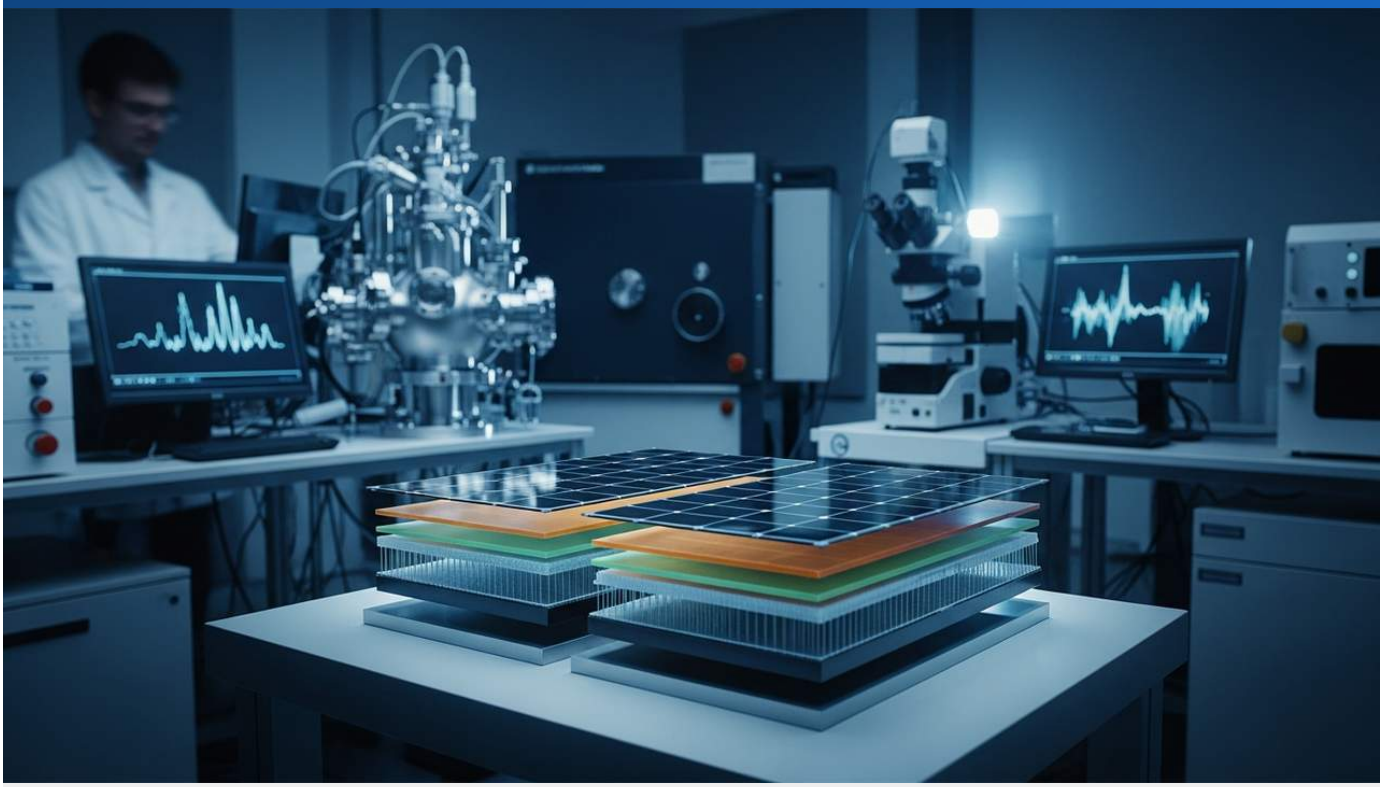
Tandem PV's impending market launch is a pivotal moment for perovskite-silicon tandem solar cells, marking a transition from a research curiosity to a tangible, commercially available product. Should the company achieve its stated goals of 37% efficiency, a 30-year warranty, and gigawatt-scale production, it could exert a disruptive influence on the global solar industry. This would translate into significant improvements in the cost-performance ratio of solar energy across residential, commercial, and utility-scale sectors, accelerating the global transition to clean energy. Industry stakeholders will closely monitor Tandem PV's execution of these ambitious commitments.

Source: https://www.pv-magazine.com/2026/08/14/the-worlds-most-efficient-solar-panel-goes-on-sale-later-this-year/

Collected: August 14, 2026 | Automated Research System (Gemini API)

#10 Kaunas University of Technology Researchers Eliminate Main Cause of Perovskite Solar Cell Degradation, Achieve Over 29% Efficiency in Tandem Devices

Published Published August 12, 2026 Kaunas University of Technology (KTU) リトアニア



OVERVIEW

Researchers at Kaunas University of Technology (KTU), in collaboration with Chinese partners, have achieved a significant breakthrough in perovskite solar cell technology. They developed a stable interfacial engineering strategy that eliminates a primary cause of degradation, enabling tandem devices to exceed 29% power conversion efficiency and facilitating uniform, high-quality coating on large-area modules. This advancement critically moves perovskite technology closer to practical commercial application.

IN DEPTH

Background

Perovskite solar cells (PSCs) continue to garner significant attention as a next-generation photovoltaic technology, owing to their remarkable high-efficiency potential and cost-effective manufacturing prospects. However, their widespread commercialization has been significantly hampered by persistent challenges with long-term stability, primarily their susceptibility to environmental factors such as humidity, oxygen, heat, and light. A critical source of this instability lies in the intrinsic degradation mechanisms at the device interfaces, particularly concerning defect formation and charge recombination at the buried interfaces between the perovskite and charge transport layers.

Addressing these fundamental barriers, a collaborative research endeavor involving scientists from Kaunas University of Technology (KTU) and their Chinese partners has made a pivotal advancement. This interdisciplinary international collaboration underscores the complex, multifaceted nature of these challenges, which necessitate diverse expertise to overcome.

Key Findings

The KTU-led team has engineered a stable interfacial engineering strategy that effectively mitigates the primary cause of intrinsic device degradation. This novel interface technology precisely optimizes contact between the perovskite layer and adjacent functional layers, facilitating highly efficient charge carrier transport. Crucially, it simultaneously passivates defect sites, thereby suppressing non-radiative recombination and minimizing power losses within the device. Additionally, the enhanced interface serves as a robust barrier against deleterious ion migration, a key contributor to perovskite instability, fundamentally improving the device's structural and chemical integrity over extended operational periods.

- **Record Efficiency in Tandem Devices:** This advanced interfacial design has enabled the creation of perovskite tandem solar cells boasting over 29% power conversion efficiency (PCE). This achievement significantly surpasses the practical efficiency limits of conventional single-junction silicon solar cells, underscoring the formidable potential of perovskite technology as a high-performance alternative.

- **Scalability for Industrial Application:** A critical aspect of this new methodology is its proven capability to facilitate uniform and high-quality layer deposition on large-area modules. This is a crucial step for transitioning laboratory successes to industrial-scale commercial production, ensuring high yields and consistent reliability in manufacturing processes.

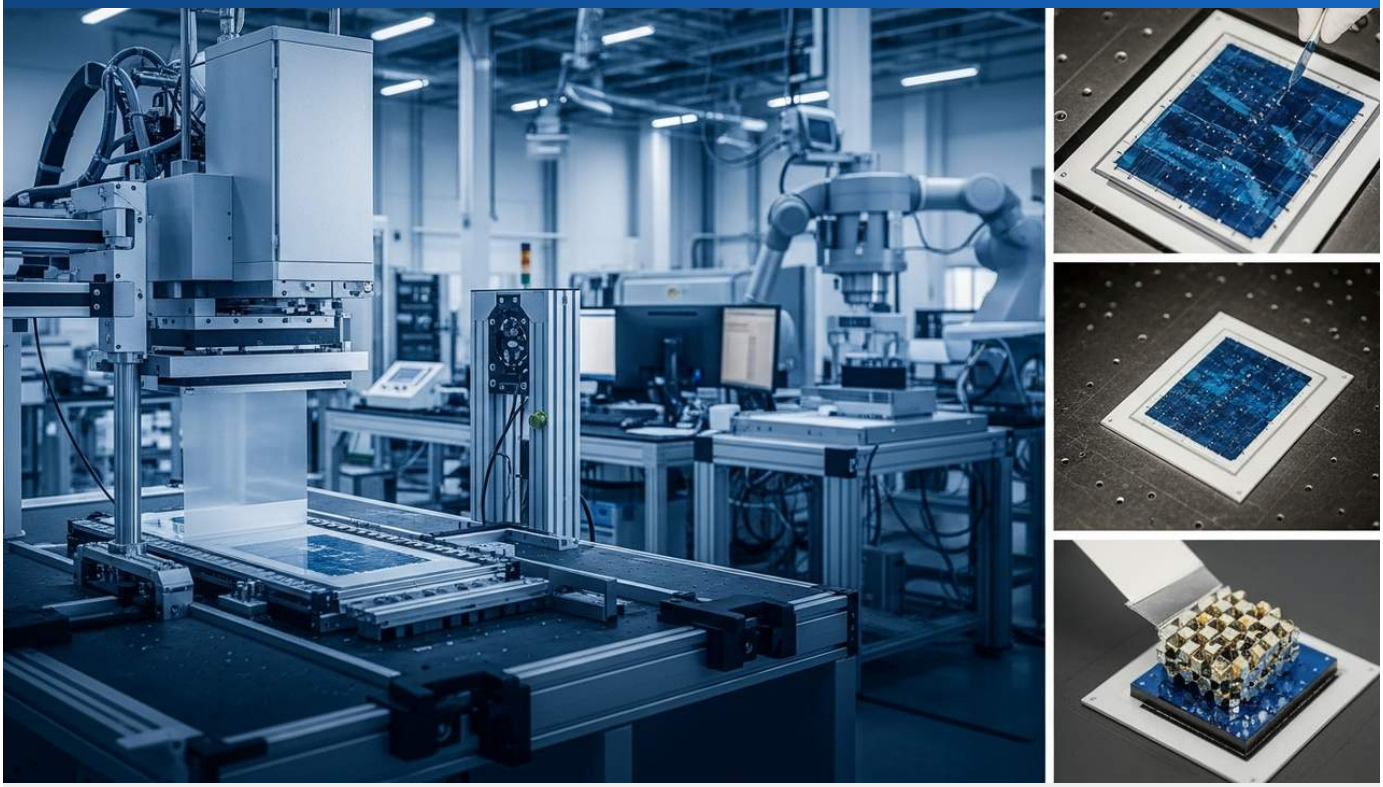
These findings are poised to significantly accelerate the commercialization of perovskite solar cells. By directly addressing the root causes of degradation and demonstrating large-area uniformity, the research reduces manufacturing complexities and enhances product reliability. The stable interface technology is now anticipated for implementation in large-scale production lines and will undergo rigorous long-term validation under real-world outdoor conditions. This progress is vital for positioning perovskite solar cells as a more durable, higher-performance solution, essential for meeting global renewable energy demands and targets.

Source: https://www.technologynetworks.com/tn/news/researchers-eliminate-a-main-cause-of-perovskite-solar-cell-degradation-415542

Collected: August 14, 2026 | Automated Research System (Gemini API)

#11 Researchers Blade-Coat 26.60% Efficient Perovskite Solar Cells with Multidentate Thiol Anchoring Molecules, Demonstrate Scalability with 23.31% on 20.9 cm^2 Mini-Modules

Published Published August 14, 2026 Perovskite-Info International研究



OVERVIEW

Researchers have unveiled a novel co-deposition strategy compatible with blade coating, enabling the fabrication of perovskite solar cells with a world-leading 26.60% power conversion efficiency (26.23% certified) for small devices. This technique, utilizing multidentate thiol anchoring molecules, enhances interfacial contact and defect passivation. Crucially, the method proved scalable, achieving 23.31% efficiency on a 20.9 cm^2 mini-module, a significant leap towards industrial production.

IN DEPTH

Background

Perovskite solar cells (PSCs) continue to excite the renewable energy sector with their remarkable potential for high power conversion efficiencies. However, translating these laboratory-scale triumphs into large-area, industrially viable production has remained a formidable hurdle. A critical missing piece has been the development of scalable coating techniques that can maintain high performance. This latest research effectively bridges this gap by combining a cost-effective, large-area deposition method—blade coating—with advanced interfacial engineering to maximize device performance, significantly clarifying the commercialization pathway for perovskite solar cells.

Key Findings

In a significant advancement for perovskite solar cell (PSC) technology, a research team has developed an innovative co-deposition strategy leveraging multidentate thiol anchoring molecules that is fully compatible with blade coating, a highly scalable manufacturing technique. This novel approach has enabled the fabrication of small-area PSCs with an astonishing champion power conversion efficiency (PCE) of 26.60% (independently certified at 26.23%). This efficiency stands among the highest reported for PSCs fabricated using scalable coating methods. Furthermore, the team successfully demonstrated the scalability of their technique by achieving 23.31% PCE on a practical 20.9 cm^2 mini-module, a crucial step towards industrial application.

Technical Details and Manufacturing Innovation

- **Blade Coating for Scalability:** Unlike laboratory-scale spin coating, blade coating is a high-throughput, cost-effective technique inherently suitable for large-area deposition. Its successful integration with advanced interfacial engineering represents a major breakthrough, making industrial production of perovskite solar cells more viable.

- **Multidentate Thiol Anchoring Molecules in SAMs:** The core innovation lies in the use of multidentate (multiple-binding-site) thiol molecules within self-assembled monolayers (SAMs). These molecules form strong, stable chemical bonds at the critical interface between the perovskite layer and the charge transport layer (typically the hole transport layer). This robust anchoring and improved interfacial contact are vital for effectively passivating defects, such as undercoordinated lead ions, which are primary sources of non-radiative recombination and efficiency loss.
- **Reduced Interfacial Stress:** The SAM modification also plays a crucial role in alleviating interfacial stress. This stress often arises from mismatches in thermal expansion coefficients between different layers of the solar cell. Reducing this stress contributes to enhanced mechanical stability and can significantly improve the long-term durability of the device.

Strategic Significance and Outlook

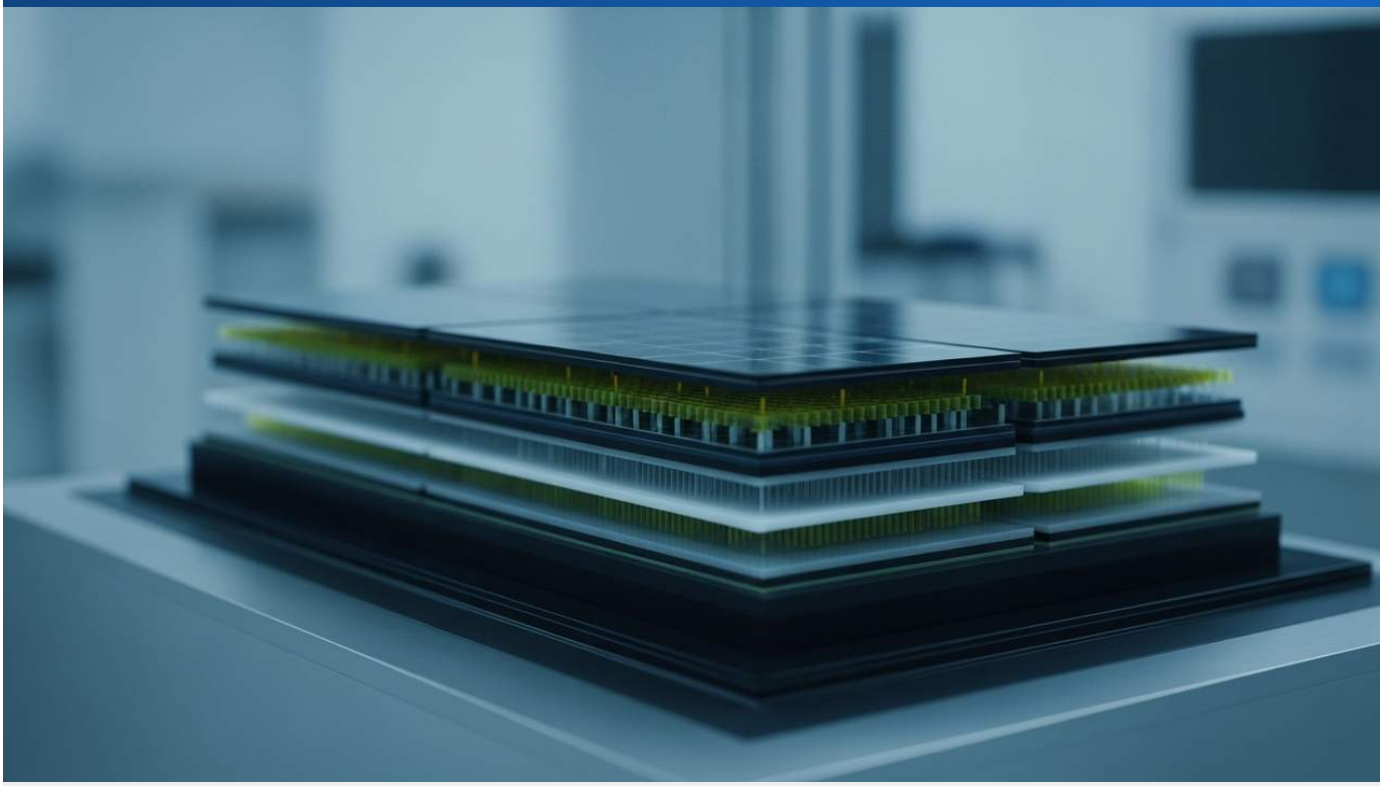
This blade-coating compatible co-deposition strategy represents a crucial breakthrough for the mass production of perovskite solar cells. The combination of world-class high efficiency in small devices and demonstrated scalability to a practical mini-module size significantly enhances the prospects for manufacturing high-performance perovskite solar modules at low cost and on a gigawatt scale. Future work will likely focus on comprehensive long-term stability assessments of modules fabricated with this technique and further performance verification on even larger module sizes. This advancement is expected to play a vital role in improving the cost-performance ratio of solar power, accelerating the global adoption of next-generation renewable energy technologies, and helping to meet ambitious clean energy targets worldwide.

Source: https://www.perovskite-info.com/researchers-blade-coat-2660-efficient-perovskite-solar-cells-using-multidentate

Collected: August 14, 2026 | Automated Research System (Gemini API)

#12 LONGi Achieves NREL-Certified World Record 35.5% Efficiency with High-Performance Crystalline Silicon-Perovskite Tandem Solar Cell Technology

Published August 06, 2026 Facebook (LONGi Solar) China



OVERVIEW

LONGi's crystalline silicon-perovskite tandem solar cell has achieved an astounding 35.5% conversion efficiency, certified as a new world record by the U.S. National Renewable Energy Laboratory (NREL). This achievement, combined with prior records like 33.5% certified by ESTI and 26.81% for silicon heterojunction cells, unequivocally demonstrates LONGi's unwavering commitment to independent R&D and relentless innovation in cutting-edge solar technology. The breakthrough signifies a major step towards surpassing conventional silicon efficiency limits.

IN DEPTH

Key Findings

LONGi Green Energy Technology Co. Ltd. (LONGi) has announced a monumental achievement: its crystalline silicon-perovskite tandem solar cell has been certified by the U.S. National Renewable Energy Laboratory (NREL) with a groundbreaking 35.5% power conversion efficiency. This sets a new world record, significantly surpassing the efficiency limits of conventional single-junction silicon solar cells and marking a pivotal milestone in the development of next-generation photovoltaic technology. The certified record underscores LONGi's leading position in solar innovation.

Technical and Manufacturing Details

- **Crystalline Silicon-Perovskite Tandem Structure:** The tandem solar cell developed by LONGi employs a layered architecture where a perovskite thin film is deposited on top of a high-performance crystalline silicon solar cell. The perovskite top cell efficiently absorbs the high-energy photons in the blue and green parts of the solar spectrum, while the bottom silicon cell captures the lower-energy photons, particularly in the infrared range. This complementary absorption allows for a broader and more efficient utilization of the solar spectrum, leading to a synergistic increase in overall conversion efficiency.
- **Significance of NREL Certification:** NREL is a globally recognized authority in photovoltaic device performance measurement and certification. The 35.5% certification by NREL provides independent validation of the record's accuracy and scientific credibility, affirming LONGi's technological prowess on an international stage.
- **Preceding Efficiency Records:** This latest achievement builds upon LONGi's previous successes, including a 33.5% tandem efficiency certified by the European Solar Test Installation (ESTI) and a 26.81% record for silicon heterojunction cells. These consistent breakthroughs across various solar cell technologies highlight the company's robust and continuous investment in advanced R&D.

Background and Context

Solar photovoltaics are a cornerstone of the global energy transition, yet conventional silicon technology is nearing its theoretical efficiency limits. To further reduce the levelized cost of electricity (LCOE) and enhance the performance of solar installations, next-generation technologies are essential. Perovskite-silicon tandem solar cells are considered the most promising solution to these challenges due to their high efficiency potential. The aggressive investment and consistent record-breaking achievements by major manufacturers like LONGi indicate the rapid maturation of this technology and a strong intent for commercialization.

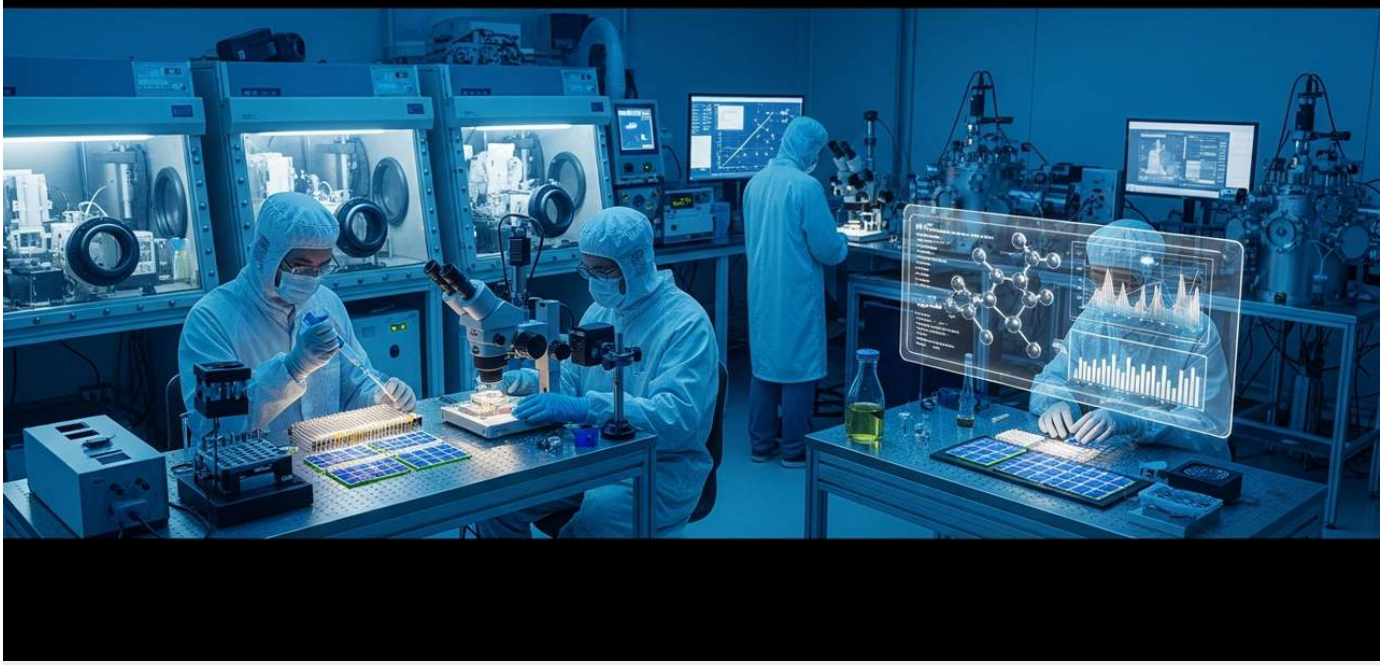
Strategic Significance and Outlook

LONGi's attainment of 35.5% conversion efficiency is a major step in the transition of perovskite-silicon tandem solar cells from laboratory research to commercial production. As this high-efficiency technology scales to mass manufacturing and addresses long-term stability challenges, the cost-performance ratio of solar power is expected to improve dramatically. This will lead to higher power output per unit area, accelerating solar deployment in space-constrained regions and high-demand energy markets. LONGi's achievement is poised to be a significant driving force towards meeting global renewable energy targets.

Source: https://www.facebook.com/LONGiSolar/posts/a-historic-1-2-sweep-at-the-electrek-american-solar-challenge-2026-both-powered-/1339086728425842/

#13 Orchestrating Thiol Chemistry Towards Durable Perovskite Solar Cells: New Insights into Defect Passivation and Ion Migration Suppression

Published Published August 12, 2026 Chem (The Royal Society of Chemistry) International研究



OVERVIEW

Breakthrough research highlights thiol molecules as exceptionally effective agents for defect passivation and interfacial modification in perovskite solar cells, dramatically boosting their durability. The strong coordination of thiol sulfur atoms with undercoordinated metal ions (e.g., Pb2+, Sn2+) reduces non-radiative recombination and suppresses ion migration, key factors in device degradation. Moreover, cleverly designed multifunctional thiols enable precise control over material synthesis and film properties, leading to enhanced mechanical stability and optimized grain structures for superior, long-lasting devices.

IN DEPTH

Background

Despite their impressive efficiency potential, perovskite solar cells continue to face a major hurdle to commercialization: insufficient long-term stability. Device degradation is often triggered by exposure to moisture, heat, and light, but critically, also by internal ion migration. Traditionally used in surface science and catalysis for its robust metal coordination, thiol chemistry has now emerged as a highly promising avenue for advanced perovskite interfacial engineering. This novel approach presents a simple yet powerful solution to enhance durability, garnering significant interest from researchers worldwide.

Key Findings

Groundbreaking research underscores the exceptional efficacy of thiol molecules in both defect passivation and interfacial modification for perovskite solar cells, contributing significantly to their enhanced durability. Studies reveal that the sulfur atoms within thiols form robust coordinate bonds with undercoordinated metal ions, such as Pb^{2+} and Sn^{2+}, embedded in the perovskite lattice. This crucial interaction not only effectively reduces non-radiative recombination pathways but also fundamentally suppresses ion migration—a primary driver of device degradation. Furthermore, the strategic design of multifunctional thiol architectures enables sophisticated control over precursor chemistry, film formation kinetics, crystallization processes, and long-term material aging, ultimately leading to superior mechanical stability and precisely controlled grain growth within the perovskite films.

Technical Details

- **Thiol Molecule Mechanism:** The sulfur atom in thiol (R-SH) molecules functions as a potent Lewis base, readily forming coordinate bonds with uncoordinated metal sites (e.g., Pb^{2+} and Sn^{2+}) which typically arise from halide vacancies within the perovskite crystal lattice. This robust bonding effectively passivates these defect sites, thereby preventing them from trapping charge carriers.

- **Suppression of Non-Radiative Recombination:** Through effective defect passivation, thiols significantly suppress non-radiative recombination—a detrimental process where photogenerated electrons and holes lose energy as heat instead of contributing to the electrical current. This suppression leads to extended carrier lifetimes and, consequently, boosts power conversion efficiencies.
- **Mitigation of Ion Migration:** The adsorption of thiol molecules onto the surface and grain boundaries of perovskite crystals establishes a physical and chemical barrier that actively inhibits the movement of detrimental ionic defects (such as halide ions) under both thermal and electrical stress. Suppressing ion migration is paramount for achieving long-term operational stability in perovskite solar cells.
- **Multifunctional Thiol Architectures:** By strategically designing thiols with multiple functional groups, researchers can achieve more than just defect passivation. They can also exert precise control over various critical aspects of the perovskite fabrication process, including modulating the viscosity and surface tension of precursor solutions, dictating crystallization kinetics, and profoundly influencing overall film quality and uniformity. These collective enhancements contribute directly to improved device reproducibility and performance.

Strategic Significance and Outlook

This innovative thiol chemistry-based approach opens exciting new frontiers for developing significantly more durable perovskite solar cells. A deeper understanding and precise optimization of defect passivation and ion migration suppression mechanisms, combined with the rational design of sophisticated multifunctional thiol molecules, could enable perovskite solar cells to achieve lifetimes comparable to, or even surpassing, existing silicon photovoltaic technologies. Such a breakthrough would dramatically enhance the cost-effectiveness of solar power, accelerate the global adoption of renewable energy, and represent a vital step forward in securing sustainable energy solutions.

Source: https://pubs.rsc.org/cc/article/doi/10.1039/d6cc03627a/1289399/Orchestrating-thiol-chemistry-toward-durable

#14 Bifacial Interface Engineering with CF3–PEAI Boosts Perovskite Memristor Performance for Optoelectronic Synapses and Neuromorphic Vision Systems

Published Published August 13, 2026 ACS Publications International研究

OVERVIEW

Researchers have developed a novel bifacial interface engineering strategy for perovskite memristors, employing CF3–PEAI modification at both the prenucleation and postgrowth stages of the perovskite layer. This dual-sided approach significantly optimizes charge carrier transport and ion migration, effectively mitigating surface defects and promoting uniform grain formation. The innovation enables stable electro-optic comodulation, crucial for high-performance optoelectronic synapses and advanced neuromorphic vision systems, paving the way for next-generation AI hardware.

IN DEPTH

Background

Perovskite materials have garnered significant attention not only for their high photovoltaic efficiency but also for their broad potential in various optoelectronic devices, including memristors and advanced sensors. However, realizing their full potential has been hampered by persistent challenges related to material stability and performance degradation, primarily stemming from interfacial defects. In the burgeoning field of neuromorphic computing, where the demand for highly efficient and stable artificial intelligence hardware is paramount, breakthroughs in interface engineering—such as the strategy presented here—are critical for developing practical and reliable devices.

Key Findings

Researchers have unveiled an innovative "bifacial interface engineering strategy" that dramatically elevates the performance and stability of perovskite memristors. This groundbreaking approach involves the precise application of CF3–PEAI (trifluoromethyl-phenylethylammonium iodide) modification at *both* the prenucleation and postgrowth interfaces of the perovskite active layer. This meticulous engineering fundamentally reconfigures the material, optimizing charge carrier transport and ion migration dynamics, which in turn effectively mitigates surface defects and promotes the formation of highly uniform grains. The result is a full realization of perovskite materials' inherent photoelectric advantages, enabling stable electro-optic comodulation—a capability essential for creating high-performance optoelectronic synapses and advanced neuromorphic vision systems.

Technical Innovation and Mechanism:

- **Bifacial Interface Engineering:** Moving beyond conventional unilateral interface modifications, this strategy simultaneously controls both the top and bottom interfaces of the perovskite layer. CF3–PEAI is strategically chosen for its unique ability to precisely tune the surface energy of perovskite crystals and effectively passivate critical defect sites across the material.

- **Prenucleation Stage Modification:** By introducing CF3–PEAI during the initial nucleation phase, researchers gain unprecedented control over the distribution and growth orientation of crystal nuclei. This proactive approach ensures the formation of more uniform, less defective perovskite films from the very outset, effectively suppressing defect introduction in the earliest stages of material formation.
- **Postgrowth Interface Modification:** Following the formation of the perovskite layer, an additional treatment with CF3–PEAI is applied. This step serves to passivate any remaining exposed surface defects and significantly reduce charge carrier recombination. The ultimate effect is a boost in charge extraction efficiency and a substantial enhancement in device stability, crucial for long-term operation.
- **Optimized Carrier Transport and Ion Migration:** The combined effect of this bifacial modification is a significant optimization of pathways for charge carriers (both electrons and holes) within the perovskite layer. Simultaneously, it actively suppresses undesirable ion migration, which is a primary cause of perovskite degradation and instability in memristor devices. This dual optimization is critical for achieving rapid response times, high endurance, and long-term reliability.

Strategic Significance and Outlook:

This advanced bifacial interface engineering strategy promises a transformative leap in the performance and stability of perovskite memristors, accelerating the development of next-generation optoelectronic devices and advanced neuromorphic systems. The CF3–PEAI-based approach maximizes the intrinsic properties of perovskite materials, thereby paving the way for the design of more sophisticated and functional devices. In the near future, the integration of this technology into neuromorphic chips is expected to enable low-power, high-speed artificial intelligence processing. This innovation stands to drive significant advancements across a wide spectrum of fields, including edge AI, Internet of Things (IoT) devices, and autonomous driving, fulfilling the growing demand for efficient, brain-inspired computing hardware.

Source: https://pubs.acs.org/jpclcd/article/doi/10.1021/acs.jpclett.6c02194/5254645/Bifacial-Interface-Engineering-of-Perovskite

#15 FAI-Induced Defect Passivation Significantly Boosts Performance of Spray-Deposited Lead-Free Cs3Bi2I9 Self-Powered Photodetectors

Published Published August 11, 2026 ACS Publications International研究

OVERVIEW

Formamidinium iodide (FAI) has been successfully utilized to passivate defects in spray-coated lead-free Cs3Bi2I9 (CBI) perovskite films, leading to dramatically enhanced structural and optical quality. This FAI treatment reduced defect states, improved crystallinity, and promoted secondary grain growth, resulting in superior charge transport and outstanding device performance in self-powered photodetectors. Optimized devices achieved a responsivity of 4.14 × 10–4 A W–1 and a detectivity of 1.73 × 1010 Jones under white light, demonstrating significant progress in eco-friendly optoelectronics.

IN DEPTH

Background

The growing demand for environmentally friendly and sustainable materials has driven intensive research into lead-free perovskites for applications in solar cells and photodetectors, primarily due to their low toxicity. Among these, Cs3Bi2I9 (CBI) stands out as a promising bio-inspired, inorganic perovskite, free of toxic lead and thus an attractive candidate for next-generation optoelectronic devices. However, the performance of these eco-friendly materials has traditionally been constrained, often lagging behind their lead-based counterparts, particularly when fabricated using conventional methods. A key challenge lies in developing scalable, cost-effective manufacturing techniques that can produce high-quality films. Spray coating addresses this by offering a low-cost, high-throughput, and scalable method for depositing uniform thin films over large areas, ideal for industrial application, yet often posing its own set of material quality challenges.

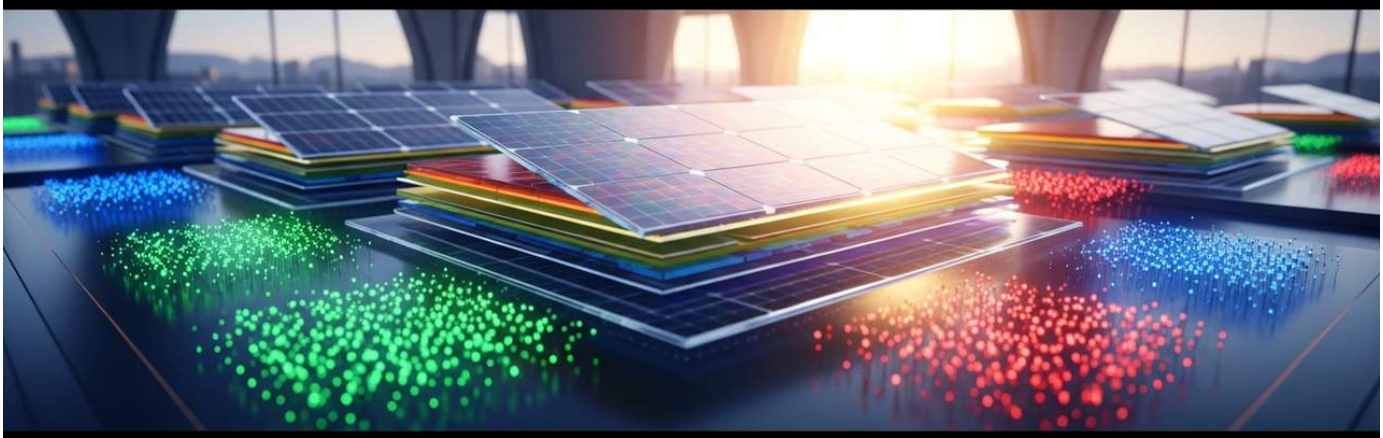
Key Findings

Groundbreaking research has demonstrated that a novel defect passivation strategy using formamidinium iodide (FAI) dramatically enhances the performance of spray-coated, lead-free Cs3Bi2I9 (CBI) perovskite films. This FAI treatment fundamentally improves both the structural and optical quality of the films by selectively binding to crucial defect sites, such as halide vacancies and uncoordinated bismuth atoms, present on the surface and within the bulk of the perovskite crystals. This targeted passivation effectively suppresses non-radiative recombination and extends the lifetime of charge carriers, leading to a more ordered crystalline structure, improved grain size and orientation, and promoting secondary grain growth. The result is denser films with significantly enhanced light absorption efficiency and optimized charge transport. These improvements culminated in superior device performance for self-powered photodetectors. The optimized devices achieved a high responsivity of 4.14 × 10–4 A W–1 and an excellent detectivity of 1.73 × 1010 Jones under white light. Operating in a self-powered mode without an external bias, these photodetectors demonstrate impressive capabilities for applications ranging from imaging to environmental monitoring and optical communications. This FAI-induced defect passivation strategy represents a major breakthrough, establishing a crucial foundation for accelerating the commercialization of high-performance, lead-free perovskite photodetectors and opening pathways for their integration into sustainable electronics.

Source: https://pubs.acs.org/aaemcq/article/9/15/9886/5222552/FAI-Induced-Defect-Passivation-for-Enhanced

#17 Perovskite-Silicon Tandem Cells Emerge as Next Major Solar Upgrade, Targeting Over 37% Efficiency; Future Pipeline Includes All-Perovskite and Quantum Dot Cells

Published August 12, 2026 Medium (Maxeon Solar Panels) International



OVERVIEW

Perovskite-silicon tandem cells are identified as the most probable near-term upgrade for solar technology, layering thin perovskite on conventional silicon to broaden light capture and push efficiencies beyond single-silicon limits, potentially exceeding 37%. Beyond these tandems, the future pipeline includes all-perovskite tandems, multi-junction cells combining three or more materials, and emerging concepts like quantum dot cells. This outlines a long-term roadmap for continuous efficiency gains in photovoltaic technology.

IN DEPTH

Key Findings

Perovskite-silicon tandem solar cells are widely considered the most likely and impactful near-term upgrade for existing solar technology. By stacking a thin perovskite layer on top of conventional silicon, these cells are capable of capturing a broader spectrum of light, effectively breaking through the intrinsic efficiency ceiling of single-junction silicon. This innovative approach holds the potential to push conversion efficiencies beyond 37%. Looking further ahead, the long-term roadmap for photovoltaic innovation includes advanced concepts such as all-perovskite tandems, multi-junction cells combining three or more distinct materials, and nascent technologies like quantum dot cells, signaling a sustained trajectory for efficiency gains in solar energy.

Technical and Manufacturing Details

- **Perovskite-Silicon Tandem Cells:** This hybrid approach combines the established stability of silicon technology with the superior light absorption and conversion capabilities of perovskites. The perovskite layer absorbs high-energy photons (e.g., blue light), while the silicon layer absorbs lower-energy photons (e.g., infrared light). This complementary absorption maximizes the utilization of the solar spectrum, leading to significantly enhanced overall efficiency. Both two-terminal (2T) and four-terminal (4T) configurations are under active development.
- **All-Perovskite Tandems:** The next evolution involves constructing both the top and bottom cells from perovskite materials with different bandgaps. This approach seeks even higher efficiencies and offers greater flexibility in manufacturing processes, potentially enabling fully solution-processed tandem cells. Research also explores lead-free perovskites for this configuration to address toxicity concerns.
- **Multi-Junction Cells:** Beyond tandems, multi-junction cells incorporate three or more distinct semiconductor materials to finely segment and absorb the solar spectrum. While offering the highest theoretical efficiencies, they present challenges in manufacturing complexity and cost. III-V semiconductor-based multi-junction cells are already used in niche applications like space, but perovskite and quantum dot combinations are being explored for terrestrial use.

- **Quantum Dot Cells:** Quantum dots are nanoscale semiconductors whose optical properties (light absorption and emission wavelengths) can be tuned by their size. Quantum dot solar cells have the potential to efficiently utilize both visible and infrared light, promising high efficiencies similar to multi-junction cells. This emerging technology explores novel conversion mechanisms, such as hot carrier extraction, distinct from traditional approaches.

Background and Context

Improving solar cell efficiency is paramount for increasing power output per unit area and reducing the overall cost of electricity generation. As conventional silicon solar cells approach their theoretical limits, new breakthroughs are necessary. Perovskite technology, with its high efficiency and potential for low-cost manufacturing, has emerged as the most promising candidate to address this challenge. The tandem architecture, which leverages existing silicon infrastructure while significantly boosting performance, has garnered substantial industry attention.

Strategic Significance and Outlook

Perovskite-silicon tandem cells are expected to dominate the market in the coming years, with efficiencies steadily climbing from the high 20s to the high 30s. Furthermore, more advanced technologies like all-perovskite tandems, multi-junction cells, and quantum dot cells will continue to evolve along the research and development roadmap. These technological innovations are anticipated to dramatically improve the cost-performance ratio of solar photovoltaics and play an indispensable role in accelerating the global transition to clean energy, ultimately shaping the future of sustainable power generation.

Source: https://maxeonsolarpanels.com/whats-next-solar-cell-technology-after-perovskite/

Collected: August 14, 2026 | Automated Research System (Gemini API)

#18 Everlight Chemical Supports Perovskite Commercialization with Encapsulation Materials and Expertise in Scalable Manufacturing, Reliability Testing

Published August 11, 2026 Perovskite-Info Taiwan

OVERVIEW

Gordon Chao of Everlight Chemical notes the perovskite industry's shift from technology validation to early commercialization, emphasizing scalable processes, manufacturing consistency, and reliability. As a materials supplier, Everlight Chemical is developing encapsulation solutions for perovskite solar cells and tandems, assisting partners with material selection, encapsulation structure design, and long-term reliability testing. Their efforts are crucial in addressing key challenges like long-term outdoor performance and large-area uniformity, accelerating the technology's market entry.

IN DEPTH

Key Findings

According to Gordon Chao of Everlight Chemical, the perovskite solar cell industry is undergoing a pivotal transition from technology validation to early commercialization, with a pronounced focus on scalable manufacturing processes, product consistency, and long-term reliability. As a leading materials supplier, Everlight Chemical is actively developing innovative encapsulation solutions specifically tailored for perovskite solar cells and tandem architectures. The company is strategically supporting its partners by providing expertise in material selection, optimizing encapsulation structure designs, and conducting rigorous long-term reliability testing. This comprehensive support is vital for addressing fundamental challenges such as ensuring prolonged outdoor performance and achieving uniformity across large-area modules, thereby accelerating the technology's market readiness.

Technical and Manufacturing Details

- **Encapsulation Material Development:** Perovskite solar cells are inherently vulnerable to environmental stressors like moisture, oxygen, and UV radiation, making high-performance encapsulation indispensable for their longevity. Everlight Chemical is developing specialized encapsulation materials (e.g., low-permeability barrier films, advanced resins) designed to minimize perovskite degradation and extend device lifetime. These materials must meet stringent requirements for transparency, adhesion, UV resistance, and thermal stability.
- **Optimization of Encapsulation Structure:** Beyond material composition, the structural design of encapsulation significantly impacts device stability. Everlight Chemical explores various encapsulation strategies, including single-layer, multi-layer, edge-sealing techniques, and combinations with gas barrier films. They advise partners on optimal structural designs for specific perovskite compositions and device architectures.

- **Manufacturing Consistency and Scalable Processes:** For mass production, manufacturing consistency—minimizing performance variations between individual products—is paramount. Everlight Chemical supports partners in achieving high-quality perovskite module production through scalable processes by supplying stable and high-quality materials, enabling laboratory-scale achievements to be replicated at industrial volumes.
- **Long-Term Reliability Testing:** Validating the efficacy of encapsulation solutions necessitates accelerated aging tests and long-term performance evaluations in real-world outdoor environments. The company assists with these tests, helping perovskite solar cells meet or exceed industry standard lifetimes (e.g., 25+ years).

Background and Context

Perovskite solar cells have garnered immense attention for their high efficiency potential and low-cost manufacturing advantages, but their inherent fragility has been the primary impediment to commercialization. Encapsulation technology is therefore a crucial component for overcoming this challenge and enabling widespread adoption of perovskite solar cells as a practical product. The active involvement of material suppliers from the development stage, offering comprehensive solutions, is instrumental in accelerating the overall commercialization process for the industry.

Strategic Significance and Outlook

The development of encapsulation technology and industry support from material suppliers like Everlight Chemical is an indispensable step towards the commercialization of perovskite solar cells. Once high-performance encapsulation solutions are established and can be reliably applied in large-scale manufacturing processes, the long-term outdoor performance and reliability of perovskite solar cells will significantly improve. This will position perovskite technology as a more competitive option across a wide range of photovoltaic markets, including residential, commercial, and specialized applications. Ultimately, it is expected to make an essential contribution to achieving global renewable energy targets.

Source: https://www.perovskite-info.com/everlight-chemicals-gordon-chao-discusses-encapsulation-

Collected: August 14, 2026 | Automated Research System (Gemini API)

#19 Chinese Academy of Sciences Develops Scalable Co-Deposition Strategy for High-Efficiency Perovskite Solar Cells, Reaching 26.60% and Significantly Boosting Long-Term Stability

Published August 10, 2026 Chinese Academy of Sciences (EurekAlert) China

OVERVIEW

Chinese scientists have developed a novel co-deposition strategy utilizing a multidentate anchoring molecule to improve self-assembled monolayer (SAM) fabrication via blade coating, a scalable technique. This method achieved a champion power conversion efficiency of 26.60% (certified 26.23%) for small-area devices and 23.31% for a 20.9 cm^2 mini-module. Critically, the strategy also enhanced long-term stability, retaining 96% efficiency after 1000 hours of continuous operation under ISOS-L-1 protocol and 91% after 1000 hours of thermal aging, addressing key commercialization barriers.

IN DEPTH

Key Findings

Researchers at the Chinese Academy of Sciences have made a significant breakthrough in the manufacturing of high-efficiency perovskite solar cells (PSCs), developing an innovative co-deposition strategy that simultaneously enhances scalability, performance, and stability. This strategy leverages multidentate anchoring molecules to improve the fabrication of self-assembled monolayers (SAMs) using blade coating, a technique well-suited for industrial application. The approach has yielded an impressive 26.60% power conversion efficiency (PCE) for small-area devices (independently certified at 26.23%) and 23.31% PCE for a 20.9 cm^2 mini-module. Crucially, the long-term stability of the devices has been dramatically improved, with 96% of initial efficiency retained after 1000 hours of continuous operation under the ISOS-L-1 protocol and 91% retained after 1000 hours of thermal aging.

Technical and Manufacturing Details

- **Co-Deposition Strategy and Multidentate Anchoring Molecules:** At the heart of this research is a co-deposition method that simultaneously deposits multidentate organic molecules at the interface between the perovskite layer and the charge transport layer. These molecules strongly bind to defect sites (e.g., uncoordinated lead ions) on the surface and grain boundaries of the perovskite crystals, effectively passivating them. This passivation effect suppresses non-radiative recombination, thereby enhancing open-circuit voltage (Voc) and fill factor (FF).
- **Applicability of Blade Coating Technology:** This strategy is compatible with blade coating, a technique suitable for industrial-scale manufacturing, as opposed to laboratory-scale methods like spin coating. Blade coating enables fast, low-cost, and uniform thin-film deposition over large areas, paving the way for mass production.
- **High Efficiency and Scalability:** The 26.60% PCE for small-area devices demonstrates the high degree of interfacial quality control achieved. Furthermore, the attainment of 23.31% PCE on a practical 20.9 cm^2 mini-module strongly suggests that this technology can be scaled up to future gigawatt-scale manufacturing.
- **Dramatic Improvement in Long-Term Stability:**

- **Operational Stability:** 96% of initial efficiency retained after 1000 hours of operation under the ISOS-L-1 protocol (continuous light exposure), indicating excellent durability under conditions similar to real-world outdoor use.
- **Thermal Aging Stability:** 91% efficiency retained after 1000 hours of thermal aging. Heat is a major degradation factor for perovskite solar cells, making this resilience extremely important for commercialization.

Background and Context

Perovskite solar cells are anticipated as a next-generation technology capable of surpassing the theoretical efficiency limits of silicon solar cells. However, their commercialization has faced significant hurdles related to maintaining high efficiency, achieving scalability for large-scale manufacturing, and ensuring long-term stability. Specifically, achieving both high efficiency and stability with scalable techniques like blade coating has been a long-standing goal for the industry. This research comprehensively addresses these challenges, significantly accelerating the commercialization of perovskite technology.

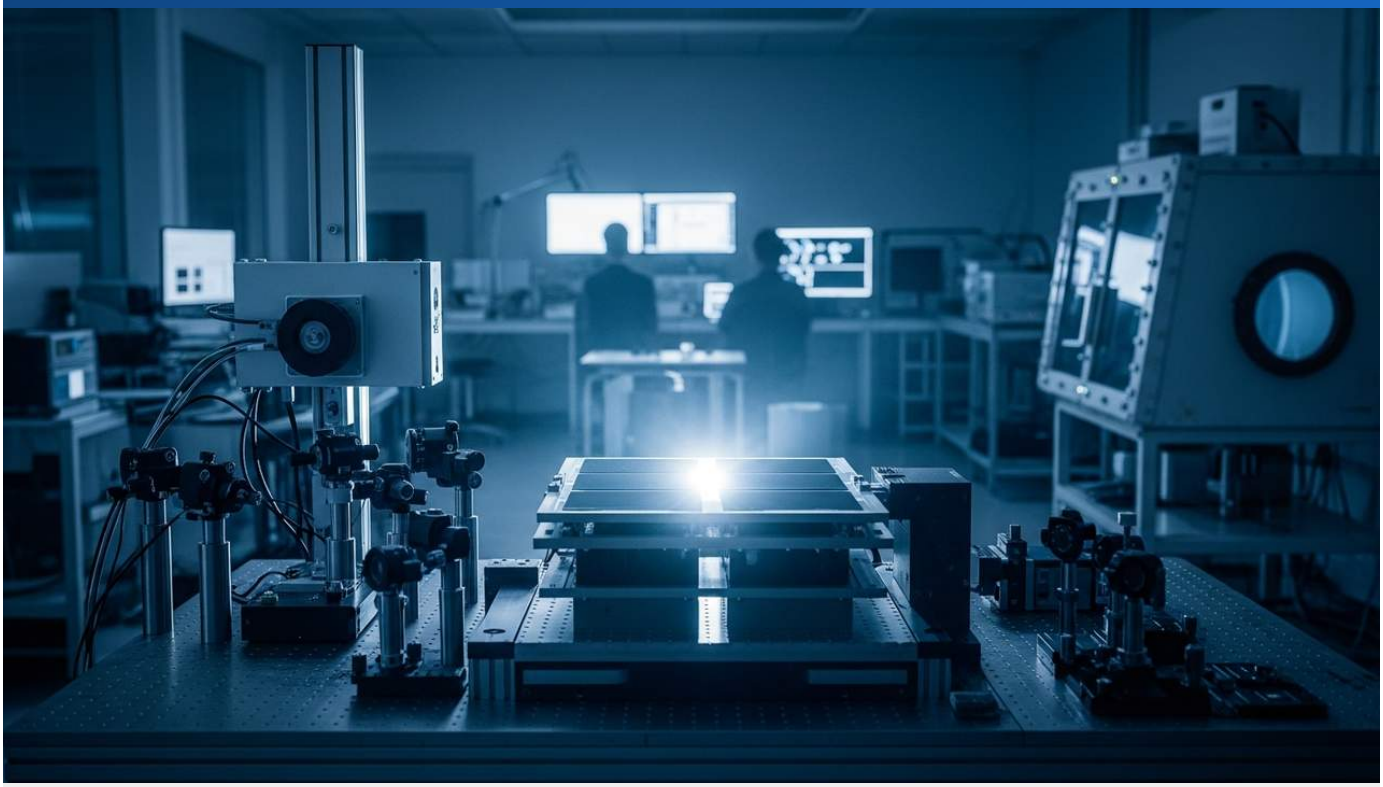
Strategic Significance and Outlook

This co-deposition strategy by the Chinese Academy of Sciences represents a critical breakthrough for the mass production of perovskite solar cells. The achieved high efficiency, demonstrated scalability, and dramatically improved long-term stability greatly enhance the potential for manufacturing high-performance perovskite solar modules at low cost and on a large scale for widespread application. Should this technology gain widespread adoption, it is expected to significantly improve the cost-performance of solar power and make an indispensable contribution to the global renewable energy transition.

Source: https://www.eurekalert.org/news-releases/1139614

#21 Chinese Academy of Sciences Team Sets New World Record with 28.04% Certified Efficiency for Perovskite-Organic Tandem Solar Cells, Demonstrates High Stability and Roll-to-Roll Compatibility

Published August 12, 2026 Pandaily.com China



OVERVIEW

A team led by Academician Li Yongfang and researcher Meng Lei at the Chinese Academy of Sciences Institute of Chemistry achieved a certified 28.04% steady-state power conversion efficiency for a perovskite-organic tandem solar cell, setting a new world record for this category. The cells maintained 90% of their initial efficiency after 625 hours of continuous light-soaking and are compatible with solution-processed roll-to-roll printing. This breakthrough accelerates the practical application of next-generation flexible solar cells.

IN DEPTH

Key Findings

A research team spearheaded by Academician Li Yongfang and researcher Meng Lei at the Chinese Academy of Sciences Institute of Chemistry has set a new world record for perovskite-organic tandem solar cells, achieving a certified steady-state power conversion efficiency (PCE) of 28.04%. This groundbreaking achievement significantly pushes the efficiency limits in this tandem configuration while substantially enhancing device long-term stability. Notably, the cells retained 90% of their initial efficiency after 625 hours of continuous light-soaking and demonstrated compatibility with solution-processed roll-to-roll (R2R) printing, strongly propelling large-scale production and flexible device applications.

Technical and Manufacturing Details

- **Perovskite-Organic Tandem Structure:** This tandem solar cell employs a layered architecture, with a wide-bandgap perovskite layer on top and an organic solar cell layer beneath. The perovskite layer efficiently absorbs high-energy photons, while the organic layer complementarily absorbs lower-energy photons, maximizing the utilization of the entire solar spectrum for high efficiency. This combination also enables lightweight and flexible devices compared to traditional silicon-based tandems.
- **28.04% Steady-State PCE:** "Steady-state" PCE refers to the stable efficiency of a solar cell under continuous operation, which is considered more representative of practical performance than short-term peak efficiencies. The 28.04% record is the highest reported for perovskite-organic tandem solar cells globally, significantly elevating the performance benchmark for this specific technology category.
- **High Stability:** The devices exhibited remarkable stability, maintaining 90% of their initial efficiency after 625 hours of continuous light-soaking. This suggests that degradation pathways, such as photoinduced degradation and ion migration, have been effectively suppressed through optimized interfaces and bulk structures of both perovskite and organic materials.

- **Roll-to-Roll Printing Compatibility:** Compatibility with solution-processed roll-to-roll (R2R) printing is one of the most significant advantages for the commercialization of this technology. R2R printing enables low-cost, high-speed, and large-area manufacturing of flexible devices, holding immense potential for drastically reducing solar cell production costs.

Background and Context

Flexible solar cells are experiencing growing demand for diverse applications, including Building-Integrated Photovoltaics (BIPV), wearable devices, IoT sensors, and electric vehicles. The combination of perovskite and organic materials is highly promising for these markets due to its advantages in lightweight, flexibility, and semi-transparency. However, achieving both high efficiency and stability, alongside establishing scalable manufacturing techniques, has been a long-standing challenge. China is nationally committed to developing renewable energy technologies, particularly next-generation solar cells, and this achievement serves as a powerful impetus.

Strategic Significance and Outlook

The 28.04% PCE achieved by the Chinese Academy of Sciences team, combined with excellent stability and R2R printing compatibility, marks a substantial step towards the commercialization of perovskite-organic tandem solar cells. This technology holds the potential to introduce low-cost, high-performance flexible solar cells to the market, significantly expanding the scope of photovoltaic applications. Future efforts will likely focus on optimizing cost-efficiency in large-scale production, conducting further long-term field tests, and validating durability under various environmental conditions, with the expectation that this innovative technology will contribute significantly to the global clean energy transition.

Source: https://www.reddit.com/r/technology/comments/1vmcaxu/china_sets_a_new_world_record_for/

Collected: August 14, 2026 | Automated Research System (Gemini API)

#22 U.S. DOE Launches $3M Perovskite Startup Prize to Accelerate Commercialization of High-Efficiency Tandem and Flexible Modules for Residential Market

Published August 07, 2026 U.S. Department of Energy (DOE) USA

OVERVIEW

The U.S. Department of Energy's Solar Energy Technologies Office (SETO) has initiated the $3 million American-Made Challenges: Perovskite Startup Prize to expedite the development and manufacturing of perovskite solar cells by new U.S. companies. This competition aims to transition world-class research from labs into marketable products, focusing specifically on high-efficiency perovskite-on-silicon tandem cells and flexible all-perovskite tandem modules for the residential market. The initiative is designed to bolster domestic innovation and manufacturing capabilities in advanced solar technology.

IN DEPTH

Key Findings

The U.S. Department of Energy's (DOE) Solar Energy Technologies Office (SETO) has unveiled the "American-Made Challenges: Perovskite Startup Prize," a $3 million competition aimed at rapidly accelerating the development and manufacturing of perovskite solar cells by new U.S. companies. This prize seeks to bridge the gap between world-class research and commercially viable products, with a specific focus on high-efficiency perovskite-on-silicon tandem cells and flexible all-perovskite tandem modules designed for the residential market. The initiative is strategically designed to strengthen domestic innovation and manufacturing capacity within the advanced solar technology sector.

Technical and Manufacturing Details

- **Prize Focus Areas:** The competition targets two key perovskite solar cell technologies:
  - **High-Efficiency Perovskite-on-Silicon Tandem Cells:** These cells combine a perovskite layer on top of a conventional silicon solar cell, achieving efficiencies higher than silicon alone. This represents a practical pathway to boost performance by leveraging existing solar infrastructure.
  - **Flexible All-Perovskite Tandem Modules:** Lightweight and flexible, these modules are ideal for diverse residential applications, including rooftops, building facades, and other curved or non-load-bearing structures, offering broader deployment opportunities.
- **Accelerating Commercialization:** True to its "Startup Prize" designation, the program is designed to fast-track the entire product development lifecycle, from proof-of-concept in the lab to prototyping, testing, and ultimately market entry. Beyond financial awards, the prize offers mentorship and technical assistance to help startups overcome common commercialization hurdles.
- **Strengthening Domestic Manufacturing:** A core objective of this prize is to build and fortify the perovskite solar cell supply chain and manufacturing ecosystem within the United States. This will enhance U.S. competitiveness in solar technology and contribute to energy security.

Background and Context

Perovskite solar cells are considered a leading candidate for next-generation photovoltaic technology due to their potential for high conversion efficiencies and low-cost manufacturing. However, challenges related to long-term stability and scalability for mass production have historically impeded their commercialization. The U.S. has been actively investing in overcoming these barriers and fostering domestic development and manufacturing of clean energy technologies. SETO's prior funding for perovskite research and this new startup prize represent direct mechanisms to bring this technology to market.

Strategic Significance and Outlook

The "American-Made Challenges: Perovskite Startup Prize" is expected to stimulate significant innovation within the U.S. perovskite solar cell sector and facilitate the creation of new companies. This will lead to the availability of high-efficiency, durable perovskite products not only for the residential solar market but also for broader photovoltaic applications. Successful outcomes from this initiative will contribute substantially to achieving U.S. renewable energy targets and establishing domestic leadership in the clean energy economy, fostering job creation and technological advancement.

Source: https://www.energy.gov/cmei/systems/american-made-challenges-perovskite-startup-prize

Collected: August 14, 2026 | Automated Research System (Gemini API)

#23 Japanese BIPV Manufacturer Monochrome to Field-Test Perovskite PV Prototype at Over 5,000m Altitude to Assess Performance and Durability

Published August 12, 2026 pv magazine Global Japan

OVERVIEW

Japanese BIPV manufacturer Monochrome will conduct field trials of a perovskite PV prototype at altitudes exceeding 5,000 meters in Pakistan's Karakoram region. This expedition-integrated test aims to evaluate power-generation performance and durability under harsh, off-grid conditions, exploring the technology's potential for future Building-Integrated Photovoltaics (BIPV) applications. The prototype will be vital for providing power for practical uses like satellite communications, offering crucial insights into perovskite robustness.

IN DEPTH

Key Findings

Monochrome, a Japanese Building-Integrated Photovoltaics (BIPV) manufacturer, is embarking on an ambitious field trial to test a perovskite PV prototype at an altitude exceeding 5,000 meters in Pakistan's Karakoram region. This rigorous expedition-integrated test is designed to comprehensively assess the power-generation performance and long-term durability of perovskite technology under extremely harsh, off-grid conditions. The initiative represents a crucial step in exploring the viability and potential of perovskite solar cells for future BIPV applications. The prototype will be actively integrated into the expedition's power system for practical purposes, including critical satellite communications.

Technical and Experimental Details

- **High-Altitude Environment:** Operating above 5,000 meters subjects solar cells to extreme conditions: low temperatures, intense ultraviolet (UV) radiation, reduced atmospheric pressure, and significant diurnal temperature swings. Data collected on power conversion efficiency and physical durability (material degradation, condensation, mechanical stress resistance) under these stressors will be invaluable for understanding the limitations and capabilities of perovskite materials.
- **BIPV Application Focus:** As a BIPV manufacturer, Monochrome's interest is specifically in how perovskite solar cells can be integrated into building facades and roofing materials. Perovskite's inherent properties such as lightweight, flexibility, and potential transparency could significantly enhance the design freedom and applicability of BIPV solutions.
- **Off-Grid Utility:** The integration of the prototype into the expedition's power system serves as a direct, real-world validation of perovskite solar cell reliability and practicality in severe off-grid environments. Its use for mission-critical functions like satellite communication will rigorously test its robustness.
- **Prototype Testing:** The deployment of a prototype represents a vital validation step in the final stages of R&D. It allows for the evaluation of complex, synergistic environmental effects that cannot be fully replicated in laboratory simulations or accelerated aging tests.

Background and Context

Perovskite solar cells are gaining global attention as a next-generation photovoltaic technology due to their high efficiency potential and low-cost manufacturing processes. However, their long-term stability, particularly under harsh environmental conditions, has been a key challenge for commercialization. Japan is a leader in renewable energy technologies, especially in the BIPV sector. Field trials by companies like Monochrome provide critical data to determine the actual commercial viability of this technology, contributing to the industry's overall progress.

Strategic Significance and Outlook

Monochrome's high-altitude field trial of the perovskite PV prototype is expected to yield crucial insights into the durability and reliability of this technology. The data gathered will inform future material design, module manufacturing processes, and encapsulation techniques for perovskite solar cells. Particularly for the BIPV market, there is a growing demand for lightweight, flexible, and durable solar solutions, and Monochrome's efforts could accelerate the adoption of perovskite technology in this sector. This achievement also holds promise for off-grid power solutions in remote and extreme environments globally.

Source: https://www.pv-magazine.com/2026/08/12/perovskite-solar-tested-at-over-5000-m-altitude/

Collected: August 14, 2026 | Automated Research System (Gemini API)

#24 SCAPS-1D Simulation Analyzes Temperature Impact on Lead-Free CH3NH3SnBr3 Perovskite Solar Cells, Highlighting Performance Decrease Due to Increased Recombination

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OVERVIEW

A SCAPS-1D simulation study investigated the thermal effects on lead-free CH3NH3SnBr3 perovskite solar cells across a 270-400 K range, revealing significant performance degradation at higher temperatures. The study found a notable open-circuit voltage reduction and a net decrease in power conversion efficiency, primarily driven by increased charge carrier recombination, while short-circuit current remained stable. These findings underscore the critical need for precise thermal management and interface optimization to improve the stability and efficiency of these promising, environmentally friendlier devices.

IN DEPTH

Background

Lead-free perovskite solar cells are critically important from environmental, regulatory, and sustainability perspectives, offering a promising alternative to their lead-based counterparts. However, they often exhibit lower performance and inherent stability challenges compared to traditional lead-halide perovskites. This study specifically investigates CH3NH3SnBr3, a lead-free perovskite material that replaces toxic lead with tin (Sn). While environmentally friendlier, tin-based perovskites are prone to oxidation, which can compromise their long-term stability and efficiency under ambient conditions.

Understanding the impact of temperature fluctuations, a common occurrence in real-world operating environments, is therefore crucial for the practical application and successful commercialization of these devices. This research employs SCAPS-1D simulation to quantitatively analyze how temperature affects the performance of lead-free tin-perovskite solar cells, aiming to provide essential insights for optimized material design and device architecture to overcome these limitations.

Key Findings

This research utilized SCAPS-1D (Solar Cell Capacitance Simulator in One Dimension) simulations to perform a comprehensive analysis of thermal effects on lead-free CH3NH3SnBr3 perovskite solar cells. The simulations, which covered a temperature range of 270 K to 400 K (-3.15 °C to 126.85 °C), meticulously examined the electrical characteristics and impedance response of the devices. SCAPS-1D's capability to incorporate temperature-dependent material properties, such as bandgap shrinkage and changes in carrier mobility, was instrumental in this detailed analysis.

The study revealed several critical insights into the temperature dependence of device performance:

- **Significant Reduction in Open-Circuit Voltage (Voc):** Higher operating temperatures led to a notable decrease in Voc. This reduction is attributed to a combination of factors: increased bandgap shrinkage and intrinsic carrier concentration at elevated temperatures, which diminishes the built-in potential of the p-n junction, and enhanced thermal excitation leading to greater charge carrier recombination.

- **Stability of Short-Circuit Current Density (Jsc):** In contrast to Voc, the Jsc remained relatively stable across the studied temperature range. Jsc primarily depends on light absorption and charge generation, and while subtle bandgap changes do occur, their impact on the overall light absorption spectrum and subsequent current generation was found to be minimal.
- **Complex Behavior of Fill Factor (FF) and Net Decrease in Power Conversion Efficiency (PCE):** The fill factor initially showed a slight increase before significantly decreasing at higher temperatures. This ultimately resulted in a substantial net decrease in the power conversion efficiency (PCE). The simulations strongly indicated that the primary driver for this PCE reduction is an increase in charge carrier recombination rates, exacerbated by higher temperatures, alongside an increase in series resistance.

These findings provide clear guidelines for advancing lead-free CH3NH3SnBr3 perovskite solar cells. The study underscores the critical importance of precise thermal control and judicious interface optimization to mitigate recombination losses and enhance device performance and long-term stability. For researchers and engineers, this insight is vital for designing devices that are more thermally robust, capable of operating stably even under challenging environmental conditions. Future research directions will likely focus on developing perovskite compositions with improved intrinsic thermal stability, engineering optimized interfacial layers to suppress recombination pathways, and implementing advanced device architectures for efficient heat dissipation. Such advancements are crucial for accelerating the commercialization of lead-free perovskite solar cells and their widespread adoption in sustainable energy initiatives.

Source: https://www.mdpi.com/2673-4117/7/8/412

#25 U.S. DOE Strategically Reallocates $71M in Congressional Perovskite Funding to Drive Efficiency, Reliability, and Material Development

Published August 12, 2026 Innovation Waypoints USA

OVERVIEW

According to Garrett Nilsen, former SETO deputy director, the U.S. Department of Energy (DOE) is strategically reallocating $71 million in congressional funding for perovskite solar cell R&D to existing laboratory research and prior commitments. This funding supports critical areas such as efficiency, long-term reliability, durability, and new materials development. This strategic approach explains why specific funding opportunity announcements might appear smaller than the total congressional allocation, ensuring comprehensive advancement of perovskite technology.

IN DEPTH

Key Findings

According to Garrett Nilsen, former deputy director at the U.S. Department of Energy's (DOE) Solar Energy Technologies Office (SETO), the substantial $71 million in congressional funding allocated for perovskite solar cell research and development is being strategically distributed across existing laboratory research and prior commitments. This allocation is designed to bolster critical areas essential for the commercialization of perovskite technology, including enhancing efficiency, ensuring long-term reliability, improving durability, and fostering the development of new materials. This nuanced approach clarifies why individual funding opportunity announcements might appear smaller than the total congressional appropriation, reflecting a comprehensive strategy to support the multifaceted advancement of perovskite technology.

Technical and Manufacturing Details

- **Purpose of Funding Allocation:** The DOE's primary objective for this funding is to accelerate the commercialization of perovskite technology by addressing the following key technical challenges:
    - **Efficiency Enhancement:** Supporting fundamental and applied research aimed at scaling up world-record laboratory efficiencies to practical module-level performance.
    - **Long-Term Reliability:** Developing a deeper understanding of material degradation mechanisms and developing mitigation strategies to ensure perovskite solar cells can operate stably in outdoor environments for extended periods (e.g., 25+ years). This includes advancements in encapsulation, interface engineering, and defect passivation.
    - **Durability Improvement:** Pursuing material science approaches to enhance resistance against environmental stressors such as moisture, heat, and UV radiation.
    - **New Material Development:** Investing in research for lead-free perovskites, more stable perovskite compositions, and novel charge transport or electrode materials.

- **Integration with Existing Research:** SETO supports these areas not only through new funding opportunities but also via ongoing research contracts with national laboratories (like NREL), universities, and private sector companies. This ensures that continuity of research and accumulated expertise are leveraged to their maximum potential.
- **Strategic Reallocation:** The total congressional allocation is not disbursed entirely through new, open solicitations. A portion is designated for extending ongoing projects, fulfilling previously made funding commitments, or supporting specific strategic initiatives (e.g., American-Made Challenges), thereby providing systematic support across the entire research ecosystem.

Background and Context

Perovskite solar cells are globally recognized as a next-generation technology with the potential to significantly improve the efficiency and cost-effectiveness of solar power. The United States is strongly supporting this field at a governmental level to maintain international competitiveness and strengthen its domestic clean energy manufacturing base. The substantial congressional funding underscores the national importance of this technology, and its allocation process is complex, considering the long-term perspective of R&D and the utilization of existing research networks.

Strategic Significance and Outlook

The DOE's strategic allocation of funding for perovskite solar cell research is crucial for comprehensively addressing the technology’s key challenges and solidifying its path to commercialization. Continuous investment in diverse areas such as efficiency, reliability, durability, and material development will enable U.S. research institutions and companies to remain at the forefront of perovskite technology. Ultimately, these efforts are expected to lead to high-efficiency, low-cost perovskite solar cells making significant contributions to the U.S. energy mix and accelerating the achievement of renewable energy goals.

Source: https://innovationwaypoints.substack.com/p/where-does-the-money-actually-go

Collected: August 14, 2026 | Automated Research System (Gemini API)

#26 Nanjing University & Renshine Achieve 22% Certified Efficiency on Meter-Scale Perovskite Modules, Demonstrating Up to 5.81% Monthly Power Gain Over Silicon in Field Tests, Published in Nature

Published August 13, 2026 Pandaily China

OVERVIEW

A collaborative team from Nanjing University and Renshine has achieved a certified efficiency of 22% on meter-scale perovskite modules, with their findings published in Nature. Leveraging a novel solvent formulation and vacuum-assisted crystallization, the modules passed IEC61215/61730 reliability tests, showcasing enhanced stability. Field demonstrations from March to May 2026 revealed the perovskite system outperforming traditional silicon systems by 3.42% to 5.81% in monthly power output, marking a significant advancement in practical viability and competitiveness.

IN DEPTH

Key Findings

A research collaboration between Nanjing University and Renshine has achieved a groundbreaking certified efficiency of 22% for meter-scale perovskite modules, with their results published in the prestigious journal 'Nature'. This accomplishment addresses critical concerns regarding scalability and long-term stability, which have been major barriers to the commercialization of perovskite solar cells. Notably, field demonstrations conducted from March to May 2026 showed the developed perovskite system outperforming conventional silicon solar cell systems by 3.42% to 5.81% in monthly power generation, unequivocally proving its practical superiority and potential.

Technical Details

This breakthrough is primarily attributed to two innovative technical approaches. First, the development of a novel solvent formulation for module fabrication significantly improved the uniformity and quality of the perovskite crystalline layer. Second, the introduction of vacuum-assisted crystallization technology allowed for precise control over crystal growth, dramatically enhancing module stability under harsh conditions such as humidity, heat, and continuous illumination. Consequently, these meter-scale modules successfully passed rigorous international reliability standards, including damp-heat and thermal cycling tests specified by IEC61215 and IEC61730. This robust performance indicates that the perovskite modules possess the necessary durability for long-term outdoor deployment, a crucial step for market acceptance.

Background & Context

Perovskite solar cells have been hailed as the 'next-generation solar cells' due to their high theoretical efficiency and potential for low-cost manufacturing. However, a persistent challenge has been scaling up high-efficiency laboratory-scale cells to practical, large-area modules while maintaining long-term stability. The inherent susceptibility of perovskite materials to moisture and heat has been a significant impediment to their widespread outdoor adoption. The achievement by Nanjing University and Renshine represents a dual breakthrough in both scalability and stability, offering a solution that the industry has eagerly awaited. The demonstrated power generation advantage over silicon cells, particularly under cloudy and low-light conditions, suggests broad applicability across diverse climatic zones, further expanding market opportunities.

Strategic Significance & Outlook

The achievement of 22% certified efficiency on meter-scale perovskite modules, coupled with proven power generation superiority over silicon, marks a definitive stride towards the commercialization of perovskite solar cells. If this technology can transition to even larger-scale manufacturing, it has the potential to further drive down the cost of solar energy and accelerate the global energy transition. Combined with low-cost manufacturing techniques like roll-to-roll processing, new market segments such as flexible solar cells and Building-Integrated Photovoltaics (BIPV) are also poised for rapid adoption. This research re-establishes China's leadership in cutting-edge perovskite solar cell technology, promising a significant impact on the global renewable energy market.

Source: https://pandaily.com/nju-renshine-perovskite-module-22-percent-nature-lead-carboxylate-passivation-aug2026

Collected: August 14, 2026 | Automated Research System (Gemini API)

#27 Chinese Academy of Sciences Achieves World Record 28.04% Efficiency in Solution-Processable Perovskite-Organic Tandem Solar Cells, Demonstrating 90% Retention After 625 Hours

Published August 12, 2026 Pandaily China

OVERVIEW

A team led by Academician Yongfang Li and Researcher Lei Meng at the Chinese Academy of Sciences Institute of Chemistry has set a new world record for perovskite-organic tandem solar cells, achieving a certified steady-state power conversion efficiency of 28.04%. Reported in Nature, these cells maintained 90% of their initial efficiency after 625 hours of continuous illumination and are compatible with solution processing and roll-to-roll printing, paving the way for flexible, low-cost next-generation solar devices and advancing clean energy technology.

IN DEPTH

Key Findings

A team led by Academician Yongfang Li and Researcher Lei Meng from the Chinese Academy of Sciences Institute of Chemistry has established a new world record for perovskite-organic tandem solar cells, achieving a certified steady-state power conversion efficiency (PCE) of 28.04%. This groundbreaking achievement, reported in 'Nature,' demonstrates superior performance by combining two solution-processable semiconductor materials. Notably, the cell exhibited excellent stability, retaining 90% of its initial efficiency after 625 hours of continuous illumination. This marks a significant advancement in addressing the critical challenge of durability for the commercialization of perovskite solar cells.

Technical Details

This new record was achieved through the meticulous optimization of a tandem structure incorporating perovskite and organic semiconductor layers. The research team precisely controlled the material selection and interfacial engineering of each layer, leading to highly efficient charge transport and minimized energy losses. The integration of organic materials, in particular, proved effective in passivating defects within the perovskite layer and broadening the light absorption spectrum. The fabrication process for these cells is solution-based, allowing for near-room-temperature manufacturing. This offers substantial energy consumption and cost reductions compared to traditional silicon solar cell production. Furthermore, compatibility with roll-to-roll printing technology has been demonstrated, opening avenues for future large-scale and low-cost manufacturing.

Background & Context

Perovskite solar cells are emerging as a next-generation technology with the potential to surpass the theoretical efficiency limits of silicon solar cells. The tandem structure with organic materials specifically enables the development of flexible and lightweight devices, which are highly anticipated for new market segments such as Building-Integrated Photovoltaics (BIPV) and wearable electronics. China has been at the forefront of perovskite solar cell research and development globally, and this new world record reaffirms its technological leadership. While long-term stability has historically been a challenge for perovskite solar cells, the demonstrated 90% efficiency retention after 625 hours in this study represents a crucial step towards overcoming this hurdle and significantly boosts commercialization prospects.

Strategic Significance & Outlook

The combination of 28.04% high efficiency, excellent stability, and solution-processable manufacturing technology is set to accelerate the commercialization of perovskite-organic tandem solar cells. If large-scale manufacturing via roll-to-roll printing becomes feasible, it could dramatically reduce production costs, contributing significantly to the widespread adoption of renewable energy. This achievement by the Chinese Academy of Sciences further elevates China's role in the global clean energy transition. Future efforts will focus on further R&D and validating the durability and scalability of this technology for practical implementation, with market entry expected within the next few years.

Source: https://pandaily.com/cas-perovskite-organic-tandem-solar-cell-record-28-04-percent-aug2026

Collected: August 14, 2026 | Automated Research System (Gemini API)

#28 LONGi Invests ¥240 Million in 100 MW Silicon-Perovskite Tandem Solar Cell Pilot Line, Accelerating Commercialization After Achieving 35.5% Efficiency

Published August 12, 2026 Energytrend Taiwan

OVERVIEW

LONGi has announced a ¥240 million (approximately $33.8 million) investment to construct a 100 MW pilot production line for high-efficiency crystalline silicon-perovskite tandem solar cells in Xixian New Area, Shaanxi province. Following its recent achievement of 35.2% efficiency in May and 35.5% in July 2026, this pilot line represents a critical step in translating laboratory world records into pilot-scale verification for commercialization, thereby accelerating the market introduction of next-generation solar cell technology.

IN DEPTH

Key Findings

Leading solar manufacturer LONGi has announced a ¥240 million (approximately $33.8 million) investment for the construction of a 100 MW pilot production line dedicated to high-efficiency crystalline silicon-perovskite tandem solar cells in Xixian New Area, Shaanxi province. This strategic move follows LONGi's recent breakthroughs in power conversion efficiency, achieving 35.2% in May and an impressive 35.5% in July 2026. The pilot line is positioned as a critical step to transition laboratory world records into pilot-scale verification for commercialization, drawing significant industry attention as a benchmark for perovskite tandem technology mass production.

Technical Details

LONGi's crystalline silicon-perovskite tandem solar cells are designed to utilize the solar spectrum more efficiently by stacking two different bandgap photovoltaic materials, thus breaking through the efficiency limits of conventional single-junction silicon solar cells. The company's technological advancements are particularly notable in interfacial passivation and optical management layers, which reduce charge recombination losses between the perovskite and silicon layers, leading to high conversion efficiencies. The 35.5% record has been certified by the European Solar Test Installation (ESTI), with strong performance also reported for practical device sizes (e.g., 32.2% for 274 cm^2). This technology is theoretically capable of reaching 43% efficiency, promising further evolutionary improvements.

Background & Context

The global solar photovoltaic market constantly demands higher efficiency and lower costs. Perovskite tandem solar cells are widely regarded as the most promising next-generation technology due to their high theoretical efficiency and potential for low-cost manufacturing. Investments by major players like LONGi in pilot production lines signify that this technology is moving beyond pure research into a phase of practical implementation and mass production. China leads the world in solar PV research, development, and manufacturing, and LONGi's investment further solidifies this competitive advantage. The success of this pilot line is expected to have significant ripple effects, accelerating the adoption of perovskite tandem technology across the industry.

Strategic Significance & Outlook

The construction of a 100 MW pilot line is an essential step for LONGi, not only for technical validation but also for optimizing manufacturing processes, evaluating cost structures, and conducting long-term reliability assessments for commercial production. A successful pilot will establish LONGi as a market leader in perovskite tandem solar cells, potentially paving the way for future gigawatt-scale mass production. This, in turn, is expected to further reduce the levelized cost of solar electricity, accelerating the energy transition away from fossil fuels. Investors and energy companies are keenly interested in the data and progress from this pilot line, as its outcomes will be a critical determinant of the future direction of the next-generation solar cell market.

Source: https://www.energytrend.com/news/20260812-51921.html

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#30 DOE Reports Small Perovskite Solar Cell Efficiency Exceeds 26%, Tandem Near 34% in 2026; Fraunhofer ISE Achieves Over 33% on 210mm-Compatible Platform

Published August 11, 2026 Market.us USA

OVERVIEW

According to the U.S. Department of Energy (DOE), small perovskite solar cell efficiency surpassed 26% and perovskite-silicon tandem cells approached 34% in 2026. Furthermore, Germany's Fraunhofer ISE opened a new research platform in May 2026 capable of processing industrial cells up to 210x210mm, reporting efficiencies over 33% on laboratory devices. This marks a significant milestone towards commercial-scale perovskite production, highlighting rapid advancements in the technology.

IN DEPTH

Key Findings

Reports from the U.S. Department of Energy (DOE) indicate that by 2026, small perovskite solar cells achieved power conversion efficiencies exceeding 26%, with perovskite-silicon tandem cells reaching an astonishing near 34%. This rapid progression signals that perovskite technology, as a next-generation solar cell, is quickly approaching practical commercial viability. Concurrently, in May 2026, the Fraunhofer Institute for Solar Energy Systems (ISE) in Germany inaugurated a new research platform capable of processing industrial-sized cells (up to 210x210mm), reporting efficiencies exceeding 33% on its laboratory devices. These achievements collectively demonstrate that perovskite solar cells are moving beyond laboratory confines and making concrete strides towards large-scale production and market entry.

Technical Details

Perovskite solar cells are garnering significant interest as a potential replacement or complement to existing silicon solar cell technology, owing to their high photoelectric conversion efficiency and the potential for low-cost manufacturing. The perovskite-silicon tandem structure, in particular, holds a much higher theoretical efficiency limit than single-junction silicon cells, as it can efficiently absorb sunlight across a broader range of wavelengths. The recent achievements reported by the DOE and Fraunhofer ISE are the result of combined advancements in material science, device architecture, and manufacturing process optimization. Fraunhofer ISE's new platform is designed to accelerate the development of manufacturing technologies for large-area substrates, thereby contributing to solving the scalability challenges necessary for mass production. This infrastructure will further stimulate research into expanding module sizes while maintaining high efficiency.

Background & Context

The solar photovoltaic industry is becoming increasingly crucial in addressing climate change and ensuring energy security. While mature silicon technology faces diminishing returns in efficiency gains, perovskite technology is still in its early developmental stages, offering substantial room for improvement in both efficiency and cost. Global research institutions and corporations are investing heavily in perovskite solar cell development, and these announcements underscore the intensifying competition in the field. Reports emanating from advanced economies like the U.S. and Germany corroborate the global attention on perovskite technology and the strong policy support and R&D efforts driving its progress. Such technological advancements are indispensable for further reducing the levelized cost of electricity (LCOE) from solar PV and accelerating the energy transition.

Strategic Significance & Outlook

The 2026 reports from the DOE and Fraunhofer ISE strongly suggest that perovskite solar cells are poised for large-scale commercial market entry in the near future. The emergence of research platforms capable of handling industrial-sized cells is particularly crucial for bridging the gap between laboratory achievements and practical products. Future efforts will likely focus on evaluating the long-term stability of these high efficiencies in real-world outdoor environments, as well as further reducing manufacturing costs. Perovskite solar cells are expected to find diverse applications in Building-Integrated PV (BIPV), flexible devices, and even EV charging, promising significant transformation in the market and the future of energy production.

Source: https://market.us/press-release/perovskite-solar-cell-market/

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#31 Perovskite Connect 2025 Illuminates Robust Industry Ecosystem with Key Global Players

Published August 11, 2026 Perovskite-Info International

OVERVIEW

The Perovskite Connect 2025 conference review highlighted the vibrant ecosystem of key companies and research institutions spanning the entire perovskite solar cell value chain. Leading players such as Oxford PV, First Solar, Hanwha Q CELLS, Microquanta, Swift Solar, Perovskia Solar, and Enecoat Technologies participated, showcasing broad industry engagement from cell/module developers to material and equipment suppliers. This extensive collaboration underscores the perovskite technology's rapid transition from a research focus to a mature industrial sector.

IN DEPTH

Key Findings: Perovskite Connect 2025 Showcases a Maturing and Collaborative Perovskite Industry Ecosystem

A comprehensive review of the Perovskite Connect 2025 conference revealed a robust and interconnected ecosystem of leading companies and research institutions actively collaborating across the entire perovskite solar cell value chain. This convergence of diverse players—from material developers to module manufacturers and end-application specialists—underscores the industry's rapid transition from a nascent research field to a commercially viable and strategically important sector in the global energy landscape.

Participating Companies and Technical Domains

- **Cell and Module Developers:**
  - **Oxford PV:** A recognized leader, having shipped the world's first commercial perovskite-silicon tandem modules, driving high-efficiency advancements.
  - **First Solar:** A dominant player in thin-film solar, signaling its strategic interest in perovskite integration and future technology roadmaps.
  - **Hanwha Q CELLS:** A major photovoltaic manufacturer, expected to contribute significantly to perovskite mass production and market penetration.
  - **Microquanta:** Known for developing high-efficiency perovskite modules, pushing performance boundaries.
  - **Swift Solar:** Specializing in lightweight and flexible perovskite technology, targeting specialized markets like aerospace and mobile applications.
  - **Perovskia Solar:** A startup dedicated to the commercialization of perovskite solar cells, focusing on innovative product designs.
  - **Enecoat Technologies:** A Japan-based developer contributing to perovskite technology advancements.
- **Material Suppliers:** Numerous companies involved in the development and supply of organic and inorganic materials for perovskite layers, electron transport layers, and hole transport layers, crucial for enhancing performance and ensuring long-term stability.

- **Equipment Manufacturers:** Providers of essential manufacturing technologies such as coating, annealing, and encapsulation equipment, supporting the efficiency and scalability of mass production processes.
- **Research Institutions:** Extensive participation from universities and national laboratories, sharing insights from fundamental to applied research, fostering new technological breakthroughs.

Background & Industry Context

Perovskite solar cells are considered one of the most transformative advancements in solar energy research in recent decades, offering unprecedented efficiency potential and the promise of lower manufacturing costs compared to conventional silicon solar cells. However, their path to commercialization involves addressing challenges related to long-term stability, establishing scalable manufacturing processes, and navigating environmental regulations. Events like Perovskite Connect 2025 serve as critical platforms for sharing solutions, fostering academic-industrial collaboration, and accelerating the overall growth and maturation of the industry, bridging the gap between scientific discovery and market readiness.

Strategic Significance & Outlook

The broad participation observed at this conference suggests that perovskite solar cells have the potential to become a mainstream technology across various energy sectors, not just niche markets. As collaboration and competition intensify among key players, the evolution of material science, optimization of manufacturing processes, and continuous improvement in product reliability will be paramount. The partnerships forged and knowledge shared through such industry events are indispensable for shaping the roadmap of perovskite solar technology, ensuring its widespread market adoption, and making substantial contributions to global energy supply and sustainability goals.

Source: #

#32 Oxford PV to Detail 2024 World-First Commercial Shipment and >30% Efficiency Module Roadmap at Perovskite Connect 2026

Published August 06, 2026 Perovskite-Info Germany

OVERVIEW

The Perovskite Connect 2026 conference, scheduled for October 21-22 in Berlin, will highlight breakthroughs in the perovskite solar cell supply chain and applications. A key presentation will feature Oxford PV's Ed Crossland discussing the company's groundbreaking shipment of the world's first commercial perovskite-silicon tandem modules in 2024 and their roadmap for modules exceeding 30% efficiency. This announcement underscores the technology's transition into practical application and its significant potential for further performance enhancement, attracting considerable industry attention.

IN DEPTH

Key Findings: Perovskite Connect 2026 to Feature Oxford PV's Landmark 2024 Commercial Shipment and Vision for >30% Efficient Modules

The upcoming Perovskite Connect 2026 conference, set to take place on October 21-22 in Berlin, Germany, has been announced as a premier event focusing on the perovskite solar cell industry's supply chain, photovoltaic applications, latest innovations, materials, and processes. A highly anticipated highlight will be the keynote address by Ed Crossland of Oxford PV, who will elaborate on the company's monumental achievement of shipping the world's first commercial perovskite-silicon tandem modules in 2024, along with their strategic roadmap for introducing modules with conversion efficiencies exceeding 30% into the market. This marks a critical juncture for perovskite technology, transitioning from laboratory promise to a tangible commercial reality with a clear path to enhanced performance and wider market adoption.

Conference Focus and Key Presentations

- **Event Overview:** The conference aims to serve as a pivotal platform for sharing the latest insights and commercialization strategies in perovskite solar cells, drawing together a diverse array of stakeholders including researchers, engineers, investors, and policymakers.
- **Oxford PV's Significant Contributions:** Ed Crossland's presentation is particularly significant due to several factors:
    - **World-First Commercial Shipment in 2024:** Oxford PV's successful shipment of commercial perovskite-silicon tandem modules in 2024 represents a groundbreaking achievement. It signifies the technology's leap from the research lab to real-world market deployment, providing crucial validation of perovskite solar cells' reliability, manufacturability, and scalability.
    - **Roadmap for >30% Efficient Modules:** The outlined development roadmap for modules exceeding 30% conversion efficiency—surpassing the theoretical limits of conventional silicon solar cells—promises a revolutionary increase in solar energy production capacity. This capability means generating more power from a smaller footprint, thereby enhancing competitiveness, especially in high-value and space-constrained markets.

- **Broader Agenda:** The conference agenda will also delve into critical discussions on supply chain challenges, breakthroughs in novel materials, manufacturing process innovations, and advancements in application areas such as BIPV (Building-Integrated Photovoltaics) and flexible solar cells.

Background & Industry Context

Perovskite solar cell technology is widely regarded as the most promising next-generation photovoltaic solution, owing to its exceptional power conversion efficiency potential and the promise of significantly lower manufacturing costs. Perovskite-silicon tandem cells, in particular, hold the key to surpassing the long-standing Shockley-Queisser theoretical efficiency limit of single-junction silicon cells, potentially revolutionizing the current solar energy market. The achievements of companies like Oxford PV, leading early commercialization efforts and outlining ambitious efficiency roadmaps, demonstrate the rapid maturation of this technology and its readiness for large-scale market penetration, setting new benchmarks for the industry.

Strategic Significance & Outlook

Perovskite Connect 2026 is poised to be an indispensable event in shaping the next phase of perovskite solar cell commercialization. Oxford PV's disclosures will likely serve as a benchmark for other companies and research institutions, intensifying the global race to develop even more efficient and stable modules. Moving forward, key challenges will include further improving material stability, achieving additional manufacturing cost reductions, and ensuring compliance with international regulatory standards for widespread adoption. This conference will provide a vital opportunity to foster international collaboration and innovation necessary to address these challenges and accelerate the deployment of perovskite solar cell technology to contribute substantially to global energy security and sustainability.

Source: #

#33 Enecoat Technologies to Showcase Perovskite Solar Cells in Concept Exhibition at GREEN×EXPO 2027

Published Published August 06, 2026　株式会社エネコートテクノロジーズ　Japan

OVERVIEW

Japanese firm Enecoat Technologies will present a concept exhibition of its innovative perovskite solar cells at the GREEN×EXPO 2027 International Horticultural Exhibition. This showcase aims to demonstrate the technology's potential for sustainable urban development, highlighting its practical applications and contributions to future energy landscapes for a global engineering audience.

IN DEPTH

Enecoat Technologies to Unveil Next-Generation Perovskite Solar Cells at GREEN×EXPO 2027

Enecoat Technologies, a Japanese innovator in renewable energy, has announced plans for a concept exhibition of its proprietary perovskite solar cells. The showcase will take place at the "Yokohama City Communication Hub" during the highly anticipated GREEN×EXPO 2027 International Horticultural Exhibition. This strategic display aims to highlight how advanced solar cell technology can profoundly impact urban environments and sustainable living, offering a glimpse into the future of decentralized, high-efficiency renewable energy solutions.

Perovskite Technology: A New Frontier for Sustainable Urbanization

Perovskite solar cells represent a significant leap forward from conventional silicon-based photovoltaics, offering compelling advantages crucial for global energy transition efforts. Enecoat Technologies' perovskite cells are distinguished by their lightweight profile, inherent flexibility, and high conversion efficiency. These characteristics make them exceptionally well-suited for a diverse range of applications, particularly Building-Integrated Photovoltaics (BIPV), where they can be seamlessly integrated into building facades, windows, and lightweight structural elements.

Beyond their aesthetic and structural integration capabilities, perovskites boast lower manufacturing costs and greater design versatility compared to silicon. Their potential for higher conversion efficiencies—especially in non-ideal conditions—positions them as a transformative technology for expanding renewable energy sources within dense urban landscapes and addressing space-constrained installations. This technological promise is critical as climate change mitigation and energy independence drive the global imperative for widespread solar adoption.

Showcasing Innovation at GREEN×EXPO 2027

GREEN×EXPO 2027, an international exposition dedicated to sustainability and cutting-edge environmental technologies, provides an unparalleled platform for Enecoat Technologies to debut its perovskite solar solutions. Exhibiting at such a prestigious event underscores the escalating global interest and anticipation for the practical implementation and evolution of next-generation renewable energy technologies. It serves to raise critical awareness among a broad spectrum of stakeholders, from the general public to industry leaders and policymakers.

For Enecoat Technologies, a Japanese company, this showcase also signifies Japan's commitment to advancing renewable energy and reinforces its position as a competitive leader in the global technological landscape. The exhibition is designed to concretely demonstrate the unique features and practical applications of these cells, highlighting their role as a viable, next-generation energy solution.

Enecoat's R&D Focus on Stability and Scalability

Enecoat Technologies is at the forefront of addressing key challenges in perovskite solar cell commercialization: long-term stability and manufacturing scalability. Through its unique technological approaches, the company is actively refining its perovskite formulations and production processes. The GREEN×EXPO 2027 exhibit will offer attendees a valuable insight into these ongoing R&D achievements, generating momentum for further technological breakthroughs and accelerating market penetration for perovskite-based energy solutions.

Strategic Vision and Future Impact

The exhibition at GREEN×EXPO 2027 represents a pivotal moment for Enecoat Technologies' perovskite solar cells, marking a crucial step towards wider public acceptance and commercial deployment. The anticipated feedback and interest generated from this global platform are expected to significantly influence the company's future technological development, foster strategic partnerships, and shape product deployment strategies.

Looking beyond the conceptual demonstrations at the 2027 expo, Enecoat envisions the seamless integration of perovskite solar cells into actual buildings and critical infrastructure. This widespread adoption is projected to make substantial contributions to realizing a lower-carbon and more sustainable society by diversifying energy sources and enhancing energy independence. The exhibition will serve as a clear articulation of the concrete solutions and transformative future prospects offered by this groundbreaking next-generation solar cell technology.

Source:
https://enecoat.com/news/2027%E5%B9%B4%E5%9B%BD%E9%9A%9B%E5%9C%92%E8%8A%B8%E5%8D%9A2027%EF%BC%89%E3%80%8C%E6%A8%AA%E6%B5%9C%E5%B8%82%E7%99%BA%E4%BF%A1%E6%8B%A0%

Collected: August 14, 2026 | Automated Research System (Gemini API)