PerovskiteSolarCells

Weekly Intelligence Report

2026-06-27 | 28 articles | 7 countries

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This Week's Keyword

Perovskite Tandem Scale

Commercialization & efficiency records surge

34.85	30	0.29	GW
%	%	$/W	scale
Record Cell Efficiency	Record Module Efficiency	Projected Mfg Cost	Production Capacity

All 28 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	Oxford PV 25.6% Module	New Product	4	4	4	4	4	Oxford PV & Fraunhofer ISE achieve 25.6% module efficiency with shingled perovskite-silicon tandem.
#02	Oxford PV Gen-3 Cells	New Product	3	4	4	4	4	Oxford PV unveils Gen-3 tandem cells targeting 26% efficiency and 15-year lifespan at Intersolar Europe.
#03	High-Purity C60 Needs	Research	2	3	3	3	3	High-purity C60 becomes critical for perovskite solar cell commercialization due to material requirements.
#04	LONGi 34.85% Record	Market Overview	4	4	4	4	4	LONGi achieves 34.85% record; Oxford PV ships 24.5% modules to US; $0.29/W cost projected.
#05	22.36% 3D/2D Hybrid	Research	4	2	3	4	3	International team develops 22.36%-efficient 3D/2D hybrid perovskite modules with enhanced stability.
#06	Kuramoto Investment	Corporate Strategy	1	3	2	2	2	Kuramoto Seisakusho stock surges after investment agreement with Hong Kong firm for perovskite business.
#07	Back-Contacted Stability	Research	4	2	3	4	3	Back-contacted single-crystal perovskite solar cells show promise for enhanced stability by suppressing degradation.
#08	U Tokyo Lead-Free PV	Research	4	1	3	4	3	U Tokyo generates record-high quantum-geometric photocurrent in lead-free perovskite CsGeI3 for sustainable PV.
#09	Trina Solar Commercial	New Product	4	4	4	4	4	Trina Solar secures first commercial order for 29.2% efficient, 907W perovskite-silicon tandem modules.
#10	Cornell Agrivoltaics	Research	3	2	4	4	4	Cornell calculates perovskite tandem agrivoltaics could offset 30.9M tons CO2e, save 840M m³ water in US.
#11	Aerogel for Displays	Research	4	2	3	4	3	Silica aerogel encapsulation of CsPbX3 nanocrystals overcomes stability issues for perovskite displays.
#12	S-Block Cation Doping	Research	4	2	3	4	3	S-block cation doping dramatically boosts PLQY and stability in lead-free perovskites for optoelectronics.

#	Article Title	Type	Tech Novelty	Market Proximity	Market Impact	Data Reliability	US/EU Relevance	Summary
#13	China Smart PV List	Corporate Strategy	●●●●○	●●●●○	●●●●○	●●●○○	●●●●○	China selects GCL Optoelectronics (>26.8% mass production) and Quzhou FiberNano (5GW) for Smart PV List.
#14	Lead-Free Memristor	Research	●●●●○	●●○○○	●●○○○	●●●●○	●●●○○	Flexible lead-free perovskite memristor achieves 8-month stability, 600 bending cycles for bionic perception.
#15	JinkoSolar 34.82% Rec	Research	●●●●○	●●●○○	●●●●○	●●●●○	●●●●○	JinkoSolar achieves 34.82% world record efficiency for N-type TOPCon perovskite-silicon tandem cell.
#16	IPVF 31% Ambient Air	Research	●●●●○	●●○○○	●●●●○	●●●●○	●●●●○	IPVF & TU Delft achieve 31% efficiency with 4cm² perovskite/silicon tandem cell processed in ambient air.
#17	7200 cm² IEC Certified	New Product	●●●○○	●●●○○	●●●○○	●●●●○	●●●○○	7200 cm² perovskite module achieves 17.2% efficiency, IEC certification with slot-die coating, green solvents.
#18	Japan National Strategy	Corporate Strategy	●○○○○	●●●○○	●●●○○	●●○○○	●●○○○	Japanese government designates perovskite solar cells as national strategy for 2030s rollout.
#19	Tiny Pyramids 30% Eff	Research	●●●●○	●●○○○	●●●○○	●●●●○	●●●○○	Tiny pyramids boost perovskite/silicon tandem efficiency to 30%, enhancing flexibility and durability.
#20	US Next-Gen Solar Mkt	Market Overview	●●○○○	●●●●○	●●●●○	●●●○○	●●●●○	US next-gen solar market heats up: DOE commits $40M, Oxford PV begins commercial tandem supply.
#21	Oxford PV 'Disruptor'	Corporate Strategy	●●○○○	●●●●○	●●●●○	●●○○○	●●●●○	Oxford PV CEO: Perovskite tandem solar cells are 'stealth disruptor' to reach GW production by 2028.
#22	Cascade Hole-Transfer	Research	●●●●○	○○○○○	●●●○○	●●●●○	●●●○○	Nature Energy reports 'cascade hole-transfer strategy' dramatically boosts long-term stability in perovskite solar cells.
#23	Japan Energy Indep.	Corporate Strategy	●●○○○	●●●○○	●●●○○	●●○○○	●●○○○	Sekisui Chemical, Panasonic, Toshiba, EneCoat lead Japan's perovskite solar cell development for energy independence.
#24	UtmoLight BIPV Modules	New Product	●●●○○	●●●●○	●●●○○	●●●●○	●●●○○	UtmoLight unveils high-strength (5400Pa) and ultra-light (4kg) perovskite solar modules for BIPV market.
#25	HZB Predict Stability	Research	●●●●○	●●○○○	●●●○○	●●●●○	●●●●○	HZB & HTW Berlin develop novel method to predict long-term stability of perovskite solar cells, enhancing testing.
#26	30% Tandem Module	New Product	●●●●○	●●●●○	●●●●○	●●●●○	●●●●○	Perovskite-silicon tandem module breaks 30% efficiency barrier, achieving over 900W peak power.
#27	Microquanta Colored	New Product	●●●●○	●●●●○	●●●●○	●●●●○	●●●●○	Microquanta launches 26%-efficient colored perovskite-silicon tandem modules for BIPV with 25-year warranty.
#28	Hanwha Qcells US Hub	Corporate Strategy	●●●○○	●●●●○	●●●●○	●●●○○	●●●●○	Hanwha Qcells completes US "Solar Hub" and builds perovskite tandem pilot line in South Korea.

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

Three Questions That Demand Your Decision This Week

❶ Is your PV strategy ready for 30%+ modules?

China's LONGi, JinkoSolar, and others are pushing tandem efficiencies past 30% at cell and module levels, with GW-scale production. How will this impact your product roadmap and market positioning in the next 2-3 years?

❷ Can EU/US manufacturing scale fast enough?

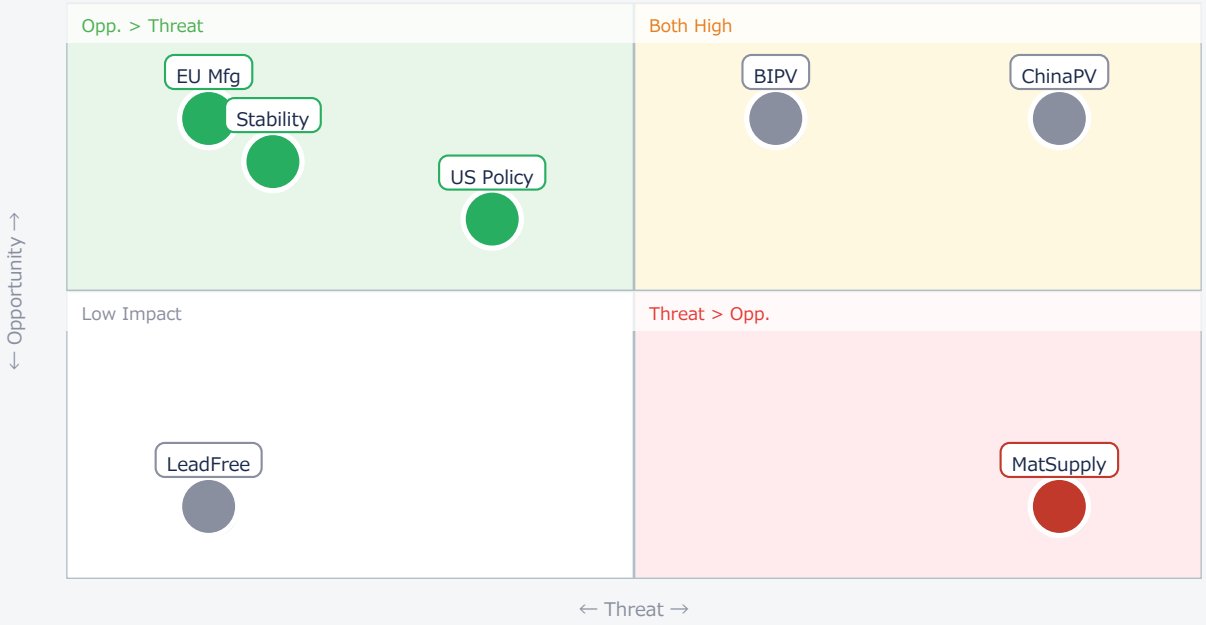
European R&D; (Oxford PV, IPVF/TU Delft) shows promise for scalable, ambient-air processing and GW targets by 2028. US DOE funding and Hanwha's hub signal intent. Are these efforts sufficient to counter Asian dominance?

❸ Are your material supply chains secure for next-gen PV?

The demand for high-purity C60 and other specialized materials is surging for commercial perovskites. Are you assessing the reliability and geopolitical risks of your material suppliers for these critical components?

Opportunities vs. Threats for US/European Companies

Opportunity vs. Threat Matrix for US/European Companies



Item	Quadrant	↑ Opportunity	↓ Threat
ChinaPV	Critical	New tech access	Market dominance
BIPV	Critical	New markets	Design pressure
EU Mfg	Opp.	Local production	—
US Policy	Opp.	Incentives	—
Stability	Opp.	Product life	—
MatSupply	Threat	—	Bottlenecks
LeadFree	Ref.	Sustain PV	—

Deep Dive ① — Perovskite Tandem: Records & Market Entry

#04 | 2026/06/18 | Energy Solutions Intelligence | Tech Novelty●●●●○ Proximity●●●●○ Market Impact●●●●● Data Reliability●●●●○ US/EU Relevance●●●●○

LONGi achieved an NREL-certified world-record 34.85% efficiency for perovskite-silicon tandem cells, while Oxford PV began shipping 24.5%-efficient commercial modules to the U.S. market in late 2024. Utility-scale deployment is projected for 2027-2029.

Manufacturing costs are expected to drop to $0.29/W, making this technology highly competitive. This dual progress in record-breaking efficiency and initial commercial shipments signals a major shift in the global solar market.

▶ Strategic Analyst's Perspective

Strategic Analyst's Perspective: The 34.85% cell efficiency is a lab record, but Oxford PV's 24.5% commercial module shipment to the US is a tangible market entry. The $0.29/W cost projection is aggressive but achievable with scale. Technical barriers remain in long-term stability and large-area uniformity for mass production. [Opportunity] for US/EU OEMs to integrate these high-efficiency cells, and for IP holders to license advanced designs. [Threat] for existing silicon PV manufacturers if they cannot rapidly adopt tandem technology or compete on cost/efficiency. Next actions: [R&D;] benchmark current product roadmaps against 30%+ efficiency targets; [Procurement] identify potential suppliers for tandem modules and assess cost competitiveness by Q4 2026.

Deep Dive ② — 30% Perovskite Tandem Module Breakthrough

#26 | 2026/06/18 | Vmaxpower PV | Tech Novelty●●●●○ Proximity●●●●○ Market Impact●●●●● Data Reliability●●●●○ US/EU Relevance●●●●○

At SNEC 2026, industrial-standard size (~3.1m²) perovskite/silicon tandem modules achieved over 900W peak power and >29% aperture efficiency, certified by a third party. This marks the first time tandem module efficiency officially exceeded 30%.

GW-scale production lines are operational in China, and multiple MW-scale perovskite PV power plants have operated stably for over a year. This establishes a strong foundation for rapid commercialization and market disruption.

▶ Strategic Analyst's Perspective

Strategic Analyst's Perspective: Achieving 30% efficiency at the module level for industrial sizes is a critical milestone, moving beyond lab-scale records. The 900W+ output is highly attractive for space-constrained installations. The claim of GW-scale production and stable MW-scale plant operation for over a year is significant but requires independent verification of long-term degradation rates. [Opportunity] for US/EU OEMs to partner with or acquire companies demonstrating such module performance and manufacturing readiness. [Threat] for US/EU PV manufacturers who lack a clear roadmap to 30%+ module efficiency and large-scale production, risking market share loss to Asian competitors. Next actions: [Strategy] conduct a detailed competitive analysis of Chinese perovskite module manufacturers by Q3 2026; [R&D;] initiate internal projects to validate and replicate 30% module efficiency on industrial scales by mid-2027.

Deep Dive ③ — Scalable Perovskite Mfg in Ambient Air

#16 | 2026/06/19 | Perovskite-Info | Tech Novelty●●●●○ Proximity●●○○○ Market Impact●●●●○ Data Reliability●●●●○ US/EU Relevance●●●●●

IPVF (France) and TU Delft (Netherlands) demonstrated a certified 31% power conversion efficiency for a 4 cm² perovskite/silicon tandem cell. Crucially, this was achieved using industrially scalable slot-die coating in ambient air.

Processing in ambient air eliminates the need for expensive inert gas environments, significantly reducing manufacturing costs and complexity. This breakthrough addresses a major hurdle for scaling high-efficiency tandem solar cell production.

▶ Strategic Analyst's Perspective

Strategic Analyst's Perspective: Achieving 31% efficiency with ambient-air slot-die coating is a significant technical leap, particularly for European research. This process is highly compatible with roll-to-roll manufacturing, offering a pathway to low-cost, high-volume production. While 4 cm² is still a lab scale, the method's industrial relevance is high. Technical barriers include scaling up to full module sizes while maintaining uniformity and efficiency, and ensuring long-term stability under ambient conditions. [Opportunity] for US/EU materials & equipment suppliers to develop compatible green solvents and high-throughput slot-die systems. [Threat] for companies relying on vacuum or inert-atmosphere processing, as this could rapidly lower manufacturing costs for competitors. Next actions: [R&D;] evaluate slot-die coating and ambient-air processing for perovskite layers; [Procurement] investigate suppliers of industrial-scale slot-die coating equipment and compatible materials by Q4 2026.

Other Notable Articles

Trina Solar Secures First Commercial Order for Perovskite-Silicon Tandem Modules in New Zealand (Metalgrass LTD)
Tech Novelty●●●●○ Proximity●●●●● Market Impact●●●●○

Trina Solar's 29.2% efficient, 907W tandem modules secure first commercial order, signaling market readiness.

China Selects GCL Optoelectronics and Quzhou FiberNano's Perovskite Projects for 2026 National Smart PV List (PV Magazine (implied from content))
Tech Novelty●●●●○ Proximity●●●●○ Market Impact●●●●●

China's national strategy supports >26.8% mass production (GCL) and 5GW ecosystem (FiberNano), accelerating industrialization.

Microquanta Launches 26%-Efficient Colored Perovskite-Silicon Tandem Modules for BIPV at Intersolar Europe, Commercialized with 25-Year Output Warranty (pv magazine Global)
Tech Novelty●●●●○ Proximity●●●●● Market Impact●●●●○

Microquanta's 26% efficient colored BIPV modules with 25-year warranty offer aesthetic and high-performance solutions.

U.S. Next-Gen Solar Market Heats Up: DOE Commits $40M, Oxford PV Begins Commercial Tandem Supply (openPR.com)
Tech Novelty●●○○○ Proximity●●●●● Market Impact●●●●○

US market sees significant DOE funding and Oxford PV commercial shipments, intensifying competition and driving adoption.

Oxford PV and Fraunhofer ISE Achieve 25.6% Module Efficiency with Shingled Perovskite-Silicon Tandem Solar Cells (PV Magazine)
Tech Novelty●●●●○ Proximity●●●●○ Market Impact●●●●○

Oxford PV and Fraunhofer ISE achieve 25.6% module efficiency with innovative shingled design, reducing losses and improving shade tolerance.

Recommended Actions This Week

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

Immediate (this week)

- [Executive] Review competitive intelligence on Chinese perovskite module efficiency and production scale, specifically 30%+ modules and GW capacity.
- [R&D;] Assess internal perovskite stability roadmaps against new 'cascade hole-transfer' and accelerated degradation testing methods from HZB/HTW Berlin.

Short-term (1 month)

- [Procurement] Initiate risk assessment for high-purity C60 and other critical perovskite material suppliers, especially non-Western sources, to identify potential bottlenecks.
- [Strategy] Evaluate potential M&A; or partnership opportunities with European perovskite R&D; leaders (e.g., Oxford PV, IPVF) to leverage ambient-air processing and shingled designs.
- [Business Dev] Analyze market demand for colored, flexible, and high-strength BIPV perovskite modules in key US/EU regions, considering offerings from Microquanta and UtmoLight.

Medium-long term (quarter+)

- [R&D;] Develop pilot lines for tandem module integration, focusing on scalable processes like slot-die coating and shingled designs to achieve >28% module efficiency by 2027.
- [Strategy] Formulate a 5-year strategy to establish domestic or allied-country supply chains for perovskite materials and manufacturing, leveraging US/EU incentives like the IRA.
- [Legal/IP] Monitor IP landscape for perovskite manufacturing processes (e.g., ambient air, slot-die) and advanced material compositions, particularly from Asian competitors, to protect future market positions.

PerovskiteSolarCells — Selected Articles

Date: 2026-06-27

Articles: 28

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#19 Tiny Pyramids Boost Perovskite/Silicon Tandem Efficiency to 30%, Enhancing Flexibility and Durability

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#21 Oxford PV CEO States Perovskite Tandem Solar Cells are 'Stealth Disruptor' to Reach Gigawatt Production by 2028 at Intersolar Europe 2026

#22 Nature Energy Paper Reports 'Cascade Hole-Transfer Strategy' Dramatically Boosts Long-Term Stability in Perovskite Solar Cells

#23 Driving Japan's Energy Independence: Sekisui Chemical, Panasonic, Toshiba, EneCoat Lead Perovskite Solar Cell Development

#24 UtmoLight Unveils High-Strength (5400Pa Load) and Ultra-Light (4kg) Perovskite Solar Modules at SNEC 2026, Bolstering BIPV Market

#25 HZB and HTW Berlin Develop Novel Method to Predict Long-Term Stability of Perovskite Solar Cells, Enhancing Accelerated Degradation Testing

#26 Perovskite-Silicon Tandem Module Breaks 30% Efficiency Barrier at SNEC 2026, Achieving Over 900W Peak Power

#27 Microquanta Launches 26%-Efficient Colored Perovskite-Silicon Tandem Modules for BIPV at Intersolar Europe, Commercialized with 25-Year Output Warranty

#28 Hanwha Qcells Completes U.S. "Solar Hub" in Cartersville, Georgia, While Building Perovskite Tandem Pilot Line in South Korea

#01 Oxford PV and Fraunhofer ISE Achieve 25.6% Module Efficiency with Shingled Perovskite-Silicon Tandem Solar Cells

Published June 18, 2026 PV Magazine Germany

OVERVIEW

Oxford PV, in collaboration with Fraunhofer ISE, has announced a breakthrough 25.6% module conversion efficiency for perovskite-silicon tandem solar cells utilizing an innovative shingled architecture. This 'Matrix Shingle' design significantly reduces internal resistance losses and eliminates the need for copper interconnects, enhancing overall module performance and simplifying manufacturing. The technology also improves resilience to partial shading, promising more stable energy output in real-world conditions. This achievement moves Oxford PV closer to its ambitious roadmap, which includes commercializing 26%-efficient products this year and reaching over 30% efficiency with extended lifespans by 2027.

IN DEPTH

Key Findings

Oxford PV, in a significant collaboration with Germany's Fraunhofer Institute for Solar Energy Systems (ISE), has achieved a remarkable 25.6% module conversion efficiency for perovskite-silicon tandem solar cells. This breakthrough is attributed to an innovative shingled architecture, representing a critical advancement towards the commercialization of next-generation high-efficiency photovoltaic technology.

Technical / Clinical Details

The 25.6% efficiency was achieved using a novel module design dubbed 'Matrix Shingle.' This architecture involves overlapping and connecting individual solar cells, a technique that drastically minimizes resistive losses commonly associated with traditional wire-grid configurations. A key benefit of this shingled approach is the elimination of copper interconnects within the module, leading to both reduced manufacturing complexity and potential cost savings. Furthermore, the shingled design offers improved performance under partial shading conditions, a common challenge in real-world installations where objects like trees or adjacent buildings can cast shadows. This enhanced resilience ensures more consistent energy generation, making the modules more reliable and effective across diverse environmental settings.

Background & Context

Perovskite solar cells are at the forefront of photovoltaic research due to their potential to surpass the theoretical efficiency limits of conventional silicon solar cells. Tandem configurations, which stack a perovskite cell atop a silicon cell, are particularly promising as they can more effectively capture a broader spectrum of sunlight, thereby boosting overall conversion efficiency. Oxford PV has been a pioneer in this field, having previously announced a 26.9%-efficient perovskite-silicon tandem module in June 2024. The latest achievement with the shingled design addresses the critical challenge of translating laboratory-scale cell efficiencies into commercially viable, high-performance modules. Bridging this gap is essential for the widespread adoption of perovskite technology.

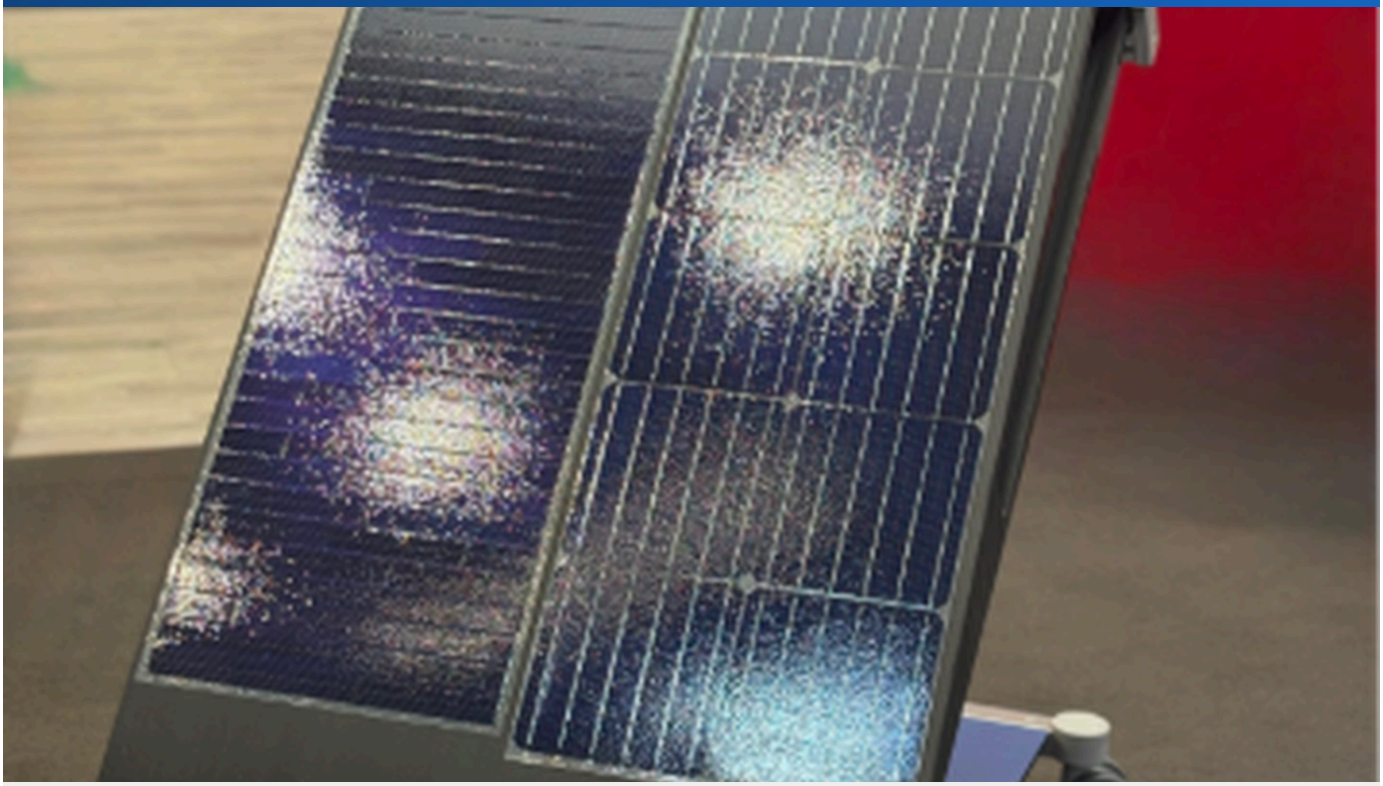
Strategic Significance & Outlook

Oxford PV has outlined an aggressive roadmap, planning to release 26%-efficient products to the market within the current year and aiming for over 30% efficiency with a 30-year operational lifespan by 2027. The success with the shingled module design significantly bolsters the feasibility of these ambitious targets. By reducing internal losses and improving shade tolerance, this technology expands the range of suitable deployment sites for solar energy systems, potentially accelerating the global transition to renewable energy. Such advancements could see perovskite-silicon tandem modules adopted in a broad array of applications, from residential rooftops to large-scale utility projects, setting new benchmarks for solar energy generation.

Source: https://www.pv-magazine.com/2026/06/18/oxford-pv-achieves-25-6-efficiency-for-perovskite-silicon-tandem-module-based-on-shingled-design/

#02 Oxford PV Unveils Gen-3 Tandem Solar Cells Aiming for 26% Efficiency and 15-Year Lifespan at Intersolar Europe 2026

Published June 23, 2026 PES Wind UK



OVERVIEW

Oxford PV showcased its latest third-generation (Gen-3) tandem solar cell technology at The smarter E Europe / Intersolar Europe 2026 in Munich, targeting mainstream and specialty applications. The company anticipates its new prototypes will achieve 26% module efficiency and a 15-year operational lifespan, aligning with its long-term roadmap to reach 30% efficiency and a 30-year lifetime by the end of 2030. These advancements signal perovskite solar cells are evolving to offer performance and reliability comparable to or exceeding traditional silicon technologies, boosting prospects for widespread commercialization.

IN DEPTH

Key Findings

Oxford PV presented its latest Gen-3 tandem solar cell prototypes at Intersolar Europe 2026, announcing expected module efficiencies of 26% and an operational lifetime of 15 years. This demonstration highlights the critical progress in transitioning perovskite solar cell technology from laboratory benchmarks to robust, market-ready products capable of meeting mainstream performance and reliability standards.

Technical / Clinical Details

The Gen-3 prototypes integrate perovskite layers with crystalline silicon, creating a tandem structure designed to harness a broader spectrum of sunlight more efficiently than single-junction cells. This hybrid approach enables significantly higher power conversion efficiencies. Beyond the impressive 26% module efficiency target, Oxford PV is emphasizing a 15-year stable operational lifespan, a crucial factor for assuring product reliability and economic viability in commercial applications. This progress is a result of concerted efforts in optimizing material science, device architecture, and manufacturing processes. The company's ambitious technology roadmap aims to achieve over 30% module efficiency and a 30-year operational lifetime by the end of 2030, positioning the Gen-3 prototype as a key stepping stone towards these long-term goals.

Background & Context

Perovskite solar cells have witnessed a dramatic increase in laboratory efficiencies over the past decade, now holding the potential to surpass the established limits of silicon photovoltaics. However, widespread commercialization hinges on overcoming challenges related to cost-effective large-scale manufacturing, long-term stability, and module durability. Showcasing specific performance targets and a clear roadmap at major industry events like Intersolar Europe is vital for building confidence among investors and potential customers, demonstrating the technology's maturity and future prospects. Oxford PV, as a frontrunner in this field, continues to provide tangible solutions to these inherent challenges.

Strategic Significance & Outlook

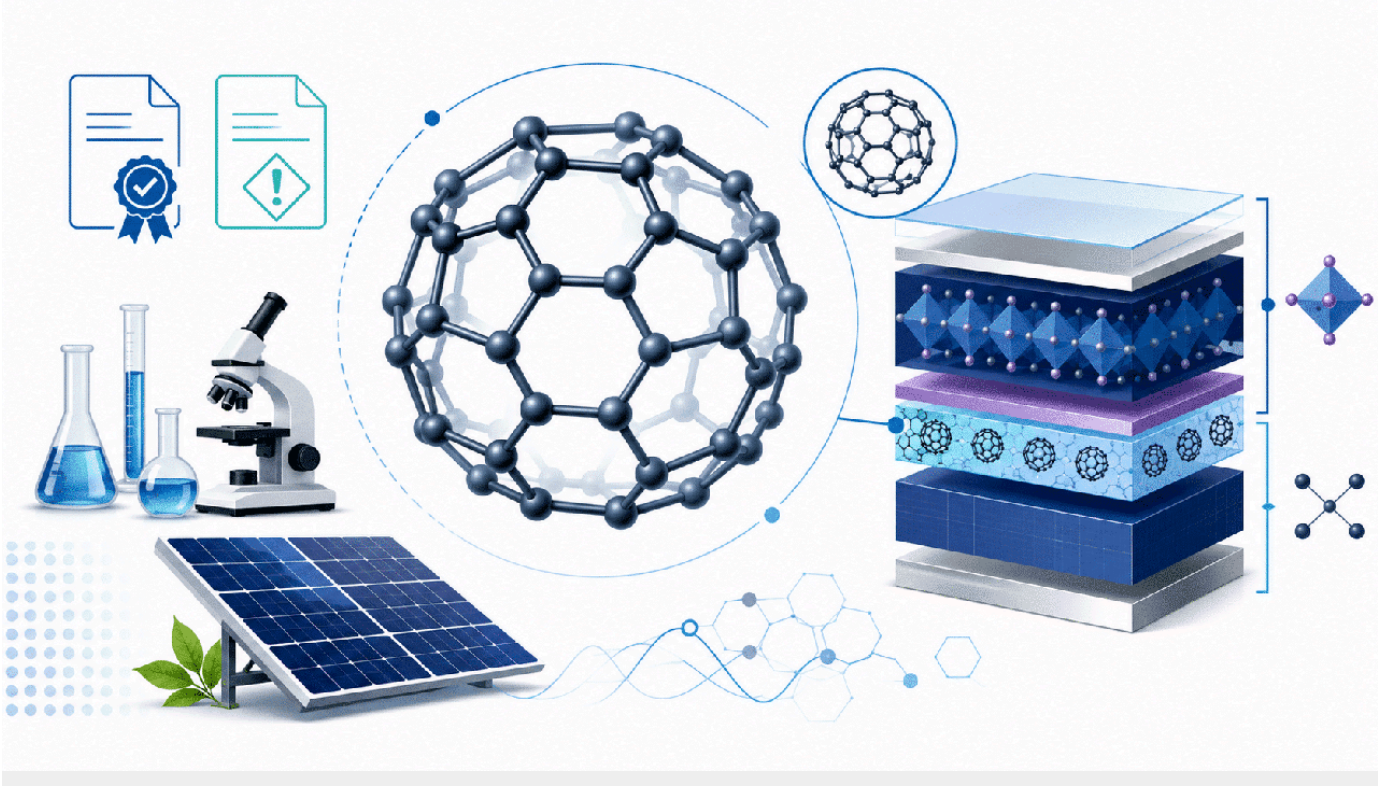
The anticipated 26% module efficiency and 15-year operational lifespan of Oxford PV's Gen-3 prototypes are set to accelerate their entry into the mainstream solar market. Higher efficiencies translate to more power generated from a smaller footprint, offering substantial advantages for residential and commercial rooftop installations, as well as specialized applications like Building-Integrated Photovoltaics (BIPV). Furthermore, ensuring a long operational lifetime enhances the economic attractiveness of perovskite tandem solar cells by reducing payback periods. Should Oxford PV successfully deliver on its roadmap to achieve 30% efficiency and a 30-year lifespan, it could revolutionize the solar industry, elevating the cost-effectiveness of renewable energy to unprecedented levels and expanding its global reach.

Source: https://pes.eu.com/press-releases/oxford-pv-showcases-next-generation-tandem-innovation-for-mainstream-and-specialty-applications-at-intersolar-europe-2026

Collected: June 26, 2026 | Automated Research System (Gemini API)

#03 High-Purity C60 Becomes Critical for Perovskite Solar Cell Commercialization, Driven by Increased Material Requirements

Published June 20, 2026 Carbonsphere Global



OVERVIEW

The commercialization of perovskite-silicon tandem solar cells is significantly elevating material purity requirements, particularly for research materials like C60 used in charge transport layers. Laboratory-grade materials, sufficient for small-area experimental devices, are proving inadequate for large-scale production, module integration, stringent stability testing, and supply chain traceability. High-purity C60, extensively studied as an electron transport layer (ETL), is crucial because its quality directly impacts device performance, manufacturing reproducibility, and long-term stability. This shift in material demands is a primary factor influencing the market entry speed and ultimate performance of perovskite solar cells.

IN DEPTH

Key Findings

As perovskite-silicon tandem solar cells advance towards widespread commercial deployment, the demand for ultra-high purity C60 and other research materials used in these devices has dramatically intensified. The material quality that sufficed for small-area laboratory experiments is now insufficient to meet the rigorous demands of large-scale manufacturing, complex module integration, extended stability testing, and comprehensive supply chain traceability.

Technical / Clinical Details

In perovskite solar cells, C60 primarily functions as an electron transport layer (ETL), efficiently extracting electrons generated in the perovskite layer and transporting them to the electrode. The quality of this layer directly impacts several critical device parameters: power conversion efficiency, manufacturing reproducibility, and, most importantly, long-term stability. For commercial deployment, materials must perform robustly beyond lab conditions, meeting stringent criteria:

- **Scalability with Manufacturing Processes:** The material must perform consistently in high-throughput processes such as roll-to-roll manufacturing.
- **Robustness in Module Integration:** Material stability must be maintained not just in single cells but within integrated modules comprising multiple cells, minimizing degradation.
- **Compliance with Stringent Stability Tests:** Devices must withstand prolonged stress tests under harsh conditions, including high temperature, humidity, and continuous light exposure.
- **Supply Chain Traceability:** The origin and quality control of materials must be transparent and consistent throughout the supply chain.

Even minute impurities can significantly degrade device performance, making ultra-high purity and uniformity essential for C60 when forming nanometer-thin films in commercial perovskite modules.

Background & Context

Perovskite solar cells have achieved near 30% efficiencies in laboratory settings, presenting a viable path to surpass the performance limits of conventional silicon photovoltaics. The tandem architecture, combining perovskite with silicon, is particularly promising due to its ability to utilize a broader spectrum of sunlight, positioning it as a leading candidate for next-generation solar technology. However, the true value of this technology lies in its ability to transition from laboratory records to mass-produced, long-lasting, and stable products. Material quality represents one of the most critical bottlenecks in this commercialization process; strict control over the purity and properties of functional materials like C60 is indispensable for achieving both high efficiency and long-term stability.

Strategic Significance & Outlook

Establishing reliable sourcing and stringent quality control for high-purity C60 is a decisive factor in the commercialization roadmap for perovskite solar cells. Material suppliers must rapidly develop advanced purification techniques and robust supply chains to meet the escalating demands of solar cell manufacturers. Resolution of this material challenge will enable perovskite-silicon tandem solar cells to achieve both cost reduction and performance enhancement, solidifying their position as major players in the global energy market. Securing high-quality materials is fundamental for enhancing technological credibility and gaining the trust of consumers and investors, ultimately accelerating the broad adoption of this transformative solar technology.

Source: https://www.thefullerene.com/high-purity-c60-perovskite-silicon-tandem-solar-cells/

Collected: June 26, 2026 | Automated Research System (Gemini API)

#04 Perovskite-Silicon Tandem Solar Cells Transition to Commercial Production: LONGi Achieves 34.85% Record, Manufacturing Cost Projected to $0.29/W

Published June 18, 2026 Energy Solutions Intelligence Global

OVERVIEW

As of 2026, perovskite-silicon tandem solar cells are transitioning from laboratory records to full-scale commercial production. LONGi, a Chinese solar giant, has achieved an NREL-certified world-record efficiency of 34.85%, while UK-based Oxford PV began shipping its 24.5%-efficient commercial modules to the U.S. market in late 2024. Full utility-scale deployment is projected between 2027 and 2029, with manufacturing costs expected to drop to $0.29/W. These developments indicate perovskite technology's potential to significantly complement silicon PV performance and expand the renewable energy market.

IN DEPTH

Key Findings

Perovskite-silicon tandem solar cells are making a definitive leap from research laboratory breakthroughs to full-scale commercial production as of 2026. LONGi, a prominent Chinese solar manufacturer, has achieved an NREL-certified world-record conversion efficiency of 34.85%, underscoring the immense potential of this technology. Concurrently, Oxford PV initiated the first commercial shipments of its 24.5%-efficient tandem modules to the U.S. in late 2024, signaling steady market entry and robust progress in commercialization.

Technical / Clinical Details

The core advantage of perovskite-silicon tandem solar cells lies in their ability to utilize the solar spectrum more efficiently. The perovskite layer absorbs shorter-wavelength light, while the underlying silicon layer captures longer wavelengths, collectively leading to higher overall energy conversion. LONGi's record-breaking 34.85% efficiency, verified by NREL, approaches the theoretical limits of this tandem architecture and significantly surpasses the performance ceiling of conventional single-junction silicon solar cells. Oxford PV’s successful shipment of 24.5%-efficient commercial modules demonstrates that this technology is already viable for mass production and is beginning to penetrate initial markets. Economically, manufacturing costs are projected to fall to $0.29/W for utility-scale deployment, anticipated between 2027 and 2029. This cost point could make them highly competitive with existing photovoltaic technologies.

Background & Context

Photovoltaic power generation is becoming increasingly vital in the global energy mix, necessitating continuous improvements in efficiency and reductions in cost for broader adoption. Perovskite solar cells have garnered significant attention as a next-generation technology due to their potential for high efficiency, low-cost material synthesis, and versatility across various substrates. The tandem configuration, in particular, is highly regarded because it leverages existing silicon infrastructure while dramatically boosting efficiency by integrating a perovskite top cell. Initial challenges, such as stability issues and the use of lead, are progressively being addressed through intensive research, bringing the technology to a commercialization-ready maturity level, as evidenced by LONGi's records and Oxford PV's market entry.

Strategic Significance & Outlook

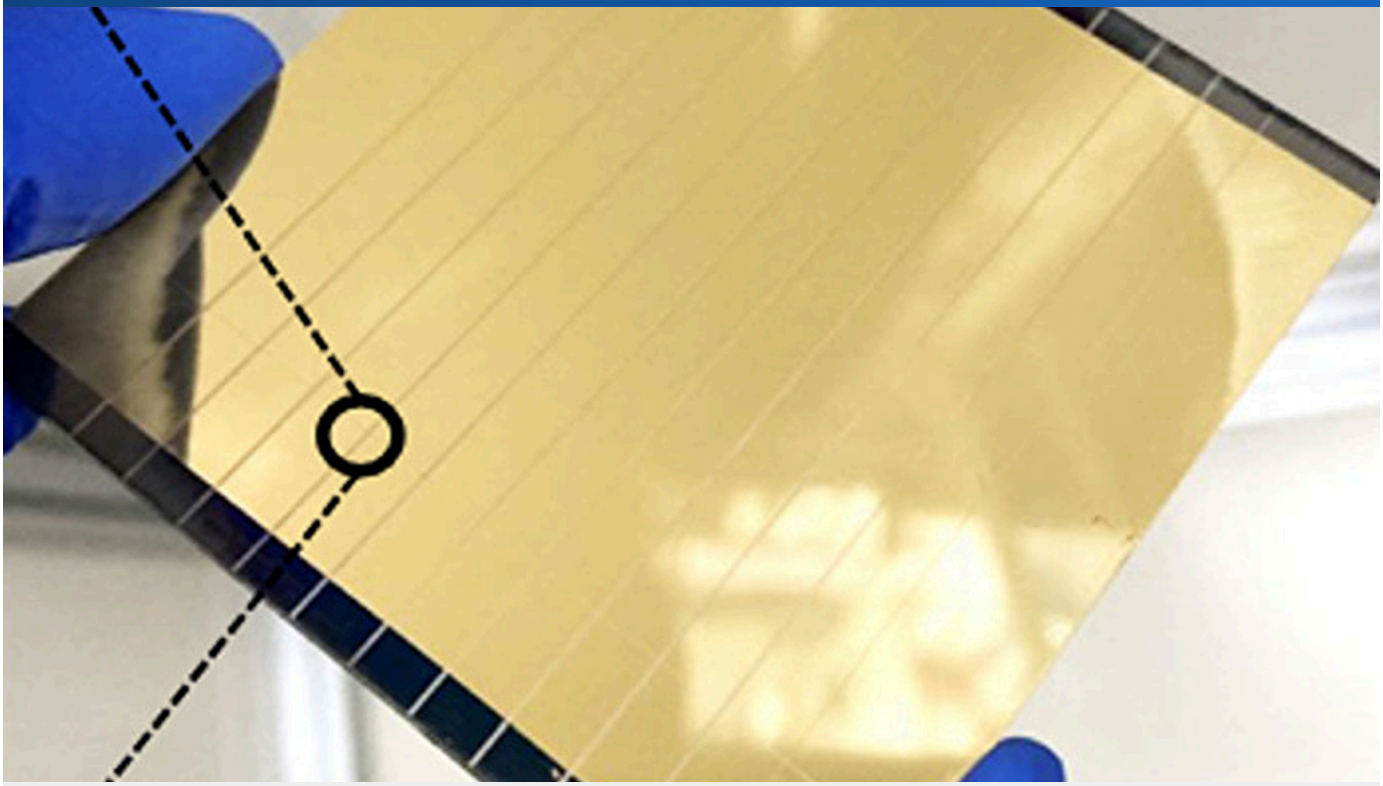
The commercialization of perovskite-silicon tandem solar cells is poised to bring about a transformative shift in the renewable energy market. The combination of ultra-high efficiency and reduced manufacturing costs will enable greater power output from smaller footprints, further lowering the barriers to solar energy adoption. The projected utility-scale deployment between 2027 and 2029 will have a substantial impact on global energy supply and contribute significantly to climate change mitigation efforts. This technology is expected to find broad application, from residential and large-scale solar farms to niche markets such as BIPV (Building-Integrated Photovoltaics) and portable power solutions, thereby becoming a crucial driver in accelerating the global energy transition.

Source: https://energy-solutions.co/articles/sub/perovskite-solar-cells-breakthrough

Collected: June 26, 2026 | Automated Research System (Gemini API)

#05 International Team Develops 22.36%-Efficient 3D/2D Hybrid Perovskite Solar Modules with Enhanced Stability

Published Published June 23, 2026 PV Magazine International共同研究



OVERVIEW

An international team has developed novel hybrid perovskite solar modules utilizing a 2D/3D heterojunction architecture, achieving a remarkable 22.36% power conversion efficiency for 25 cm^2 modules. This breakthrough simultaneously addresses the critical challenge of stability, with modules retaining over 90% of their initial performance after 1000 hours of continuous 1-sun illumination. This paves the way for practical, high-efficiency, and long-lifetime perovskite solar cells, accelerating their journey towards large-scale commercialization.

IN DEPTH

Background

Perovskite solar cells have garnered considerable attention as a next-generation photovoltaic technology due to their high power conversion efficiency and potential for low-cost manufacturing. However, their inherent instability against humidity, heat, and light has remained a major barrier to commercialization. Previous research often faced a trade-off between improving stability and maximizing efficiency. The 2D/3D heterojunction strategy presented in this study is a promising approach to achieve both simultaneously. Demonstrating high efficiency and long-term stability at the module level is a critical step in bridging the gap between laboratory results and real-world product application. This technology is particularly vital for developing solar cells capable of enduring prolonged outdoor use.

Key Findings

An international research team has successfully developed stabilized hybrid perovskite solar cells and modules leveraging a novel manufacturing technique and a 2D/3D heterojunction architecture. This innovative approach has significantly boosted both the power conversion efficiency and long-term stability of the devices, achieving a high efficiency of 22.36% in 25 cm^2 mini-modules.

Technical Details

The research employed a heterojunction architecture combining layers of 2D and 3D perovskites. 2D perovskites, known for their excellent environmental stability and charge-blocking properties, mitigate the inherent vulnerability of 3D perovskites to moisture and heat. This hybrid structure, coupled with a new manufacturing technique, resulted in a high conversion efficiency of 25.14% for small-area cells measuring 0.094 cm^2. More notably, an efficiency of 22.36% was achieved in practical-sized 25 cm^2 mini-modules. Groundbreaking results were also obtained in terms of stability: the modules retained over 90% of their initial performance after more than 1000 hours of continuous 1-sun illumination. This represents a substantial improvement in long-term stability, one of the primary challenges for conventional perovskite solar cells, suggesting a significant step towards practical deployment.

Strategic Significance & Outlook

This stabilized hybrid perovskite technology marks a significant milestone towards realizing next-generation solar cells that offer both high efficiency and long-term stability. Further optimization of the 2D/3D heterojunction design and manufacturing processes is expected to lead to even higher module efficiencies and extended lifespans in the future. If this technology can be successfully applied to large-scale production, it could introduce new competition into the current silicon solar cell market and further improve the cost-effectiveness of renewable energy. Its application is anticipated across diverse fields, including rooftop installations, Building-Integrated Photovoltaics (BIPV), and mobile power sources, significantly contributing to the realization of a sustainable society. This achievement is expected to be a powerful driver accelerating the commercialization of perovskite solar cells globally.

Source: https://www.pv-magazine.com/2026/06/23/researchers-build-22-36-efficient-3d-2d-solar-modules-based-on-stabilized-hybrid-perovskite/

Collected: June 26, 2026 | Automated Research System (Gemini API)

#06 Kuramoto Seisakusho Stock Surges Following Investment Framework Agreement with Hong Kong Firm for Perovskite Solar Cell Business

Published June 22, 2026 Moomoo (Fisco Japan) Japan

OVERVIEW

Kuramoto Seisakusho announced an investment framework agreement with a Hong Kong company for its perovskite solar cell business, causing its stock price to surge. This agreement signals a crucial strategic partnership aimed at advancing the company's perovskite technology development and market expansion. Prior to the agreement, Kuramoto Seisakusho confirmed a $300,000 transfer from the Hong Kong firm on June 15, indicating the concrete launch of the project's initial phase. This capital injection and partnership are expected to accelerate the company's efforts towards the early commercialization of perovskite solar cells.

IN DEPTH

Key Findings

Kuramoto Seisakusho announced the signing of an 'Investment Framework Agreement' with a Hong Kong company concerning its perovskite solar cell business. Following this news, the company's stock price experienced a sharp increase, reflecting strong market anticipation. This agreement represents a significant step for Kuramoto Seisakusho to accelerate its business development in the field of perovskite solar cells, a next-generation solar technology.

Technical / Clinical Details

The core purpose of this agreement is the commercialization of perovskite solar cell technology, which Kuramoto Seisakusho has been developing. While specific technical details or the full scope of the partnership have not been fully disclosed, perovskite solar cells are generally recognized as a promising next-generation technology offering the potential for higher conversion efficiencies than traditional silicon solar cells and lower manufacturing costs. Kuramoto Seisakusho is believed to be leveraging its expertise in glass substrate processing for displays to advance research and development in perovskite layer deposition and module integration. Preceding the agreement, a transfer of $300,000 (approximately 47 million JPY) from the Hong Kong firm was confirmed on June 15, likely allocated as initial investment capital for R&D and equipment upgrades.

Background & Context

The solar power generation market is rapidly expanding due to concerns about climate change and energy security, driving demand for more efficient and cost-effective next-generation technologies. Perovskite solar cells, with their high potential, are at the center of an intense global R&D race. The entry of companies like Kuramoto Seisakusho into this field through strategic partnerships with international firms is crucial for Japanese technology to establish a presence in the global market. Capital financing and international collaborations also contribute to accelerating technology development and diversifying risks associated with large-scale commercialization.

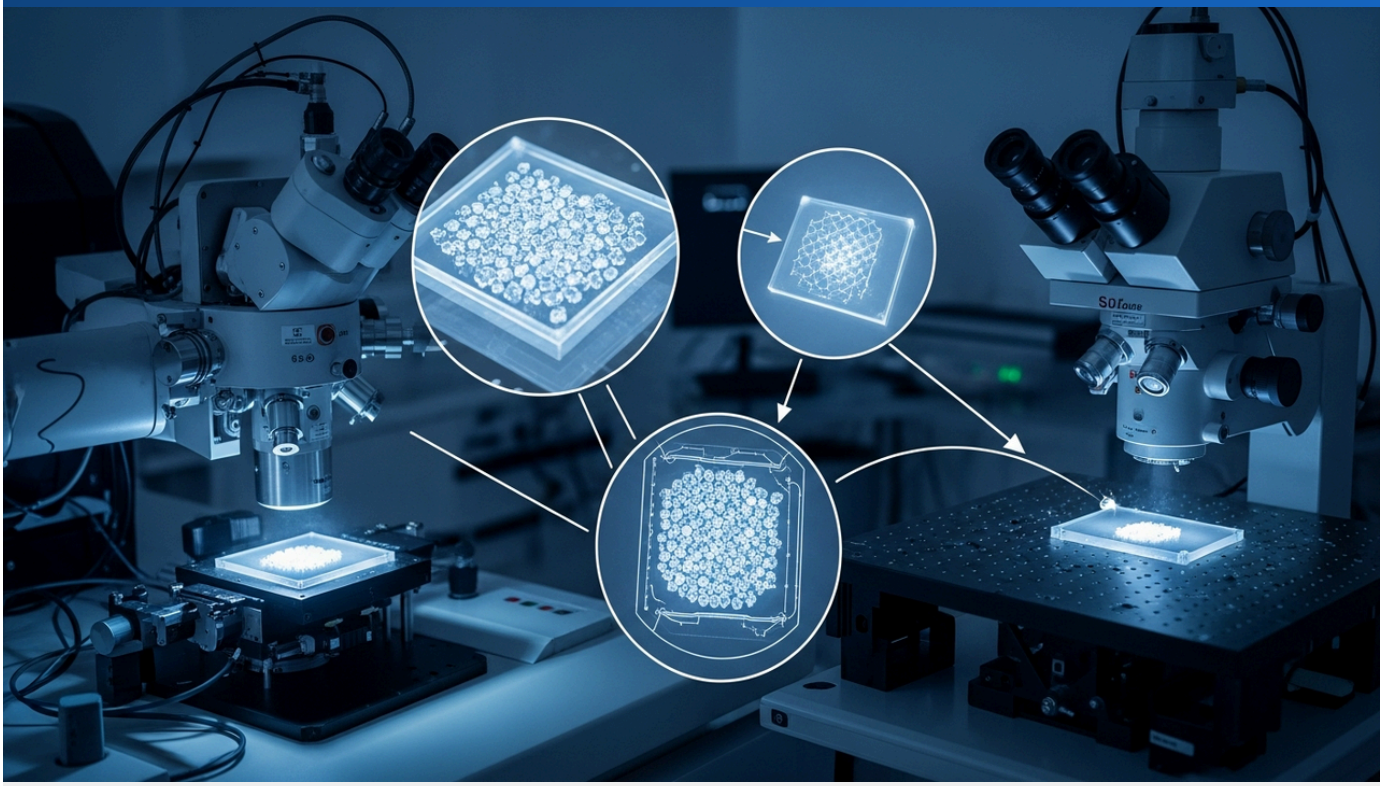
Strategic Significance & Outlook

The signing of this investment framework agreement suggests that Kuramoto Seisakusho's perovskite solar cell business has entered a significant expansion phase. The capital injection from the Hong Kong firm will accelerate R&D and enable concrete progress towards building prototype lines and establishing mass production technologies. Moving forward, under the cooperative framework of both companies, advancements in perovskite solar cell performance, cost reduction, and the establishment of long-term reliability are anticipated. Should this partnership succeed, Kuramoto Seisakusho could establish itself as a key player in the perovskite solar cell market, contributing to renewable energy adoption and enhancing its corporate value. Further announcements regarding specific business plans and product roadmaps are awaited.

Source: https://www.moomoo.com/news/post/71800297/kuramoto-surges-sharply-after-signing-an-investment-framework-agreement-regarding

#07 Back-Contacted Single-Crystal Perovskite Solar Cells Show Promise for Enhanced Stability by Suppressing Electrode Interface Degradation

Published Published June 20, 2026 MDPI International学術誌



OVERVIEW

Perovskite solar cells have reached impressive efficiencies, but long-term stability issues due to ion migration at electrode interfaces have hindered adoption. New back-contacted single-crystal designs address this by eliminating costly transparent conductive oxide (TCO) electrodes and suppressing degradation pathways. This innovation promises significantly enhanced operational lifetimes and reduced manufacturing costs, positioning perovskites for widespread commercialization.

IN DEPTH

Background

Perovskite solar cells continue to capture global attention from researchers and industry, touted as a next-generation photovoltaic technology. Their high power conversion efficiency, reaching 27% in the past decade, and low-cost manufacturing potential position them as a strong contender to traditional silicon solar cells, especially in tandem configurations where they promise exceptionally high theoretical efficiencies when combined with silicon. However, despite their remarkable performance, their long-term operational stability remains a critical challenge for practical deployment. The paramount barrier to widespread commercialization has been their inherent instability when exposed to environmental stressors such as humidity, heat, and light. Resolving this stability issue is critical; its breakthrough would accelerate the widespread adoption of perovskite solar cells across diverse applications, from rooftop installations and large-scale solar farms to flexible electronics and Building-Integrated Photovoltaics (BIPV).

Key Findings

The fundamental challenge to perovskite longevity stems from electric-field-driven ion migration within the device's conventional vertical structure. This movement precipitates degradation at the interface between the active absorption layer and the electrodes, leading to performance decay and shortened operational lifespan. Recent advancements in back-contacted single-crystal perovskite solar cells offer a compelling solution by radically reconfiguring the device architecture. This design places both electrodes on the same side, a significant departure from traditional vertical setups. Crucially, this arrangement entirely eliminates the need for transparent conductive oxide (TCO) electrodes, which are conventionally costly to manufacture and contribute to resistive losses. By bypassing TCOs, back-contacted designs promise reduced manufacturing energy input and substantial cost savings. Furthermore, this innovative architecture is posited to physically redirect or suppress ion migration pathways, directly mitigating interface degradation and significantly enhancing long-term operational stability. The integration of single-crystal perovskite materials further refines this approach, contributing to intrinsically lower defect densities and optimized charge transport, thus bolstering both efficiency and stability.

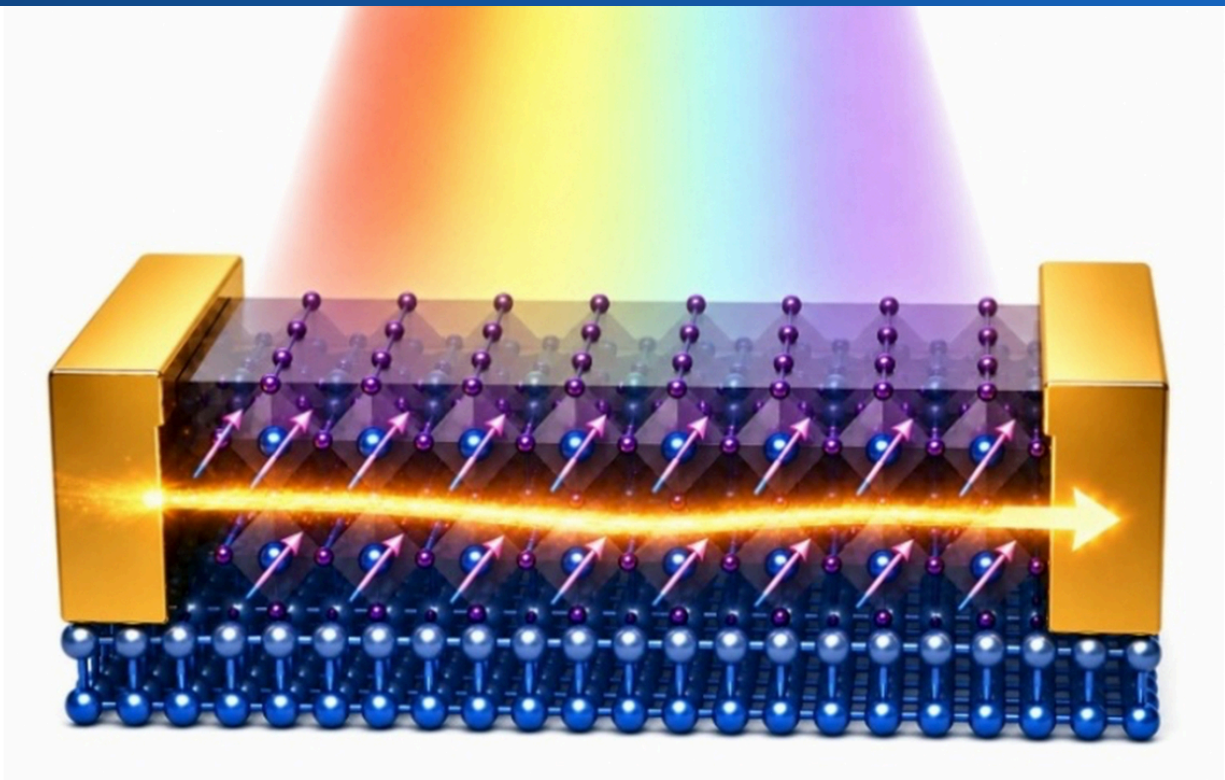
This architectural innovation is poised to be a pivotal driver for the commercialization of perovskite technology. By effectively suppressing electrode interface degradation and eliminating the necessity for TCO electrodes, these cells directly contribute to extending device lifespan and significantly reducing manufacturing costs, thereby increasing the overall energy generation lifetime. While acknowledging the need for further optimization and scalable manufacturing processes, the robust achievement of enhanced stability and efficiency positions back-contacted single-crystal perovskite solar cells to become major players in the renewable energy market. This advancement could profoundly accelerate the global energy transition by elevating the cost-effectiveness of solar power to unprecedented levels, paving the way for a more sustainable future.

Source: https://www.mdpi.com/1996-1944/19/11/2415

Collected: June 26, 2026 | Automated Research System (Gemini API)

#08 University of Tokyo Generates Record-High Quantum-Geometric Photocurrent in Lead-Free Perovskite CsGeI3, Paving Way for Sustainable High-Performance PV

Published June 23, 2026 TechXplore / Phys.org (reported by The University of Tokyo) Japan



OVERVIEW

A research team at The University of Tokyo has discovered that the environmentally friendly, lead-free halide perovskite material CsGeI3 generates an exceptionally large 'shift current,' exceeding previously reported values by over an order of magnitude. This groundbreaking finding demonstrates that ferroelectric halide perovskites are promising materials for next-generation solar cells, photodetectors, and other optoelectronic devices with reduced environmental impact. This significantly expands the performance limits of lead-free materials, opening a pathway for new photovoltaic technologies that combine both sustainability and high performance.

IN DEPTH

Key Findings

A research team from The University of Tokyo has successfully demonstrated the generation of an exceptionally large 'shift current' in CsGeI3, an environmentally friendly, lead-free halide perovskite material. This current is more than an order of magnitude higher than previously reported values. This pivotal discovery firmly establishes ferroelectric halide perovskites as highly promising materials for developing next-generation solar cells and optoelectronic devices that are both high-efficiency and environmentally conscious.

Technical / Clinical Details

Shift current is a unique type of photocurrent that arises from the absorption of light in a material without the need for an external electric field, operating on a different mechanism compared to conventional p-n junction solar cells. The research team measured this shift current using CsGeI3, a lead-free ferroelectric halide perovskite. The results revealed that the magnitude of the shift current generated by CsGeI3 vastly exceeded that of any previously reported ferroelectric material by orders of magnitude. This highly efficient shift current generation is believed to originate from the unique crystal and electronic band structures of CsGeI3. By entirely eliminating lead, this research addresses a significant environmental concern associated with many conventional perovskite solar cells, enabling the development of more sustainable photo-conversion technologies.

Background & Context

While perovskite solar cells have attracted considerable attention for their high conversion efficiencies, the use of toxic lead in most formulations has been a significant environmental concern. Consequently, research into lead-free perovskite materials is paramount for balancing the widespread adoption of solar cells with environmental sustainability. Previous lead-free perovskites often lagged behind their lead-containing counterparts in terms of efficiency and stability, but the dramatic improvement in shift current demonstrated here represents a major step towards bridging that performance gap. Harnessing shift currents in ferroelectric materials enables the design of photo-conversion devices based on new operating principles, contributing to devices with characteristics difficult to achieve with conventional technologies.

Strategic Significance & Outlook

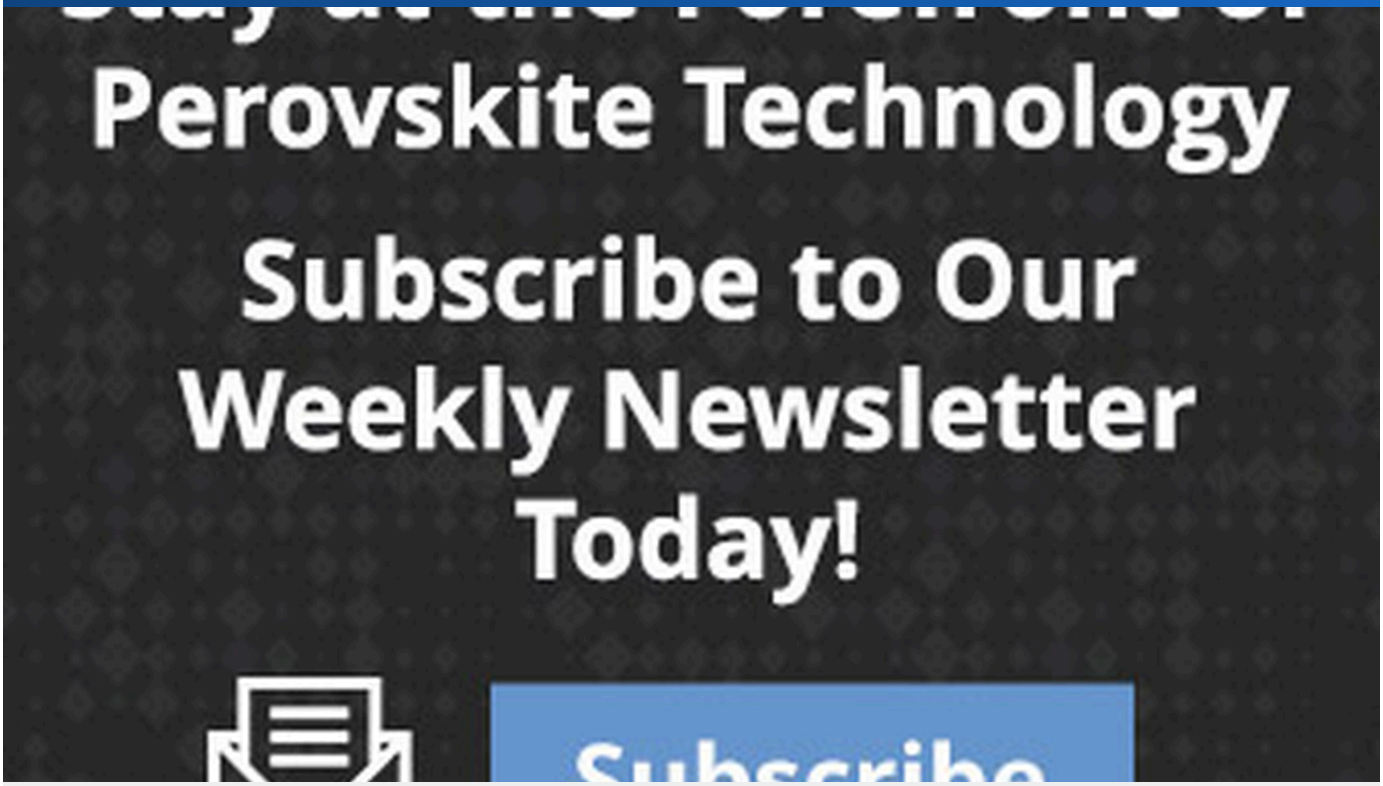
This discovery suggests that lead-free ferroelectric halide perovskites could form the foundational material for high-efficiency, sustainable next-generation solar cells, photodetectors, and other optoelectronic devices. Specifically, the ability to generate photocurrent without an applied electric field through shift current enables simplified device structures and low-power operation, opening new application avenues in energy harvesting and sensor technologies. Moving forward, continued progress in enhancing the stability of this material and developing large-scale synthesis processes will accelerate the practical implementation of environmentally friendly, high-performance optoelectronic devices, significantly contributing to a sustainable society. This technology holds the potential to be a breakthrough in the renewable energy sector, offering a green alternative without compromising on performance.

Source: https://www.t.u-tokyo.ac.jp/en/press/pr2026-06-23-001

Collected: June 26, 2026 | Automated Research System (Gemini API)

#09 Trina Solar Secures First Commercial Order for Perovskite-Silicon Tandem Modules in New Zealand: Certified 29.2% Efficiency, 907W Output

Published June 19, 2026 Metalgrass LTD China



OVERVIEW

Trina Solar has secured its first commercial order for high-performance perovskite/crystalline silicon tandem solar modules in New Zealand, marking a significant milestone in the commercialization of tandem photovoltaic technology. This project represents the inaugural deployment of Chinese-developed tandem PV products into the global high-end residential market. The company's 3.1 m^2 industrial-sized tandem modules have been certified by TÜV SÜD for an impressive 907W peak power and 29.2% conversion efficiency, demonstrating the practical viability and superior performance of this next-generation solar technology. This achievement highlights market confidence in perovskite tandem technology and its potential to accelerate the global energy transition.

IN DEPTH

Key Findings

Trina Solar, a leading Chinese solar manufacturer, has announced securing its first commercial order for high-performance perovskite/crystalline silicon tandem solar modules, destined for a project in New Zealand. This represents a groundbreaking development in the commercialization of next-generation tandem photovoltaic technology, unequivocally demonstrating its practical readiness for the global market.

Technical / Clinical Details

The Trina Solar tandem modules ordered feature a stacked architecture where a perovskite layer is combined with a crystalline silicon layer. This design allows both layers to efficiently absorb different wavelengths of sunlight, resulting in significantly higher conversion efficiencies compared to traditional single-junction silicon modules. Specifically, the 3.1 m^2 industrial-sized module has been independently certified by TÜV SÜD to achieve an impressive peak power of 907W and a high conversion efficiency of 29.2%. These performance metrics are outstanding even when compared to mainstream solar modules currently available on the market, making them particularly attractive for the high-end residential sector seeking maximum power generation from limited installation areas. The New Zealand project marks the first instance of a Chinese-developed, innovative tandem PV product being introduced into the international premium residential market.

Background & Context

The solar photovoltaic industry is in a constant pursuit of improved efficiency and reduced costs. Perovskite solar cells have garnered considerable attention as a next-generation technology, demonstrating near 30% conversion efficiencies at the laboratory level and offering potential for low-cost manufacturing. The tandem architecture, particularly when integrated with existing silicon solar cell infrastructure, is seen as a highly promising approach to dramatically enhance efficiency while ensuring stability and reliability. Historically, perovskite technology has primarily been confined to research labs, but Trina Solar's acquisition of a commercial order signals the technology's growing maturity as a product and its gaining market confidence. This also underscores the leadership of Chinese enterprises in advancing cutting-edge technologies within the global market.

Strategic Significance & Outlook

Trina Solar's first commercial order is a critical milestone that will accelerate the market adoption of perovskite/crystalline silicon tandem solar modules. The high efficiency of 29.2% and substantial power output of 907W will encourage the broader deployment of tandem modules across various applications, from residential and commercial installations to large-scale power plants. Its advantages are particularly evident in Building-Integrated Photovoltaics (BIPV) and urban areas with limited installation space. This success is expected to stimulate other solar manufacturers to invest in and develop tandem technologies, fostering innovation and competition across the entire solar industry. Trina Solar is poised to leverage this technology to further strengthen its leadership in the global renewable energy market.

Source: https://www.perovskite-info.com/trina-solar-secures-first-commercial-order-perovskite-silicon-tandem-modules

Collected: June 26, 2026 | Automated Research System (Gemini API)

#10 Cornell University Calculates Perovskite Tandem Agrivoltaics Could Annually Offset 30.9 Million Tons CO2e and Save 840 Million m^3 Water in US

Published June 21, 2026 Cornell University USA

OVERVIEW

Researchers at Cornell University have assessed the environmental and resource-saving potential of integrating perovskite tandem agrivoltaics into lettuce production systems across the United States. Modeling perovskite-silicon (P-S) and all-perovskite (P-P) tandem technologies with power conversion efficiencies of 25%, 30%, and 35%, and system lifetimes from 2 to 10 years, revealed that under optimized conditions, agrivoltaics could offset up to 30.9 million tons of CO2 equivalent emissions and save approximately 840 million cubic meters of water annually. This study clearly demonstrates the sustainability and environmental impact reduction potential of agrivoltaics, balancing food and energy production.

IN DEPTH

Key Findings

Researchers at Cornell University have quantitatively evaluated the environmental and resource-saving benefits of integrating perovskite tandem agrivoltaics into lettuce production systems across the United States. Their findings reveal an astonishing potential under optimized scenarios: an annual reduction of up to 30.9 million tons of CO2 equivalent emissions and the conservation of approximately 840 million cubic meters of water. This groundbreaking study underscores the profound positive impact that a sustainable coexistence of renewable energy and food production can have on the global environment.

Technical / Clinical Details

The study modeled two types of perovskite tandem technologies: perovskite-silicon (P-S) tandem and all-perovskite (P-P) tandem. These technologies were simulated with varying power conversion efficiencies of 25%, 30%, and 35%, and system lifetimes ranging from 2 to 10 years. Agrivoltaic systems involve deploying solar modules over agricultural land, allowing for power generation while simultaneously optimizing sunlight exposure for crop growth. Perovskite solar cells are particularly well-suited for agrivoltaics due to their tunable light transparency, enabling efficient power generation alongside an ideal light environment for crops. The model demonstrated that integrating agrivoltaics into lettuce production optimizes land use, facilitating the simultaneous creation of clean energy and food. The water conservation effects were particularly significant, attributed to reduced evaporation and improved irrigation efficiency under the partial shade provided by the panels.

Background & Context

Global population growth and climate change present severe challenges on both food and energy security fronts. Critically, securing agricultural land and deploying renewable energy often result in competing land-use demands. Agrivoltaics emerges as an innovative approach to resolve this conflict, maximizing the utilization of limited land resources, and is gaining worldwide attention. Perovskite solar cells, with their high efficiency, manufacturing flexibility, and tunable transparency, are considered particularly advantageous for agrivoltaic applications. They can achieve efficient power generation while minimizing adverse effects on crops, a task that has been challenging for traditional silicon solar cells.

Strategic Significance & Outlook

This Cornell University research unequivocally demonstrates that perovskite tandem agrivoltaics offer a powerful solution for achieving sustainable food and energy production simultaneously. The projections of tens of millions of tons of annual CO2 emission reductions and billions of cubic meters of water savings provide compelling justification for large-scale investments in this technology for policymakers and investors. As demonstration projects for this technology expand and further validation of agricultural productivity impacts and economic viability are conducted, agrivoltaics holds the potential to fundamentally transform global agriculture and energy systems. Its adoption is expected to accelerate, especially in water-stressed regions and countries with limited land, significantly contributing to the achievement of Sustainable Development Goals (SDGs).

Source: https://www.perovskite-info.com/farm-fork-life-cycle-impacts-perovskite-tandem-agrivoltaics

Collected: June 26, 2026 | Automated Research System (Gemini API)

#11 Silica Aerogel Encapsulation of CsPbX3 Nanocrystals Overcomes Stability Issues for Perovskite Displays

Published Published June 18, 2026 ACS Publications International学術誌

OVERVIEW

An international research team has developed a robust, low-cost silica aerogel (AGs) encapsulation strategy to overcome the inherent stability limitations of inorganic halide perovskite nanocrystals (NCs). This novel approach enabled CsPbX3 NCs to exhibit exceptional stability under moisture, heat, and irradiation stress, paving the way for their practical application in wide-color-gamut displays. This achievement deepens the understanding of perovskite stability mechanisms and creates new opportunities for durable optoelectronic material development in high-efficiency display and lighting technologies.

IN DEPTH

Key Findings

An international research team has developed an innovative solution to address the intrinsic stability issues faced by inorganic halide perovskite nanocrystals (NCs), which hold immense promise for next-generation display and lighting technologies. By introducing a robust, low-cost silica aerogel (AGs) encapsulation strategy, CsPbX3 NCs successfully demonstrated unprecedented stability under severe environmental stressors such as moisture, heat, and light irradiation. This breakthrough significantly advances the practical application of perovskite materials.

Technical Details

Inorganic halide perovskite NCs have garnered significant attention as key materials for next-generation displays due to their superior optoelectronic properties, particularly their high photoluminescence quantum yield (PLQY) and wide color gamut reproduction capabilities. However, their vulnerability to external environmental factors like humidity, heat, and UV light has been the primary barrier to widespread commercialization. The silica aerogel encapsulation strategy developed in this study uniformly disperses CsPbX3 NCs within a porous yet transparent aerogel matrix, providing both physical protection and a barrier against environmental elements. This aerogel creates nanoscale isolated spaces around the NCs, effectively inhibiting the ingress of moisture and oxygen. Experimental results confirmed that these encapsulated CsPbX3 NCs remarkably maintained their optical properties and stability even after prolonged moisture exposure, high-temperature environments, and continuous light irradiation. This significantly enhances device long-term reliability and expands their potential as next-generation emissive materials, potentially replacing or complementing quantum dots.

Background & Context

Display technology continually strives for sharper, more realistic image quality, demanding wide color gamuts, high brightness, and superior contrast. Perovskite NCs were expected to meet these demands as ideal emissive materials, but their instability remained the biggest hurdle. This stability issue, similar to that in perovskite solar cell research, is a critical topic in materials science. The silica aerogel encapsulation technology not only enhances the durability of perovskite NCs but also provides new insights into stability mechanisms, opening avenues for application in other perovskite-based optoelectronic devices, such as LEDs and photodetectors.

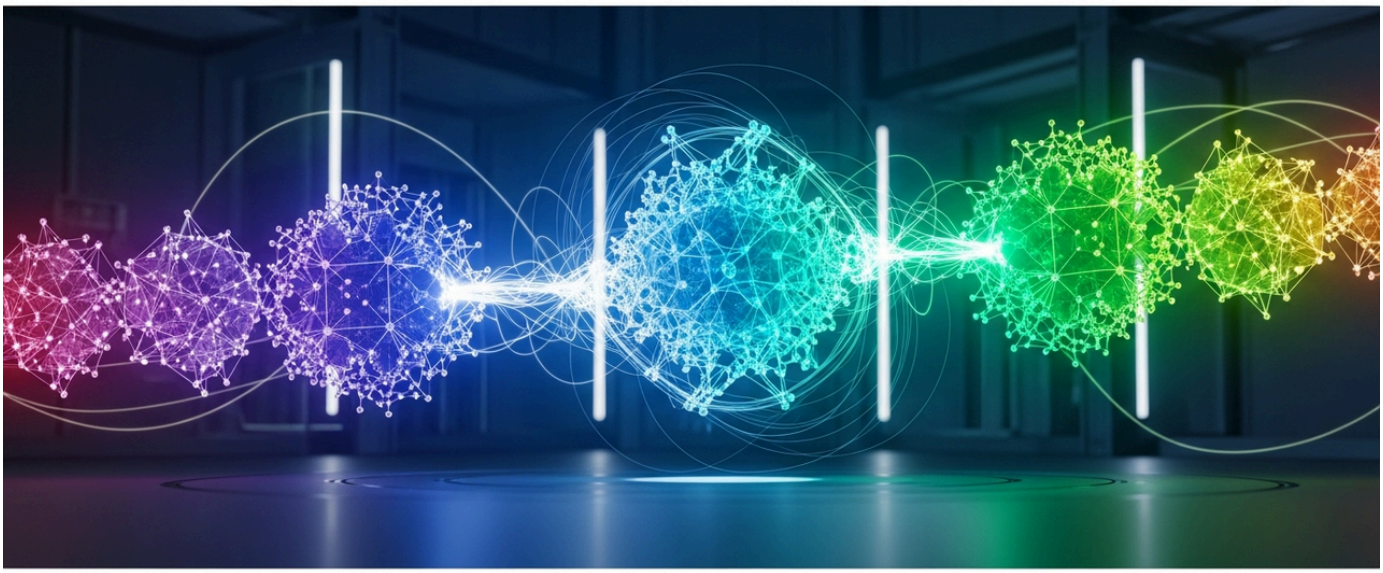
Strategic Significance & Outlook

The successful silica aerogel encapsulation strategy for CsPbX3 NCs marks a crucial milestone towards realizing wide-color-gamut, high-brightness, and long-lifetime next-generation display and lighting technologies. This technology holds the potential to further improve the performance of OLED and LCD displays and offers new options to the market as an alternative or complement to quantum dot technology. Moving forward, as this encapsulation technology is adapted for large-scale manufacturing processes and more cost-effective materials are developed, the commercialization of high-performance perovskite-based optoelectronic devices will accelerate. This is expected to enable consumers to enjoy more immersive visual experiences and contribute to the widespread adoption of energy-efficient lighting solutions.

Source: https://pubs.acs.org/doi/10.1021/acsami.6c00834

#12 S-Block Cation Doping Dramatically Boosts Photoluminescence Quantum Yield and Stability in Lead-Free Perovskites

Published Published June 25, 2026 ResearchGate International学術誌



OVERVIEW

A recent comprehensive review reveals s-block cation doping (e.g., Li^+, Na^+, K^+) as a transformative strategy for overcoming critical limitations in lead-free halide perovskites, such as indirect bandgaps, low photoluminescence quantum yield (PLQY), and insufficient environmental stability. This doping method significantly enhances PLQY and imparts robust resistance against moisture, thermal stress, and photo-oxidation. The breakthrough promises substantial contributions to the development of environmentally friendly, high-efficiency optoelectronic devices.

IN DEPTH

Background

Lead-free halide perovskites are attracting significant attention as sustainable alternatives to traditional lead-containing counterparts, driven by growing environmental concerns. Despite their promise for next-generation solar cells and other optoelectronic devices, their practical application has been hampered by long-standing challenges, including indirect bandgaps, low photoluminescence quantum yield (PLQY), and inadequate environmental stability. PLQY, in particular, is a critical metric not only for emissive devices but also for overall solar cell efficiency.

Key Findings

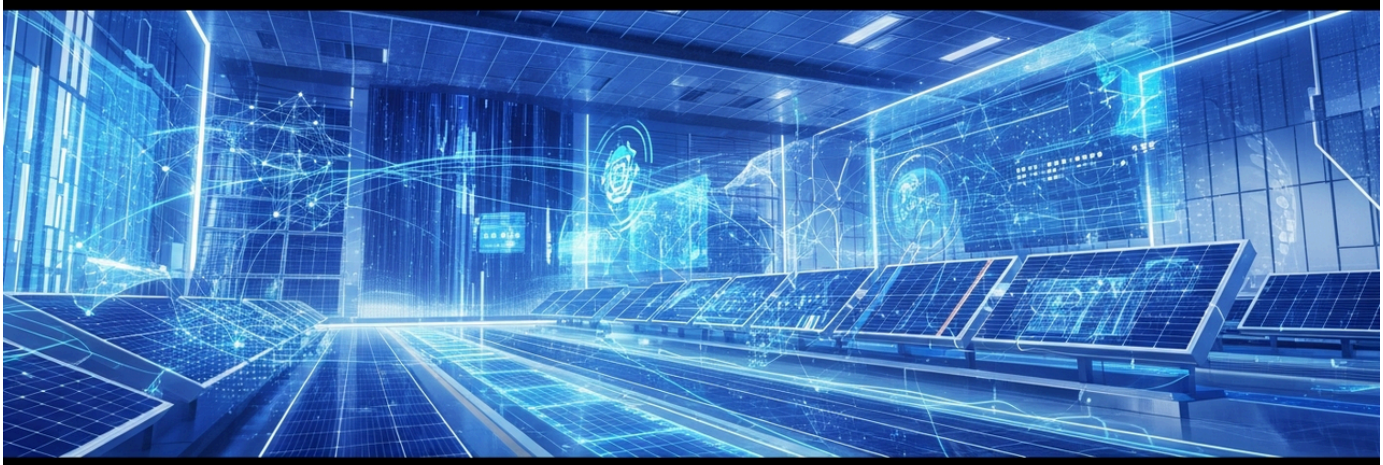
A recent comprehensive review highlights s-block cation doping (e.g., Li^+, Na^+, K^+) as a transformative strategy to overcome these limitations and dramatically enhance lead-free perovskite performance. The review meticulously details how s-block cations influence both the structure and properties of these materials, leading to several key improvements:

- **Significant PLQY Enhancement:** S-block cations effectively passivate defect states within the crystal lattice, suppressing non-radiative recombination and dramatically increasing PLQY—the efficiency with which photoexcited carriers convert into light.
- **Improved Environmental Stability:** Doping strengthens the perovskite crystal lattice, conferring robust resistance against external stressors like moisture, thermal stress, and photo-oxidation. This significantly extends the potential operational lifetime of devices.
- **Optimized Structure-Property Relationships:** The ionic radii and electron configurations of s-block cations precisely tune the perovskite's lattice parameters and electronic band structure, thereby optimizing its optical and electrical properties.

These advancements are critical for substantially improving the performance and reliability of optoelectronic devices, from solar cells and LEDs to photodetectors. The review posits that s-block cation doping is a powerful strategy poised to accelerate the development of sustainable, high-efficiency optoelectronic devices amid escalating environmental regulations. Ultimately, optimizing material compositions and device architectures based on this doping strategy is expected to position lead-free perovskites as crucial players in the global renewable energy market and the broader optoelectronics industry, merging high performance with environmental sustainability.

#13 China Selects GCL Optoelectronics and Quzhou FiberNano's Perovskite Projects for 2026 National Smart PV List, Achieving >26.8% Mass Production Efficiency

Published June 24, 2026 PV Magazine (implied from content) China



OVERVIEW

Five Chinese government agencies, including the Ministry of Industry and Information Technology (MIIT), have selected two perovskite-based projects from GCL Optoelectronics and Quzhou FiberNano New Energy Technology for the 2026 National Smart PV Project List. GCL Optoelectronics has established a 1.15 × 2.4-meter full-size tandem module production line, achieving a stable mass production efficiency of over 26.8%. Meanwhile, Quzhou FiberNano is building a 5GW integrated manufacturing ecosystem, reporting module efficiencies exceeding 23.9% for single-junction and 26.49% for tandem structures. These selections underscore the Chinese government's strategic emphasis on perovskite solar cells and its aggressive push for large-scale industrialization.

IN DEPTH

Key Findings

The Chinese government, through a joint announcement by five ministries including the Ministry of Industry and Information Technology (MIIT), has selected two perovskite solar cell-related projects—from GCL Optoelectronics and Quzhou FiberNano New Energy Technology—for its '2026 National Smart Photovoltaic (PV) Project List.' This designation clearly indicates that perovskite technology holds a significant position within China's national strategy and is moving into a large-scale commercialization phase.

Technical / Clinical Details

The two selected projects symbolize China's leadership in the mass production and high-efficiency development of perovskite solar cells:

- **GCL Optoelectronics Project:** The company has established a production line for practical full-sized tandem modules, measuring 1.15 × 2.4 meters. This line has achieved a high conversion efficiency of over 26.8% in stable mass production, demonstrating not only laboratory records but also consistent high performance in an actual manufacturing process.
- **Quzhou FiberNano New Energy Technology Project:** This company aims to build a massive 5GW integrated manufacturing ecosystem in the future. They have already reported module efficiencies exceeding 23.9% for single-junction perovskite devices and over 26.49% for tandem structures, highlighting their advanced technological capabilities and pursuit of economies of scale.

These figures illustrate that perovskite technology is now achieving performance levels comparable to or even surpassing silicon solar cells in large-scale production.

Background & Context

China is the world's largest producer and installer of solar power, and it aggressively promotes innovation in renewable energy technologies as a national strategy. Perovskite solar cells are considered the most promising candidate for next-generation PV technology due to their high efficiency, low manufacturing costs, and versatility across diverse applications. Government selection and support for such large-scale projects aim to accelerate technological development, establish robust supply chains, and ultimately enhance global market competitiveness. China's initiatives in this sector have the potential to further reshape the global solar power market landscape.

Strategic Significance & Outlook

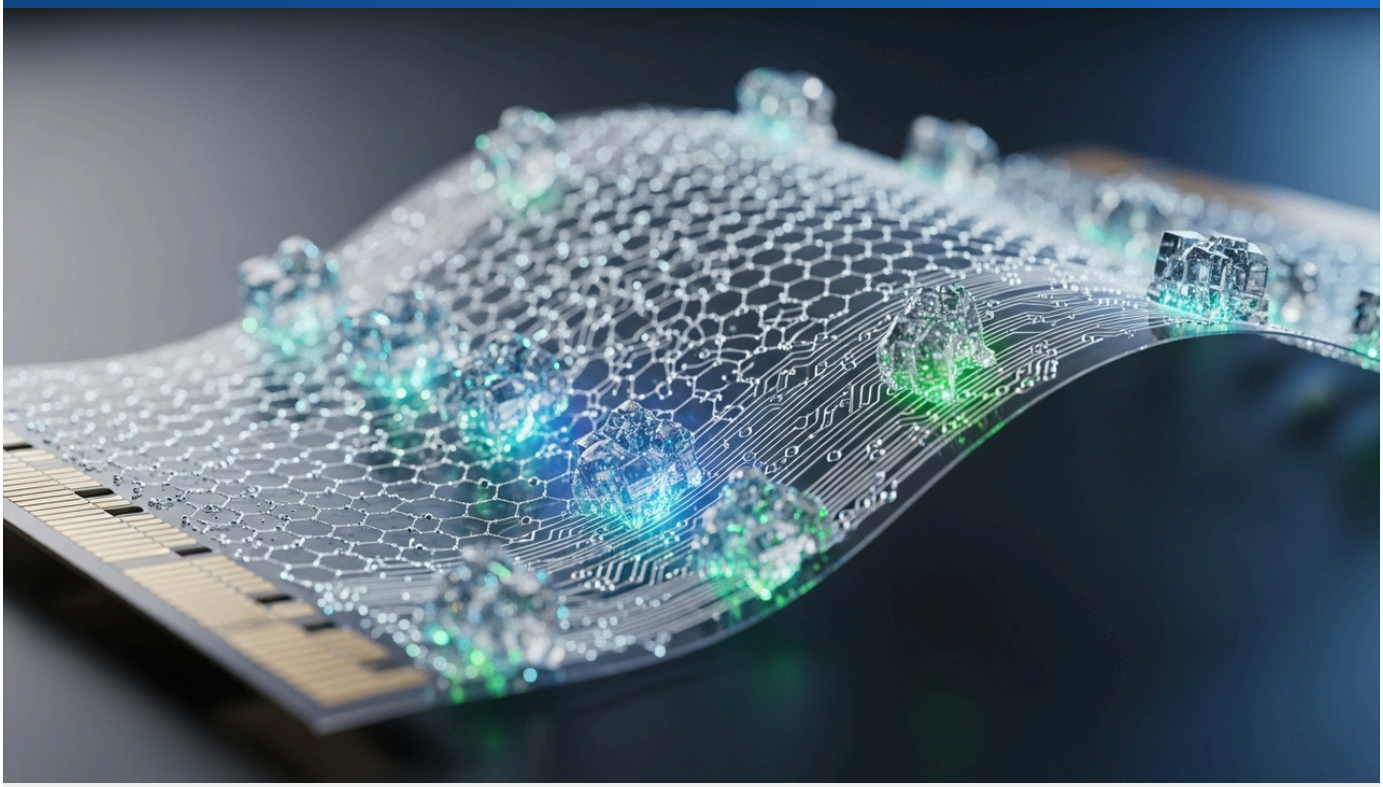
The inclusion of GCL Optoelectronics and Quzhou FiberNano’s perovskite projects in the national list signifies China's strong commitment to accelerating the commercialization of this technology at a national level. The success of these projects will demonstrate to the world the reliability, cost-competitiveness, and mass production capabilities of perovskite solar cells. Specifically, stable mass production efficiency of over 26.8% (GCL) and a 5GW integrated manufacturing ecosystem (Quzhou FiberNano) will set new benchmarks for the solar industry, potentially encouraging similar investments in other countries and companies. As a result, perovskite solar cells are expected to establish their presence as one of the key technologies accelerating the global energy transition. China's efforts will contribute significantly to global renewable energy adoption and catalyze a new wave of technological innovation.

Source: https://www.perovskite-info.com/china-highlights-two-perovskite-projects-2026-national-smart-pv-case-list

Collected: June 26, 2026 | Automated Research System (Gemini API)

#14 Flexible Lead-Free Perovskite Memristor Achieves 8-Month Stability and Over 600 Bending Cycles for Bionic Perception Applications

Published Published June 20, 2026 ACS Publications (ACS Applied Materials & Interfaces) International学術誌



OVERVIEW

An international research team has developed a groundbreaking lead-free perovskite flexible memristor, fabricated via a low-temperature process (approx. 100 °C). This innovative device demonstrates exceptional resistance switching characteristics, remarkable environmental stability exceeding eight months, and robust mechanical flexibility enduring over 600 bending cycles. This breakthrough paves the way for new applications in multimodal intelligent perception and biological simulation, critical for next-generation flexible electronics and AI devices.

IN DEPTH

Background

Next-generation electronics are rapidly evolving towards flexible and low-power devices, encompassing a wide range of applications from wearables and IoT sensors to advanced biomedical equipment. Central to this evolution is flexible memory technology, particularly memristors, which are essential for enabling bionic perception and neuromorphic computing. However, conventional memristor materials often encounter significant hurdles in achieving both sufficient flexibility and long-term environmental stability. Perovskite materials, especially less toxic lead-free variants, offer a promising avenue to overcome these limitations. This research marks a pivotal advancement in the field by successfully developing a flexible and stable memristor that maximizes the inherent properties of lead-free perovskites.

Key Findings

An international research team has successfully fabricated an innovative PET/graphene/Cs2AgBiBr6/Ag flexible memristor, leveraging the environmentally friendly, lead-free perovskite material Cs2AgBiBr6. Fabricated through a relatively low-temperature process (approximately 100 °C), which ensures high compatibility with heat-sensitive flexible substrates, this device demonstrates a confluence of remarkable properties. Memristors, as electronic components whose resistance changes based on their past electrical history, are fundamental for artificial intelligence (AI) and neuromorphic computing applications that seek to mimic human synaptic functions.

Experimental results underscore the device's outstanding performance:

- **Robust Resistance Switching:** Achieved stable and reliable switching between ON/OFF states with a high ON/OFF ratio, crucial for memory and computing operations.
- **Exceptional Long-Term Environmental Stability:** Demonstrated minimal performance degradation over an impressive 8 months when exposed to ambient air, a critical factor for practical device deployment.
- **Superior Mechanical Flexibility:** Maintained its full electrical functionality and performance even after enduring more than 600 bending cycles, showcasing excellent flexibility and durability vital for flexible electronics.

The strategic choice of lead-free materials further diminishes the device's environmental footprint, contributing significantly to the realization of more sustainable electronic technologies.

Strategic Significance & Outlook

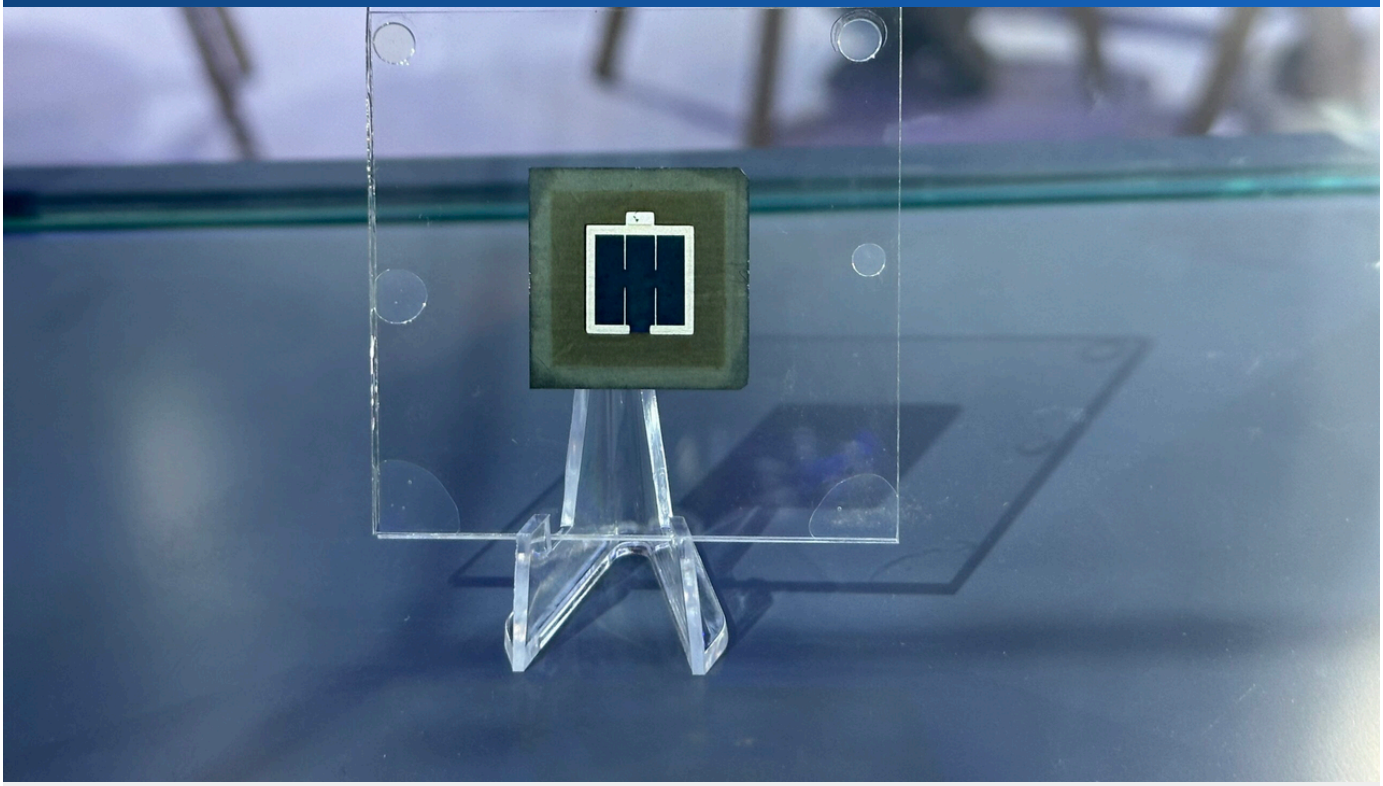
The successful development of this lead-free flexible perovskite memristor unlocks new and previously challenging application areas, including advanced multimodal intelligent perception systems and sophisticated biological simulations. Imagine flexible robotic skins seamlessly integrating haptic sensors with embedded AI processing, or ultra-low-power neuromorphic chips that precisely mimic human brain functions, enabling unprecedented levels of cognitive computing in compact, adaptable forms.

Future advancements in the performance and scalability of this technology for large-scale production could profoundly impact the development of next-generation flexible electronics, smart sensors, and artificial intelligence devices, ushering in transformative innovations across daily life and industrial sectors. Moreover, its inherent environmentally friendly material composition underscores its importance as a sustainable technology, aligning with global efforts for greener electronics.

Source: https://pubs.acs.org/doi/abs/10.1021/acsami.6c01730

#15 JinkoSolar Achieves 34.82% World Record Efficiency for N-Type TOPCon Perovskite-Silicon Tandem Cell, Advancing Commercialization

Published June 19, 2026 pv magazine Global China



OVERVIEW

JinkoSolar has announced a new world record efficiency of 34.82% for its N-type TOPCon perovskite-silicon tandem solar cell, validated by the Shanghai Institute of Microsatellite Innovation. This breakthrough was achieved through a suite of innovations, including a dual-layer composite passivation contact structure, multi-dimensional interface passivation, gradient crystallization rate control, and enhanced optical coupling. This achievement marks a significant step towards the industrialization of next-generation perovskite tandem technology.

IN DEPTH

Key Findings

JinkoSolar, a global leader in the solar PV industry, has achieved a groundbreaking power conversion efficiency of 34.82% for its N-type TOPCon perovskite-silicon tandem solar cell. This record-setting performance, independently certified by the Shanghai Institute of Microsatellite Innovation (SIMIT), demonstrates a significant leap forward in the practical application and commercial viability of perovskite-silicon tandem technology.

Technical Details

The record efficiency was attributed to JinkoSolar's integrated innovation across several core technologies. Key advancements include: 1) A dual-layer composite passivation contact structure developed for N-type TOPCon cells, effectively minimizing carrier recombination losses. 2) The implementation of multi-dimensional interface passivation technology, which suppresses defects at the critical interface between the perovskite and silicon layers, thereby improving charge separation efficiency. 3) A gradient crystallization rate control strategy that enhances the quality and uniformity of the perovskite active layer. 4) Advanced optical coupling and light management techniques, optimizing light absorption across both sub-cells to maximize overall photon utilization. These innovations collectively contribute to both the high efficiency and potential stability of the device, addressing some of the key challenges in perovskite development.

Background & Context

Perovskite-silicon tandem solar cells are widely regarded as the most promising next-generation photovoltaic technology, capable of surpassing the theoretical efficiency limits of conventional single-junction silicon cells. By combining a perovskite top cell that efficiently absorbs high-energy photons with a silicon bottom cell that captures lower-energy photons, tandems can utilize a broader spectrum of sunlight, leading to higher power output per unit area. JinkoSolar's achievement marks its 33rd world record in solar cell efficiency, underscoring its continuous commitment to innovation and R&D prowess in the competitive PV landscape. This success builds upon the company's established expertise in N-type TOPCon technology, now synergistically applied to the burgeoning perovskite sector.

Strategic Significance & Outlook

JinkoSolar emphasizes that this breakthrough represents a 'crucial step towards the industrialization of next-generation perovskite tandem technology.' Higher efficiencies are paramount for maximizing power generation in limited installation spaces and reducing the Levelized Cost of Energy (LCOE) for solar projects. The company aims to rapidly translate these laboratory-scale results into commercial production, accelerating the deployment of perovskite tandem solar cells in utility-scale projects and distributed generation markets. This technological advancement positions JinkoSolar to play a critical role in meeting global energy transition goals and shaping the future of solar energy production.

Source: https://www.pv-magazine.com/2026/06/19/jinkosolar-achieves-34-82-efficiency-for-perovskite-silicon-tandem-solar-cell/

#16 IPVF and TU Delft Achieve 31% Efficiency with 4cm² Perovskite/Silicon Tandem Cell Processed in Ambient Air via Slot-Die Coating

Published June 19, 2026 Perovskite-Info France

OVERVIEW

IPVF and TU Delft have jointly demonstrated a certified 31% power conversion efficiency for a 4 cm^2 2-terminal monolithic perovskite/silicon tandem solar cell. This significant achievement utilized an industrially scalable slot-die coating process for the perovskite top cell, performed under ambient air conditions. The breakthrough substantially enhances the commercial scalability of high-efficiency tandem solar cells, promising reduced manufacturing costs and lower environmental impact.

IN DEPTH

Key Findings

Researchers from IPVF in France and TU Delft in the Netherlands have jointly achieved a certified 31% power conversion efficiency for a 4 cm^2 two-terminal (2T) monolithic perovskite/silicon tandem solar cell. This remarkable efficiency not only pushes the boundaries of photovoltaic performance but crucially, it was achieved through a manufacturing process—slot-die coating in ambient air—that is highly compatible with industrial-scale production. This represents a major leap towards making high-efficiency tandem solar cells economically viable and widely accessible.

Technical Details

The high-performance device integrates a nanostructured silicon heterojunction bottom cell, fabricated at TU Delft, with a perovskite top cell deposited at IPVF using slot-die coating under ambient air conditions. Slot-die coating is a solution-based deposition technique known for its high speed, excellent film uniformity, and compatibility with roll-to-roll manufacturing, making it ideal for large-scale, low-cost production. Crucially, performing this process in ambient air eliminates the need for expensive inert gas environments, such as nitrogen, significantly reducing manufacturing costs, energy consumption, and overall process complexity. This combined approach addresses critical challenges in traditional perovskite manufacturing, mitigating the necessity for high vacuum or specialized gas environments and establishing a more sustainable and economic production pathway.

Background & Context

Perovskite/silicon tandem solar cells are among the most intensely researched and promising next-generation technologies, poised to exceed the theoretical efficiency limits of conventional single-junction silicon solar cells. While various research groups and companies have reported efficiencies exceeding 30%, many of these achievements have been on small-area cells or under highly controlled, lab-specific conditions. The work by IPVF and TU Delft stands out by demonstrating high efficiency (31%) on a practical cell area (4 cm^2) using an industrially relevant, ambient-air slot-die coating process. This dual focus on both record efficiency and scalable, cost-effective manufacturing is particularly significant for the industry, distinguishing it from purely academic records.

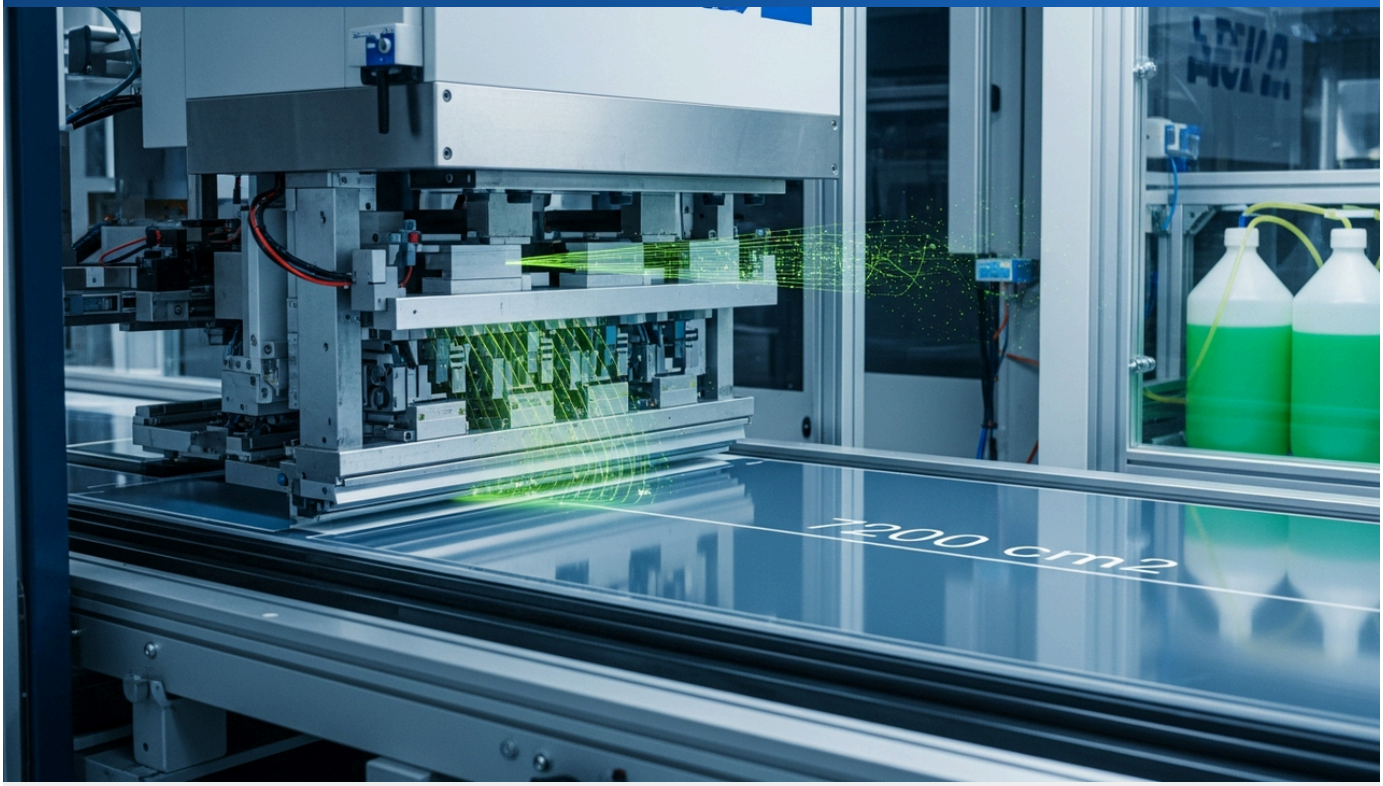
Strategic Significance & Outlook

This pioneering achievement holds immense potential for accelerating the mass production of high-efficiency, low-cost perovskite/silicon tandem solar cells. The validation of ambient-air slot-die coating technology removes a major hurdle for scaling production from kilowatt to gigawatt levels. This advancement is expected to further drive down the Levelized Cost of Energy (LCOE) for solar photovoltaics, fostering broader market adoption. Furthermore, the compatibility with flexible substrates opens up diverse application areas, including building-integrated photovoltaics (BIPV), portable devices, and electric vehicles, thereby significantly contributing to the global penetration of renewable energy technologies.

Source: https://www.perovskite-info.com/ipvf-and-tu-delft-reach-31-efficiency-ambient-air-processed-perovskitesilicon

#17 7200 cm² Perovskite Module Achieves 17.2% Efficiency and IEC Certification with Slot-Die Coating and Green Solvents, Accelerating Commercialization

Published June 22, 2026 [Science Journal] Unknown



OVERVIEW

A 7200 cm² perovskite photovoltaic module achieved a certified stabilized efficiency of 17.2% and received IEC 61215 international reliability standard certification, leveraging slot-die coating and green solvent systems. The use of low-boiling-point green solvents, combined with optimized process flow, reduces energy consumption during manufacturing and minimizes environmental impact. Demonstrated stability under Damp Heat conditions (85 °C, 85% RH, 1000 hours), certified by TÜV Rheinland, represents a critical step in overcoming reliability challenges for perovskite solar commercialization.

IN DEPTH

Key Findings

A large-area perovskite photovoltaic module (PPM), spanning a significant 7200 cm^2, has achieved a certified stabilized efficiency of 17.2%. Crucially, this module has also successfully passed rigorous testing under the IEC 61215 international reliability standard certification framework, including extended Damp Heat tests. This breakthrough was realized by combining an environmentally friendly green solvent system with industrial-scale slot-die coating technology, signifying a major advance in the reliability and manufacturability of perovskite solar cells for commercial deployment.

Technical Details

The core innovation lies in the adoption of green solvent systems, which replace traditional toxic solvents to address both environmental and regulatory concerns. These green solvents, characterized by their lower boiling points and optimized process flows, significantly reduce energy consumption during the manufacturing process. This eco-conscious solvent system was integrated with slot-die coating technology, which enables high-speed and uniform film deposition, making it ideal for large-scale, efficient module production. Critically, reliability tests, certified by TÜV Rheinland, demonstrated stable performance with no significant degradation after 1000 hours under Damp Heat conditions (85 °C, 85% relative humidity). Meeting the stringent IEC 61215 international standard suggests that these perovskite solar cells can offer reliable, long-term performance in real-world outdoor environments, a key factor for widespread adoption.

Background & Context

Perovskite solar cells are considered a promising next-generation PV technology due to their high efficiency potential and low manufacturing costs. However, long-term stability and environmental compatibility have remained primary hurdles to their commercialization. Achieving high efficiency on large-area modules and securing durability certifications under practical conditions are pivotal for market entry. This research provides concrete solutions to these challenges, addressing both green chemistry and scalable manufacturing processes. It marks a significant progression toward the industrialization of perovskite photovoltaics and contributes to reducing the environmental footprint typically associated with solar cell manufacturing, aligning with sustainable energy production goals.

Strategic Significance & Outlook

The achievement of 17.2% efficiency on a 7200 cm^2 module coupled with IEC certification strongly indicates that perovskite PV modules are transitioning from laboratory curiosities to practical, deployable technology. The combination of slot-die coating and green solvents establishes a robust foundation for achieving a competitive Levelized Cost of Energy (LCOE) in the future. This technology is expected to find applications in a wide range of areas, including Building-Integrated PV (BIPV) and large-area distributed power generation systems. Continued advancements in efficiency and long-term stability will likely position perovskite solar cells as a dominant force in the renewable energy market, playing a crucial role in the global energy transition.

Source: #

#18 Japanese Government Designates Perovskite Solar Cells as National Strategy for 2030s Rollout; EneCoat Technologies Begins Demonstration

Published June 25, 2026 Labmemo Japan

OVERVIEW

As of 2026, perovskite solar cells are recognized as a key technology for Japan's energy security and decarbonization efforts, with METI driving a national strategy for widespread adoption by the 2030s. EneCoat Technologies, a Kyoto University spin-off, commenced demonstration operations of its perovskite modules in March 2026, leveraging low-cost solution-process manufacturing. BIPV products for high-end homes and offices are expected around 2027-2028, with mass market penetration for general households anticipated by 2030.

IN DEPTH

Key Findings

The Japanese government has officially designated perovskite solar cells as a strategic technology vital for enhancing national energy security and achieving a decarbonized society. Led by the Ministry of Economy, Trade and Industry (METI), a national strategy is underway to ensure the full-scale social implementation and widespread adoption of this technology by the 2030s. As part of this initiative, EneCoat Technologies, a startup spun out of Kyoto University, commenced demonstration operations of its perovskite modules in March 2026, marking a concrete step towards the practical application of low-cost, solution-processed manufacturing.

Technical Details

EneCoat Technologies' perovskite solar cells are primarily manufactured using a solution process, specifically printing methods. This technology offers a significant advantage over silicon solar cells, as it eliminates the need for high-temperature and high-vacuum processes, enabling manufacturing at room temperature and atmospheric pressure, thereby drastically reducing production costs. The company also boasts expertise in depositing thin films on flexible substrates, aiming to commercialize thin, lightweight modules that can be installed in diverse locations such as building walls, windows, and vehicles. The ongoing demonstration operations are crucial for evaluating performance under real-world conditions and accumulating reliability data, which are indispensable for future product commercialization and market entry.

Background & Context

Japan heavily relies on overseas imports for most of its energy resources, making the improvement of energy self-sufficiency a long-standing national challenge. Additionally, the country faces urgent pressure to expand renewable energy adoption to meet its 2050 carbon neutrality goals. Perovskite solar cells are garnering significant attention in Japan due to their high efficiency in low-light conditions, flexibility for various shapes, and transparency—characteristics that overcome installation constraints prevalent in urban environments and for mobile applications, which are challenging for conventional solar cells. METI aims to establish a large-scale domestic production system for perovskite technology by the 2030s, positioning it as a key energy source, and EneCoat Technologies' demonstration is a vital step towards achieving this objective.

Strategic Significance & Outlook

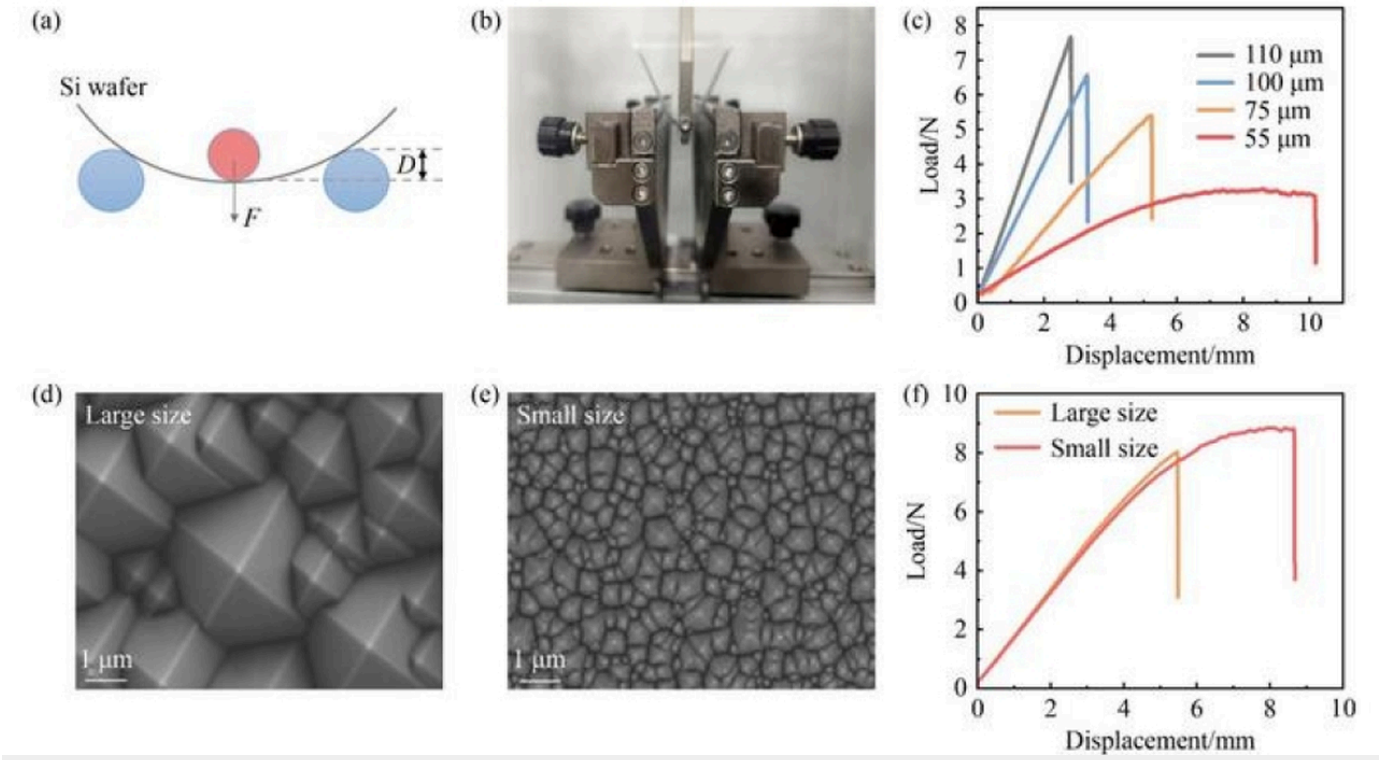
Japan's perovskite solar cell market is projected for rapid expansion in the coming years. Market forecasts suggest that building-integrated photovoltaics (BIPV) products for high-end residential and office buildings will begin appearing on the market around 2027-2028. Furthermore, by approximately 2030, products for general households are expected to achieve full-scale penetration and become widely adopted. EneCoat Technologies' technology holds the potential to be a core driver of this growth. The widespread adoption of low-cost, high-efficiency solar power generated by perovskite cells is expected to significantly transform Japan's energy mix and contribute to the realization of a sustainable society. With strong government support and concerted corporate R&D efforts, Japan's perovskite industry is poised to enhance its international competitiveness.

Source: https://labmemo.com/perovskite-solar-cell-guide-2026/

Collected: June 26, 2026 | Automated Research System (Gemini API)

#19 Tiny Pyramids Boost Perovskite/Silicon Tandem Efficiency to 30%, Enhancing Flexibility and Durability

Published June 18, 2026 Compound Semiconductor News China



OVERVIEW

A research team from the Shanghai Institute of Microsatellite Innovation (SIMIT) has achieved 30% power conversion efficiency in perovskite/silicon tandem solar cells by optimizing silicon wafer thickness and reducing surface texturing pyramid size. This innovative approach significantly improves the mechanical performance and flexibility of the device by mitigating mechanical stress between the silicon bottom cell and perovskite top cell, thereby solving delamination and degradation issues. This marks a crucial step towards commercializing high-efficiency tandem solar cells.

IN DEPTH

Key Findings

A research team at the Shanghai Institute of Microsatellite Innovation (SIMIT) has achieved a high efficiency of 30% for perovskite/silicon tandem solar cells through an innovative structural design. This breakthrough is particularly significant because it not only pushed efficiency boundaries but also substantially improved the overall mechanical performance and flexibility of the device by optimizing the thickness of the silicon bottom cell and miniaturizing the size of surface texturing pyramids.

Technical Details

The SIMIT team developed a technique to significantly reduce the thickness of the silicon wafer while forming minute texturing pyramids on its surface. These pyramids are crucial for efficiently trapping light and optimizing its transmission into the perovskite top cell. However, conventional larger pyramids typically induce substantial mechanical stress between the silicon and the overlaid perovskite layer, leading to delamination and device degradation. The SIMIT team effectively mitigated this mechanical stress by shrinking the pyramid size to the nanoscale. This stress reduction is paramount for enhancing the long-term stability and durability of tandem solar cells. Additionally, the thinner silicon wafer contributes to increased device flexibility, broadening its adaptability for various installation environments and applications, such as building-integrated photovoltaics or wearable electronics.

Background & Context

Perovskite/silicon tandem solar cells are garnering significant attention as a next-generation photovoltaic technology capable of surpassing the theoretical efficiency limits of single-junction silicon solar cells. However, achieving high efficiency while simultaneously addressing device long-term stability, particularly degradation caused by mechanical stress, has been a major hurdle for commercialization. Internal stresses arising from differences in thermal expansion coefficients between the perovskite and silicon layers, when stacked, can shorten device lifespan. SIMIT's achievement presents a clever solution to this structural challenge through microscopic surface texturing, representing a critical technological advancement in achieving both high efficiency and reliability.

Strategic Significance & Outlook

The achievement of 30% efficiency, coupled with enhanced device flexibility and durability, provides a powerful impetus for the commercialization of perovskite/silicon tandem solar cells. Resolving issues like delamination and degradation due to mechanical stress will extend product lifetimes and improve overall reliability. This breakthrough is expected to significantly expand the application range for flexible solar cells, including building-integrated photovoltaics (BIPV), automotive applications requiring curved surfaces, and wearable devices. This technology holds immense potential to accelerate the adoption of high-efficiency solar cells and contribute substantially to global energy transition goals, fostering a more sustainable energy future.

Source:
https://compoundsemiconductor.net/article/124498/Tiny_pyramids_boost_perovskite_silicon_tandem_efficiency

#20 U.S. Next-Gen Solar Market Heats Up: DOE Commits $40M, Oxford PV Begins Commercial Tandem Supply

Published June 24, 2026 openPR.com United States

OVERVIEW

The U.S. market is witnessing rapid commercialization of perovskite solar cells, with the Department of Energy (DOE) injecting $40 million into 22 funding initiatives to vigorously support R&D. Oxford PV has already commenced supplying commercial tandem modules to U.S. utilities, intensifying competition among companies like Hunt Perovskite Technologies, Swift Solar, Saule Technologies, and Greatcell Energy. The allure of efficiencies exceeding 25% and low-cost manufacturing methods like solution printing and vapor deposition is driving increased demand for BIPV and flexible applications.

IN DEPTH

Key Findings

The next-generation solar market in the United States, particularly the perovskite solar cell sector, is experiencing a surge in activity with accelerated commercialization efforts. The U.S. Department of Energy (DOE) is bolstering this critical technology's research, development, and market entry by investing a total of $40 million across 22 funding initiatives. Furthermore, Oxford PV has already begun supplying commercial perovskite-silicon tandem modules to U.S. utility companies, signaling the market's increasing maturity and heightened competition among key players.

Technical Details

The primary appeal of perovskite solar cells stems from their high power conversion efficiency and low manufacturing costs. Current R&D efforts consistently achieve efficiencies exceeding 25%, surpassing the theoretical limits of traditional silicon solar cells. In terms of production, inexpensive methods such as solution printing and vapor deposition, highly suitable for large-scale manufacturing, are employed, enhancing the cost competitiveness of perovskite solar cells. Companies like Hunt Perovskite Technologies, Swift Solar, Saule Technologies, and Greatcell Energy are actively developing their proprietary technologies and vying for market entry. This includes diverse innovative product developments, such as applications on flexible substrates and integration into Building-Integrated Photovoltaics (BIPV). The DOE's funding is strategically directed towards research aimed at overcoming challenges related to stability, durability, and scalability, which are crucial for widespread adoption.

Background & Context

The United States is intensifying its investments in renewable energy technologies to accelerate the transition to clean energy. Solar power, in particular, is positioned as a key energy source, leading to high expectations for next-generation technologies that can further improve efficiency and reduce costs. Perovskite solar cells hold the potential to unlock new installation sites and applications previously challenging for silicon solar cells, thus playing a strategic role in diversifying the U.S. energy mix and bolstering energy security. The DOE's funding also aims to enhance U.S. competitiveness in perovskite technology development, where countries like China have established an early lead, and to establish a robust domestic supply chain.

Strategic Significance & Outlook

The growth of the perovskite solar cell market in the U.S. is expected to accelerate further, driven by strong government support and fierce technological competition among multiple companies. Significant demand expansion is anticipated in high-value-added sectors such as BIPV and flexible solar cells, and success in these markets is expected to bolster the overall penetration of perovskite technology. Oxford PV's initiation of supplies to utility companies signifies that perovskite solar cells have entered a practical deployment phase, and the variety and volume of products entering the market are projected to increase substantially in the coming years. This technological innovation will be an indispensable component in achieving U.S. clean energy goals and will profoundly impact the global solar power industry.

Source: https://www.openpr.com/news/4559519/next-gen-solar-takes-center-stage-as-u-s-perovskite-market

#21 Oxford PV CEO States Perovskite Tandem Solar Cells are 'Stealth Disruptor' to Reach Gigawatt Production by 2028 at Intersolar Europe 2026

Published June 25, 2026 PV Tech Germany

OVERVIEW

At Intersolar Europe 2026, David Ward, CEO of Oxford PV, predicted that perovskite-silicon tandem technology would commence 'gigawatt-scale' production by 2028, becoming a 'stealth disruptor' that can fundamentally transform existing silicon manufacturing lines. Laurent Bodin, CCO of French PV startup HoloSolis, also emphasized that the EU has a 'one-off chance' to invest in the future of PV manufacturing through tandem technology. These statements highlight the strategic importance of next-generation solar cell manufacturing in Europe.

IN DEPTH

Key Findings

During discussions at Intersolar Europe 2026, David Ward, CEO of Oxford PV, a company specializing in perovskite-silicon tandem solar cells, boldly predicted that this innovative technology would achieve 'gigawatt-scale' production by 2028. He underscored the potential for tandem technology to become a 'stealth disruptor,' delivering immense value to the solar industry without fundamentally altering existing silicon manufacturing lines. This statement clearly reflects the industry's optimistic outlook on the role next-generation solar cells will play in achieving Europe's energy independence.

Technical Details

Perovskite-silicon tandem solar cells are poised to break through the theoretical efficiency limits of conventional single-junction silicon solar cells. While silicon efficiently absorbs longer-wavelength light, perovskites effectively capture shorter-wavelength light. By stacking these two materials, a broader spectrum of solar energy can be converted into electricity. Ward's characterization of the technology as a 'stealth disruptor' suggests its potential for relatively easy integration into existing silicon solar cell manufacturing facilities. This means high-efficiency modules can be produced by leveraging existing infrastructure, circumventing the need for expensive new capital expenditures. This approach allows for substantial increases in power generation while containing manufacturing costs. Laurent Bodin, CCO of French PV manufacturing startup HoloSolis, also noted that given the concentration of perovskite expertise in European research institutions like Oxford PV and Fraunhofer, the EU has a 'one-off chance' to invest in PV manufacturing based on tandem technology.

Background & Context

The European Union (EU) is accelerating the adoption of renewable energy, particularly solar photovoltaics, to strengthen energy security and achieve its 2050 carbon neutrality goals. However, the current heavy reliance on Asian manufacturers for the majority of solar panel production is perceived as a supply chain risk. Consequently, bolstering domestic manufacturing capacity within Europe has become an urgent priority. In this context, perovskite-silicon tandem technology is viewed as a strategic trump card for Europe to regain global competitiveness in PV manufacturing. The ability to utilize existing infrastructure is particularly appealing, as it significantly reduces the time and cost associated with building new manufacturing facilities, thereby contributing to a rapid increase in European production capacity.

Strategic Significance & Outlook

The Oxford PV CEO's forecast of gigawatt-scale production indicates that perovskite-silicon tandem solar cells could become a mainstream technology in the solar PV market within the next few years. As Europe possesses leading companies and research institutions in this technological development, a concerted effort combining policy support and industrial investment could establish the region as a major hub for next-generation PV manufacturing. This would enable the EU to enhance its energy self-sufficiency and strengthen its leadership in the global clean energy technology market. The advancement of perovskite technology is expected to bring about significant transformations not only in solar power efficiency but also in manufacturing methods and supply chain structures, contributing to the establishment of a more sustainable and decentralized energy system.

Source: https://now.solar/2026/06/25/intersolar-europe-2026-domestic-solar-manufacturing-wont-be-a-disruptor-fronius-pushes-eu-made-message-pv-tech/

Collected: June 26, 2026 | Automated Research System (Gemini API)

#22 Nature Energy Paper Reports 'Cascade Hole-Transfer Strategy' Dramatically Boosts Long-Term Stability in Perovskite Solar Cells

Published June 26, 2026 Nature Energy Unknown

OVERVIEW

A study published in Nature Energy reports the development of a 'cascade hole-transfer strategy' for hybrid perovskite/organic solar cells, which suppresses charge recombination and provides inherent moisture stability. This novel strategy addresses the long-standing challenge of perovskite solar cells' sensitivity to heat and humidity, which has historically limited their practical application. Building upon previous work demonstrating thiocyanate-incorporated perovskites' processability in humid ambient air, this research establishes a groundbreaking approach to mitigate moisture-related instability.

IN DEPTH

Key Findings

A recent research paper published in Nature Energy reports the successful development of an innovative 'cascade hole-transfer strategy' for hybrid perovskite/organic solar cells. This strategy effectively suppresses charge recombination while simultaneously imparting inherent moisture stability. This breakthrough represents a significant advancement in overcoming the major hurdle of sensitivity to heat and humidity, which has critically limited the commercialization of perovskite solar cells.

Technical Details

The cascade hole-transfer strategy developed in this study involves the sequential arrangement of multiple hole-transporting materials, creating an efficient pathway for the extraction of charge carriers (holes). This configuration ensures that holes generated within the perovskite layer smoothly migrate to the electrode, dramatically suppressing energy losses due to charge recombination. This strategy builds upon prior research that demonstrated the stable functionality of thiocyanate-incorporated perovskite materials even when processed in humid ambient air. Thiocyanate compounds are known to passivate defects within the perovskite crystal structure, thereby enhancing its resistance to degradation induced by moisture. The novel cascade hole-transfer strategy further amplifies this inherent moisture stability, leading to a synergistic improvement in the overall durability of the device. This provides a concrete solution to the long-standing challenge of simultaneously achieving high performance and long-term stability in perovskite solar cells.

Background & Context

Perovskite solar cells have seen a dramatic increase in power conversion efficiency over the past decade, positioning them as a leading candidate for next-generation photovoltaics. However, despite their high efficiency, vulnerability to environmental factors such as heat, humidity, and UV light has remained the most significant barrier to commercialization. Moisture, in particular, is a primary culprit, disrupting the perovskite crystal structure and causing performance degradation. Previous research efforts have focused on improving stability through material composition modifications and encapsulation techniques, but these have not fully resolved the intrinsic stability issues. The 'cascade hole-transfer strategy' is a highly anticipated breakthrough for the industry, as it addresses fundamental moisture stability from both material design and device architecture perspectives.

Strategic Significance & Outlook

The success of this cascade hole-transfer strategy clearly defines a pathway for perovskite solar cells to achieve reliable, long-term performance in outdoor environments. Enhanced moisture stability will extend the product lifespan of perovskite solar cells, potentially enabling them to match or even surpass the durability of conventional silicon solar cells. This breakthrough is expected to accelerate commercial deployment across a wide range of applications, including Building-Integrated Photovoltaics (BIPV), flexible solar cells, and transparent solar cells. Furthermore, if ambient-air processing remains applicable, it could lead to further reductions in manufacturing costs, representing a critical step towards making perovskite solar cells more affordable and widely accessible. This achievement solidifies the role of perovskite technology in the global clean energy transition.

Source: https://now.solar/2026/06/26/a-cascade-hole-transfer-strategy-towards-stable-hybrid-perovskite-solar-cells-nature/

#23 Driving Japan's Energy Independence: Sekisui Chemical, Panasonic, Toshiba, EneCoat Lead Perovskite Solar Cell Development

Published June 23, 2026 YouTube Japan

OVERVIEW

Perovskite solar cells are gaining national attention in Japan for energy security and industrial policy. Major corporations like Sekisui Chemical, Panasonic, Toshiba, and EneCoat Technologies, alongside research institutions such as Kyoto University, AIST, and NIMS, are intensively pursuing R&D and demonstration. The realization of roll-to-roll continuous production is expected to significantly reduce manufacturing costs, envisioning a future where walls, windows, and car bodies become power generators, forming 'power-generating social infrastructure.'

IN DEPTH

Key Findings

In Japan, perovskite solar cells are receiving national attention as a core technology for ensuring energy security and achieving a decarbonized society. Leading industrial players such as Sekisui Chemical, Panasonic, Toshiba, and EneCoat Technologies, alongside prominent research institutions including Kyoto University, the National Institute of Advanced Industrial Science and Technology (AIST), and the National Institute for Materials Science (NIMS), are collaboratively driving the research, development, and demonstration of this innovative solar cell technology.

Technical Details

Japanese R&D efforts are focused on low-cost manufacturing, high efficiency, and versatile application possibilities for perovskite solar cells. A critical objective is the establishment of continuous production methods, such as roll-to-roll (R2R) printing. If realized, R2R production is expected to dramatically simplify manufacturing processes and substantially reduce production costs compared to conventional silicon solar cells. R2R enables high-speed, continuous deposition of perovskite layers onto flexible substrates like plastic films, leading to lighter, thinner, and highly adaptable modules for various shapes. This facilitates deployment in challenging locations such as building-integrated photovoltaics (BIPV) for windows and walls, and even vehicle bodies, where traditional solar cell installation has been difficult. Additionally, high power generation efficiency in low-light conditions, common in Japan's often cloudy climate, presents a significant advantage.

Background & Context

Japan, being poor in energy resources, has long faced the national challenge of improving its energy self-sufficiency. Simultaneously, the country is urgently pressed to maximize renewable energy adoption to achieve its 2050 carbon neutrality goal. Perovskite solar cells are positioned as a 'game-changer' that can meet Japan's unique environmental and policy demands. In a country with limited land for large-scale ground-mounted solar farms, perovskites, which can be easily integrated into building vertical surfaces and urban infrastructure, are deemed essential for transforming Japan's energy mix. Under strong government support, active industry-academia collaboration is underway to establish internationally competitive technologies.

Strategic Significance & Outlook

The industry-academia-government collaboration in Japan for perovskite solar cell development is not merely about technological innovation; it holds a grand vision for redefining social infrastructure. If roll-to-roll technology is established and manufacturing costs are drastically reduced, solar cells will evolve from specialized power generation equipment into 'power-generating social infrastructure' integrated into all building materials and products. A future where windows generate electricity, car bodies charge themselves, and building walls produce power will promote local energy production for local consumption and enhance the resilience of communities. This technology is expected to become a crucial pillar for fundamentally reforming Japan's energy structure and realizing a sustainable and self-sufficient society.

Source: https://www.youtube.com/watch?v=yEVakh-T1Jo

#24 UtmoLight Unveils High-Strength (5400Pa Load) and Ultra-Light (4kg) Perovskite Solar Modules at SNEC 2026, Bolstering BIPV Market

Published June 18, 2026 pv magazine Global China

OVERVIEW

China's UtmoLight launched a new series of highly durable and ultra-light perovskite solar modules at SNEC 2026, addressing critical market needs for robust and versatile PV solutions. The "Chuangshi S2" model features 3.2mm tempered glass and a high mechanical load resistance of 5400 Pa, certified by TÜV Rheinland. Concurrently, the "Chuangshi S1" offers an ultra-light design, measuring only 2.6mm thick and weighing approximately 4kg, specifically targeting Building-Integrated Photovoltaics (BIPV) and distributed PV applications.

IN DEPTH

Key Findings: UtmoLight Introduces Durable and Lightweight Perovskite Modules for Diverse Applications

UtmoLight, a cutting-edge Chinese solar cell manufacturer, unveiled a new line of perovskite solar modules at SNEC 2026, one of the world's largest photovoltaic exhibitions. This new series represents a significant advancement by combining high mechanical strength—a previous challenge for perovskite technology—with ultra-lightweight properties demanded by specific applications. These innovative products are poised to strongly drive the adoption of Building-Integrated Photovoltaics (BIPV) and distributed PV applications.

Product and Technical Details: Characteristics of Chuangshi S2 and S1

- **Chuangshi S2 (High-Strength Model):** This model achieves exceptional durability through the use of 3.2mm thick tempered glass. It is certified by TÜV Rheinland to withstand a high mechanical load of 5400 Pa, among the highest in the industry. This load resistance guarantees reliability under severe environmental conditions, such as high wind pressure and heavy snow loads. The S2 is ideal for large-scale ground-mounted solar farms and commercial buildings where robustness is paramount.
- **Chuangshi S1 (Ultra-Light Model):** In contrast, the Chuangshi S1 distinguishes itself with an impressive ultra-lightweight design, measuring only 2.6mm thick and weighing approximately 4kg. This design is perfect for existing structures where roof load must be minimized, for BIPV applications where integration with building aesthetics is key, and for portable power solutions. The reduced weight also streamlines installation processes, potentially lowering overall installation costs.

Background and Industry Context

Perovskite solar cells have been hailed as a "dream solar cell" due to their high conversion efficiency and potential for low-cost manufacturing. However, improving long-term stability and mechanical properties has been a crucial hurdle for commercialization. UtmoLight's announcement addresses these challenges by offering practical solutions through advanced module design and material selection. This signifies that perovskite technology is evolving from mere high-performance "cells" into "products" that meet diverse market needs. The BIPV market, in particular, stands to benefit significantly from lightweight and durable perovskite modules, as they offer the potential to combine architectural aesthetics with energy generation, accelerating the growth of this sector.

Strategic Significance and Outlook

The modules introduced by UtmoLight are set to open new avenues for the commercialization of perovskite solar cells. The high-strength model provides peace of mind for customers in demanding environments, while the ultra-lightweight model enables solar power deployment in locations previously deemed unsuitable due to structural limitations. This technological innovation is expected to foster greater integration of solar power into buildings, contributing to both urban aesthetics and renewable energy production. UtmoLight aims to expand the market applicability of perovskite solar cells through these products, thereby contributing to the global energy transition.

Source: https://www.perovskite-info.com/utmolight-unveils-high-strength-and-ultra-light-perovskite-solar-modules

Collected: June 26, 2026 | Automated Research System (Gemini API)

#25 HZB and HTW Berlin Develop Novel Method to Predict Long-Term Stability of Perovskite Solar Cells, Enhancing Accelerated Degradation Testing

Published June 26, 2026 EurekAlert! Germany

OVERVIEW

Researchers from Helmholtz-Zentrum Berlin (HZB) and HTW Berlin have published a groundbreaking method in Joule for more accurately assessing the long-term stability of perovskite solar cells. Through 20 months of outdoor degradation testing, they identified three key degradation mechanisms: phase separation, copper corrosion, and edge patterns. Crucially, they demonstrated that increasing light intensity can accelerate all these degradation processes, promising a significant boost in the accuracy and reliability of accelerated aging tests.

IN DEPTH

Key Findings: New Methodology Established for Long-Term Stability Assessment of Perovskite Solar Cells

A joint research team from Germany's Helmholtz-Zentrum Berlin (HZB) and HTW Berlin has developed an innovative approach to evaluate the long-term stability of perovskite solar cells, publishing their findings in the scientific journal Joule. This study provides crucial guidelines for improving the reliability of accelerated degradation tests by meticulously analyzing the degradation behavior of solar cells under real outdoor conditions. Specifically, the team identified three primary degradation mechanisms over a 20-month period of natural degradation testing and demonstrated that these processes can be significantly accelerated by increasing light intensity.

Technical Details: Identification of Degradation Mechanisms and Acceleration Techniques

- **Identified Degradation Mechanisms:**
  - **Phase Separation:** This phenomenon involves changes in the crystalline structure of perovskite materials over time, leading to performance degradation. It is particularly common in mixed-cation perovskite systems.
  - **Copper Corrosion:** Copper, often used in solar cell module electrodes and wiring, can react with the perovskite layer or the surrounding environment, causing corrosion. This leads to poor electrical contact, impacting the module's electrical pathways and resulting in reduced power output.
  - **Edge Patterns:** These refer to visible patterns and performance deterioration caused by moisture and oxygen ingress from the module edges, leading to degradation of the perovskite layer. Improving encapsulation technology is vital for addressing this issue.
- **Acceleration via Light Intensity:** The research team successfully demonstrated that increasing the light intensity irradiated onto the solar cells can simultaneously accelerate all three identified degradation mechanisms. This breakthrough enables the replication of 20 months of real-world degradation in a much shorter accelerated test, dramatically shortening the durability assessment cycle for new materials and devices.

Background and Industry Context

Perovskite solar cells are highly anticipated as a next-generation photovoltaic technology due to their high energy conversion efficiency and potential for low-cost manufacturing. However, a major challenge to their commercialization has been ensuring long-term stability, especially maintaining performance under harsh outdoor conditions. Traditional stability evaluation methods are time-consuming and expensive, hindering the development cycle of new materials. This new research offers a quicker and more accurate method for accelerated degradation testing, significantly bolstering the credibility and market adoption of perovskite solar cells.

Strategic Significance and Outlook

The findings from HZB and HTW Berlin are expected to have a direct impact on the design and material development of perovskite solar cells. Degradation mechanisms' clear understanding, coupled with established accelerated testing methods, will foster the development of more stable perovskite materials and device architectures. This will, in turn, make product lifetime guarantees easier to achieve, building greater trust among investors and consumers. In the future, this new evaluation method is anticipated to become an industry standard, providing a fundamental basis for perovskite solar cells to achieve multi-decade stable operation, comparable to conventional silicon solar cells.

Source: https://www.eurekalert.org/news-releases/1133550

Collected: June 26, 2026 | Automated Research System (Gemini API)

#26 Perovskite-Silicon Tandem Module Breaks 30% Efficiency Barrier at SNEC 2026, Achieving Over 900W Peak Power

Published June 18, 2026 Vmaxpower PV China

OVERVIEW

At SNEC 2026, perovskite/silicon tandem solar cell technology demonstrated remarkable progress, with large industrial-standard size (~3.1m^2) tandem modules achieving over 900W peak power and over 29% aperture efficiency. Certified by an authoritative third party, this marks the first time tandem module efficiency has officially exceeded 30%, while single-junction perovskite modules also surpassed 23%. Furthermore, GW-scale production lines are operational in China, and multiple MW-scale perovskite PV power plants have operated stably for over a year, establishing a strong foundation for commercialization.

IN DEPTH

Key Findings: Perovskite Tandem Modules Surpass 30% Efficiency Threshold, Accelerating Commercialization

At the SNEC 2026 International Solar Photovoltaic and Smart Energy Exhibition, perovskite/silicon tandem solar cell technology once again captured the industry's attention with groundbreaking advancements. Latest presentations revealed that industrial-standard large-area (approximately 3.1 m^2) tandem modules have achieved an astonishing performance of over 900W peak power and over 29% aperture efficiency. This performance, certified by an authoritative third-party institution, signifies a historic milestone as tandem module conversion efficiency has officially exceeded 30% for the first time. Concurrently, single-junction perovskite modules have also reached over 23% efficiency, demonstrating the overall maturity of perovskite technology.

Technical and Commercialization Details: Record Efficiency and Large-Scale Production

- **Record Tandem Module Efficiency:** Surpassing 30% module efficiency pushes the boundaries of existing solar cell technology. This is attributed to the perovskite layer's ability to absorb a broader range of the solar spectrum, working synergistically with the silicon layer to convert significantly more solar energy into electricity. The over 900W peak power output offers a substantial advantage, especially in markets where land utilization efficiency is critical, as it enables higher power generation from a limited installation area.
- **Large-Scale Production and Stable Operation in China:** In China, gigawatt (GW)-scale perovskite solar cell production lines are already operational, indicating rapid establishment of industrial infrastructure for mass production. Furthermore, the successful stable operation of multiple megawatt (MW)-scale perovskite PV power plants for over a year unequivocally demonstrates that this technology possesses not only laboratory-level performance but also real-world reliability and durability. These proven track records are expected to boost investor confidence for future large-scale commercial deployments.

Background and Industry Context

Enhancing solar power efficiency is crucial for improving the economics of renewable energy adoption. Perovskite/silicon tandem technology has been the subject of intense global research and development, holding the promise of breaking through the efficiency limits of conventional silicon solar cells. The achievement of over 30% module efficiency is not merely a technical feat; it could play a decisive role in further lowering the Levelized Cost of Electricity (LCOE) for solar power, thereby strengthening its competitiveness against fossil fuels.

Strategic Significance and Outlook

The announcements at SNEC 2026 strongly suggest that perovskite solar cells are poised for a full-scale entry into the mainstream photovoltaic market within the next few years. Specifically, China's GW-scale production capacity and the proven stable operation of actual power plants underscore the technology's approaching commercial maturity. Such advancements will accelerate the global energy transition and serve as a vital driving force towards achieving a sustainable society. In the future, it is expected that higher efficiency, lower-cost perovskite tandem modules will be widely adopted across all solar power applications, from residential to large-scale power plants.

Source: https://www.vmaxpowerpv.com/news/perovskite-tandem-sets-new-world-record-distributed-pv-becomes-the-main-installed-capacity-driver/

Collected: June 26, 2026 | Automated Research System (Gemini API)

#27 Microquanta Launches 26%-Efficient Colored Perovskite-Silicon Tandem Modules for BIPV at Intersolar Europe, Commercialized with 25-Year Output Warranty

Published June 24, 2026 pv magazine Global China

OVERVIEW

China's Microquanta unveiled 26% efficient colored perovskite-silicon tandem modules for the Building-Integrated PV (BIPV) market at Intersolar Europe. These modules integrate architectural finishes, like a marble effect, with 4-terminal tandem technology to significantly mitigate the performance degradation typically associated with colored PV facades. The fully commercialized product comes with a 25-year linear power output warranty and a 12-year product and manufacturing warranty, marking a significant advancement for BIPV adoption.

IN DEPTH

Key Findings: Microquanta Commercializes 26% Efficient Colored Perovskite Tandem Modules for BIPV

Microquanta, a Chinese solar photovoltaic technology company, unveiled an innovative product tailored for the Building-Integrated Photovoltaics (BIPV) market at Intersolar Europe, held in Germany. The company showcased 26% efficient colored perovskite-silicon tandem modules. This product aims to balance the power generation performance of a solar cell with the aesthetic design requirements of architecture, offering a groundbreaking solution to overcome the significant challenge of performance degradation often associated with colored PV facades.

Technical and Product Details: Balancing Aesthetics and High Efficiency

- **Coloration and High Efficiency:** Traditional colored solar cells tend to suffer from reduced efficiency as they sacrifice light absorption for aesthetic purposes. Microquanta's new modules maintain a high conversion efficiency of 26% while featuring beautiful architectural finishes, such as a marble effect. This is achieved through a combination of advanced material science and sophisticated device design.
- **Four-Terminal Tandem Technology:** The module employs a 4-terminal tandem technology, which allows for independent optimization of the perovskite and silicon layers. This enables each layer to efficiently absorb different parts of the solar spectrum, thereby maintaining high overall power output. It is specifically designed to maximize light utilization efficiency even when color filters are applied.
- **Optimized for BIPV Applications:** BIPV involves integrating solar cells directly into building exteriors, such as facades and roofs, combining power generation with building material functionality. Microquanta's colored modules offer a highly attractive option for architects and developers who prioritize harmony with urban landscapes.
- **Comprehensive Warranty:** This product is fully commercialized and comes with a 25-year linear power output warranty and a 12-year product and manufacturing warranty to underscore its reliability. Such extensive guarantees are crucial for alleviating market concerns about new technologies and promoting large-scale adoption.

Background and Industry Context

The BIPV market is experiencing rapid growth driven by urbanization and increasing demand for sustainable architecture. However, a key challenge for conventional solar cells has been their often-unappealing appearance, which can clash with building aesthetics. Perovskite solar cells, with their high transparency and flexibility, have long been anticipated for BIPV applications, but achieving both coloration and high efficiency has been a significant technical hurdle. Microquanta's announcement provides a concrete solution to this challenge, contributing to the further expansion of the BIPV market.

Strategic Significance and Outlook

Microquanta's 26% efficient colored perovskite-silicon tandem modules have the potential to bring about a major transformation in the BIPV market. By combining aesthetic appeal with high efficiency and a long-term warranty, the adoption of solar PV in the architectural industry is expected to accelerate. This will lead to improved energy self-sufficiency for buildings and contribute to reducing overall urban CO2 emissions. The company plans to continue developing products that meet diverse architectural needs, aiming to lead the global green building movement.

Source: https://www.pv-magazine.com/2026/06/24/microquanta-launches-26-efficient-colored-perovskite-silicon-tandem-modules-for-building-integrated-pv/

Collected: June 26, 2026 | Automated Research System (Gemini API)

#28 Hanwha Qcells Completes U.S. "Solar Hub" in Cartersville, Georgia, While Building Perovskite Tandem Pilot Line in South Korea

Published June 22, 2026 Perovskite-Info South Korea/USA

OVERVIEW

South Korea's Hanwha Qcells has completed its vertically integrated "Solar Hub" in Cartersville, Georgia, establishing full domestic production from ingot to module in the U.S. Concurrently, the company is constructing a perovskite-silicon tandem solar cell pilot line in South Korea, with plans for additional investments towards future gigawatt-scale tandem production. This strategic move aims to maximize manufacturing credits under the U.S. Inflation Reduction Act (IRA) and secure a competitive edge in the global next-generation solar market.

IN DEPTH

Key Findings: Hanwha Qcells Completes U.S. "Solar Hub" and Drives Global Perovskite Tandem Innovation

Hanwha Qcells, a prominent South Korean solar energy company, has achieved a significant milestone in bolstering its U.S. solar manufacturing capabilities. The company has completed its vertically integrated "Solar Hub" in Cartersville, Georgia, a facility that encompasses the entire production chain from ingot to wafer, cell, and final module manufacturing. The completion of this massive manufacturing base not only contributes to establishing a robust domestic solar supply chain in the U.S. but also serves as a crucial element in the company's global strategy. Simultaneously, Hanwha Qcells is progressing with the construction of a pilot production line for next-generation perovskite-silicon tandem solar cells in South Korea, with plans for additional investments towards future gigawatt (GW)-scale tandem production.

Strategic Investments and Technology Development Details

- **Completion of U.S. "Solar Hub":** The Cartersville plant demonstrates Hanwha Qcells' commitment to enhancing solar product self-sufficiency in the United States. This vertically integrated facility enables end-to-end production from raw materials to finished products, strengthening the supply chain and optimizing production costs. A key objective is also to maximize economic competitiveness by leveraging manufacturing credits provided by the U.S. Inflation Reduction Act (IRA).
- **Perovskite Tandem Pilot Line in South Korea:** Hanwha Qcells is accelerating its research and development for the commercialization of high-efficiency perovskite-silicon tandem solar cells. The construction of a pilot line in South Korea is a critical step towards establishing mass production processes for this advanced technology. Perovskite tandem technology is able to break the efficiency limits of current single-junction silicon solar cells, enabling even higher efficiencies, making investment in this area indispensable for securing future market leadership.
- **Plans for Future GW-Scale Production:** Based on insights gained from the pilot line, the company is advancing plans to scale up to gigawatt-scale perovskite tandem solar cell production. This ambitious goal clearly indicates Hanwha Qcells' intent to establish itself as a dominant player in the next-generation solar market.

Background and Industry Context

As the global energy transition progresses, solar power continues to grow in importance as a primary renewable energy source. In the United States, the Inflation Reduction Act (IRA) is strongly promoting policies to bolster domestic manufacturing and establish clean energy technology supply chains. Hanwha Qcells' substantial investment in the U.S. is a strategic move to maximize this policy environment, contribute to local job creation and economic growth, while expanding its market share. At the same time, investment in perovskite tandem technology ensures long-term technological superiority and drives innovation in the global solar PV market.

Strategic Significance and Outlook

The completion of Hanwha Qcells' U.S. Solar Hub and the construction of its perovskite tandem pilot line in South Korea illustrate the company's strategy to accelerate growth in the global solar power market through a dual focus: localized manufacturing and cutting-edge technology development. With the synergy of U.S. policy support and the maturing perovskite technology, Hanwha Qcells is expected to play a crucial role in delivering higher-performance and more cost-efficient solar power solutions to the market, further driving the global energy transition. Successful transition to future GW-scale tandem production would establish the company as a decisive entity in the global clean energy supply chain.

Source: https://www.perovskite-info.com/hanwha-qcells-completes-us-solar-hub-prepares-base-future-tandem-scale

Collected: June 26, 2026 | Automated Research System (Gemini API)