

PerovskiteSolarCells

Weekly Intelligence Report

2026-08-02 | 26 articles | 11 countries

troy-technical.jp

This Week's Keyword

Perovskite Tandem

Efficiency & Commercialization Surge

26

articles

Total Articles Analyzed

11

countries

Source Countries/Regions

35.5

%

Record Efficiency (LONGi)

5

GW

Largest Production Target

All 26 Articles This Week — 5-Axis Evaluation Matrix

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

#	Article Title	Type	Tech Novelty	Market Proximity	Market Impact	Data Reliability	US/EU Relevance	Summary
#01	LONGi 35.5% Tandem Rec	Research						LONGi achieves 35.5% perovskite-silicon tandem cell efficiency, ESTI verified, with 1m² modules at 25.8%.
#02	Sydney 30.2% 10cm² Cell	Research						U. Sydney achieves 30.2% efficiency on 10 cm² perovskite-silicon tandem cell, verified by CSIRO.
#03	GCL SI Flexible 33.44%	New Product						GCL SI achieves 33.44% efficiency in flexible perovskite-silicon tandem cells with >2,000 W/kg P2W ratio.
#04	Chinese 27.43% Stable	Research						Chinese researchers achieve 27.43% efficiency with 1,000-hour damp heat stability using novel CPI layer.
#05	PolyU Shading Resist	Research						Hong Kong PolyU develops perovskite-organic tandem cell retaining 97% efficiency under shading, improving durability.
#06	UV-Ozone Indoor PV	Research						UV-ozone processed P3HT boosts indoor perovskite solar cell performance, but shows trade-offs under full sun.
#07	FTAC 25.06% Stable	Research						Novel FTAC strategy achieves 25.06% efficiency and 1,000-hour durability in perovskite solar cells.
#08	CAS Perovskite-CIGS	Research						CAS develops 29.71% efficient perovskite-CIGS tandem cell with 2,000-hour stability via 2PyS engineering.
#09	Polish ST-PSC ITO	Research						Polish scientists develop 21.87% efficient semi-transparent perovskite PV, mitigating ITO sputtering damage.
#10	Arginine PeLEDs	Research						Arginine-mediated interface enables highly efficient, air-processed green PeLEDs with enhanced stability.
#11	Oxford PV Commercial	New Product						Oxford PV begins commercial production and shipment of 24-27% efficient perovskite-silicon tandem modules in 2026.
#12	Halocell R2R Partner	Corporate Strategy						Halocell Energy partners with MSWay (SK) to scale roll-printed perovskite solar modules for niche applications.

#	Article Title	Type	Tech Novelty	Market Proximity	Market Impact	Data Reliability	US/EU Relevance	Summary
#13	Cs Additive Air-Proc	Research	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●● ●	●●●●○ ○	Cesium cation additive boosts air-processed MAPbI3 perovskite solar cell efficiency to 23.17% with enhanced stability.
#14	US DOE \$29M Funding	Corporate Strategy	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●● ○	●●●●● ●	US DOE commits \$29M R&D; funding for solar manufacturing, PV recycling, and perovskite development.
#15	US DOE Strategy	Corporate Strategy	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●● ○	●●●●● ●	US DOE unveils research strategy for perovskite solar cells focusing on stability, scalability, and manufacturability.
#16	DOE PVRD2 Tandem R&D;	Research	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●● ○	●●●●● ●	DOE PVRD2 project researches interconnection design and reliability for perovskite-silicon tandem modules.
#17	TiOxNy Tandem Layers	Research	●●●●● ○	●●●●○ ○	●●●●○ ○	●●●●● ●	●●●●○ ○	Multifunctional TiOxNy layers boost performance and durability in perovskite-silicon tandem solar cells.
#18	Sheffield Lightweight	Research	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●● ●	U. Sheffield and partners launch project for lightweight solar power using micro-groove film for rooftops/facades.
#19	Intellivation R2R PVD	New Product	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●● ●	Intellivation LLC reports R2R PVD coating advances critical for enhancing flexible perovskite solar cell stability.
#20	Vacuum-Dep 25.53%	Research	●●●●● ○	●●●●○ ○	●●●●○ ○	●●●●● ○	●●●●○ ○	Researchers boost vacuum-deposited perovskite solar cell efficiency to 25.53% with acetate-driven crystallization control.
#21	JA Solar 0.6GW Invest	Corporate Strategy	●●●●○ ○	●●●●● ○	●●●●● ○	●●●●● ○	●●●●○ ○	JA Solar invests \$29M in a new 0.6 GW perovskite tandem module production line in China.
#22	Qcells NASA Lunar	Corporate Strategy	●●●●● ○	●●●●○ ○	●●●●● ○	●●●●○ ○	●●●●● ●	Hanwha Qcells to supply perovskite-silicon tandem cells for NASA lunar project, bolstering US manufacturing.
#23	Navitas/Caelux 5GW	Corporate Strategy	●●●●○ ○	●●●●○ ○	●●●●● ○	●●●●○ ○	●●●●● ●	Navitas Solar (India) and Caelux (US) partner for 5 GW perovskite-silicon tandem module manufacturing in India.
#24	Perovskia IoT Funding	New Product	●●●●○ ○	●●●●● ○	●●●●○ ○	●●●●○ ○	●●●●● ●	Swiss Perovskia Solar raises \$2.4M, secures 10 customers, scales to 1M cells for IoT printed perovskite solar.
#25	EU Tech Sovereignty	Corporate Strategy	●●●●○ ○	●●●●● ○	●●●●● ●	●●●●○ ○	●●●●● ●	European solar market shifts to perovskite-on-silicon for tech sovereignty, Oxford PV expands German production.
#26	Horizon EU Funding	Corporate Strategy	●●●●○ ○	●●●●○ ○	●●●●○ ○	●●●●● ○	●●●●● ●	Horizon Europe 2026/2027 funds industrial processes/equipment for perovskite-Si tandem commercialization.

●●●●○ 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?

New efficiency records (LONGi 35.5%) and commercial launches (Oxford PV 24-27%) for perovskite-silicon tandems are redefining performance benchmarks. Does your product roadmap account for this rapid shift, or risk falling behind?

❷ How exposed is your supply chain to Asian perovskite manufacturing?

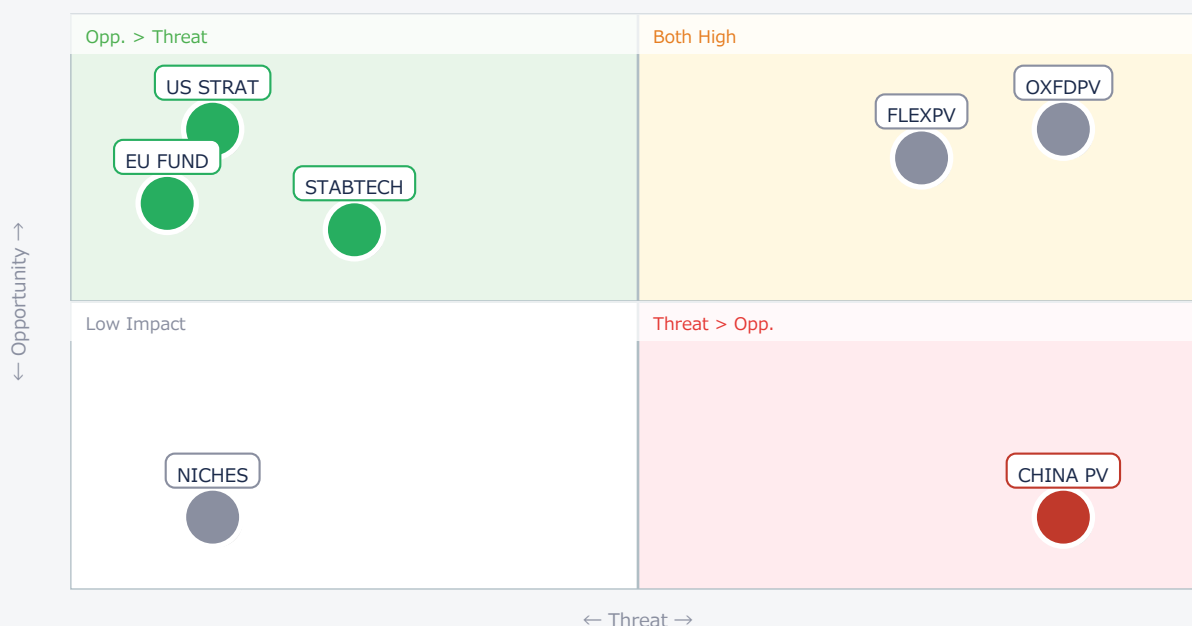
Chinese firms (LONGi, GCL SI, JA Solar) are aggressively scaling production and setting efficiency records. Are your procurement strategies diversified enough, or are you vulnerable to potential market dominance and IP shifts?

❸ Are you investing in next-gen flexible/BIPV applications?

Breakthroughs in flexible perovskites (GCL SI >2,000 W/kg) and BIPV solutions (U. Sheffield, Perovskia Solar) are opening new, high-value markets. Is your R&D exploring these opportunities, or are you ceding ground to agile competitors?

Opportunities vs. Threats for US/European Companies

Opportunity vs. Threat Matrix for US/European Companies



Item	Quadrant	↑ Opportunity	↓ Threat
OXFDPV	Critical	New high-eff modules	Incumbent tech obsol
CHINA PV	Threat	Access high-eff tech	Market share loss
US STRAT	Opp.	US market growth	Non-US market access
STABTECH	Opp.	New materials/IP	—
FLEXPV	Critical	New market entry	Miss niche markets
NICHES	Ref.	Niche market entry	—
EU FUND	Opp.	EU R&D; funding	—

Deep Dive ① — Oxford PV Commercializes Perovskite-Si Tandem

#11 | 2026/07/29 | EIN Presswire | Tech Novelty●●●●○ Proximity●●●●● Market Impact●●●●● Data Reliability●●●●○ US/EU Relevance●●●●●

Oxford PV has launched commercial production and shipment of perovskite-silicon tandem solar cells, achieving 24-27% module efficiency. This marks a critical step in next-gen PV commercialization, accelerating market entry for high-efficiency solutions.

The tandem design utilizes a broader light spectrum, surpassing standalone silicon limits. Years of R&D; addressed stability and manufacturability, focusing on uniform film formation and robust encapsulation for real-world durability.

► Strategic Analyst's Perspective

Strategic Analyst's Perspective: The 24-27% module efficiency is realistic for initial commercialization, though below peak lab records. Key technical barriers remaining include demonstrating long-term stability under diverse real-world conditions and scaling manufacturing yield consistently. [Opportunity] for US/EU OEMs to integrate these high-efficiency modules and for materials suppliers to partner with Oxford PV. [Threat] for traditional silicon PV manufacturers who fail to adapt quickly. [Procurement] Evaluate Oxford PV's samples and technical specifications immediately. [Strategy] Assess competitive impact on existing product lines by end of quarter.

Deep Dive ② — LONGi Sets New 35.5% Tandem Efficiency Record

#01 | 2026/07/27 | LONGi (CleanTechnica) | Tech Novelty●●●●○ Proximity●●●○○ Market Impact●●●●○ Data Reliability●●●●● US/EU Relevance●●●●○

LONGi achieved a new world record of 35.5% efficiency for perovskite-silicon tandem solar cells, independently verified by ESTI. Innovations include dual-layer interface passivation and asymmetric textured silicon.

These strategies significantly reduce recombination losses and optimize light capture. While the record is for lab cells, commercial-sized cells reached 30.1% and 1m² modules 25.8%, accelerating the path to widespread adoption.

► Strategic Analyst's Perspective

Strategic Analyst's Perspective: The 35.5% lab record is impressive, but scaling to 1m² modules at 25.8% is a more realistic commercial indicator. Challenges remain in achieving this efficiency consistently at gigawatt scale and ensuring long-term outdoor stability. [Opportunity] for US/EU R&D; to benchmark against this record and accelerate internal development. [Threat] for US/EU PV manufacturers if they fall behind in efficiency leadership. [R&D;] Analyze LONGi's technical papers for interface strategies and material science insights within 1 month. [Strategy] Re-evaluate internal efficiency roadmaps and competitive positioning.

Deep Dive ③ — Qcells & NASA Partner for Lunar Perovskite PV

#22 | 2026/07/26 | Troy Technical / EnkiAI | Tech Novelty●●●●○ Proximity●●●○○ Market Impact●●●●○ Data Reliability●●●○○ US/EU Relevance●●●●●

Hanwha Qcells secured a strategic contract to supply perovskite-silicon tandem solar cells for NASA's lunar power demonstration project, validating high reliability for extreme space environments.

Concurrently, Qcells leverages a \$1.45 billion DOE loan to strengthen its domestic solar supply chain capabilities in the U.S. This initiative expands clean energy frontiers both in space and on Earth, showcasing advanced solar technology.

► Strategic Analyst's Perspective

Strategic Analyst's Perspective: Supplying NASA is a strong validation of reliability, but lunar conditions are unique; terrestrial stability challenges remain distinct. The DOE loan is a significant boost for US manufacturing capabilities. [Opportunity] for US materials & component suppliers to partner with Qcells for domestic supply chain integration. [Threat] for non-US firms seeking to enter the US market or compete in specialized applications like space. [Business Dev] Explore partnerships with Qcells for US-based manufacturing and specialized component supply immediately. [Strategy] Monitor US domestic content requirements and evaluate implications for future market access.

Other Notable Articles

GCL SI Achieves 33.44% Efficiency in Flexible Perovskite-Silicon Tandem Cells with Over 2,000 W/kg Power-to-Weight Ratio (Perovskite-Info)
Tech Novelty●●●●○ Proximity●●●○○ Market Impact●●●●○

Flexible perovskite-silicon tandem cells with high efficiency and power-to-weight ratio open new markets like drones and BIPV.

Chinese Academy of Sciences Develops Perovskite-CIGS Tandem Solar Cell with 29.71% Efficiency and 2,000-Hour Stability through 2PyS Engineering (pv magazine International)
Tech Novelty●●●●○ Proximity●●○○○ Market Impact●●●●○

High-efficiency perovskite-CIGS tandem with excellent stability offers a strong alternative to silicon-based tandems.

JA Solar to Invest 210 Million Yuan in New 0.6 GW Perovskite Tandem Module Production Line at Yangzhou Factory (Perovskite-Info)
Tech Novelty●●○○○ Proximity●●●●○ Market Impact●●●●○

Major Chinese manufacturer's investment signals rapid industrialization and mass production of perovskite tandem modules.

Navitas Solar and Caelux Form Partnership for 5 GW Perovskite-Silicon Hybrid Tandem Module Development and Manufacturing in India (Renewables Now)
Tech Novelty●●●○○ Proximity●●●○○ Market Impact●●●●○

US IP holder Caelux partners for 5 GW production in India, highlighting global expansion and market potential for tandem tech.

European Solar Market Shifts Focus to Perovskite-on-Silicon Cells for Technological Sovereignty, Oxford PV Expands Production in Germany with 25% Certified Efficiency (Enki AI)
Tech Novelty●●○○○ Proximity●●●●○ Market Impact●●●●●

Europe's strategic pivot to perovskite-on-silicon for tech sovereignty, exemplified by Oxford PV's German expansion, challenges Asian dominance.

Recommended Actions This Week

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

■ Immediate (this week)

- [Procurement] Contact Oxford PV for commercial perovskite-Si tandem module samples and technical specifications for evaluation.
- [R&D;] Review LONGi's 35.5% efficiency breakthrough and CAS's 29.71% Perovskite-CIGS stability for new interface strategies and materials.

■ Short-term (1 month)

- [Strategy] Assess the competitive impact of Chinese mass production investments (JA Solar, GCL SI) on current PV product roadmaps and market share projections.
- [Business Dev] Investigate partnership opportunities with Hanwha Qcells for US domestic supply chain integration, especially for specialized/space applications.
- [R&D;] Evaluate the feasibility of flexible/lightweight perovskite solutions (GCL SI, Halocell) for BIPV, drone, and IoT product lines.

■ Medium-long term (quarter+)

- [Strategy] Develop a comprehensive strategy for technological sovereignty in next-gen PV, leveraging US DOE and Horizon Europe funding opportunities.
- [Legal/IP] Conduct a landscape analysis of perovskite stability and manufacturing IP, particularly for vacuum deposition and interface engineering.
- [Executive] Re-evaluate long-term investment in traditional silicon PV versus accelerated transition to tandem technologies, considering global market shifts.

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PerovskiteSolarCells — Selected Articles

Date: 2026-08-02

Articles: 26

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#18 University of Sheffield and Partners Launch International Project for Lightweight Solar Power, Targeting Underutilized Rooftops and Building Sides

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#23 Navitas Solar and Caelux Form Partnership for 5 GW Perovskite-Silicon Hybrid Tandem Module Development and Manufacturing in India

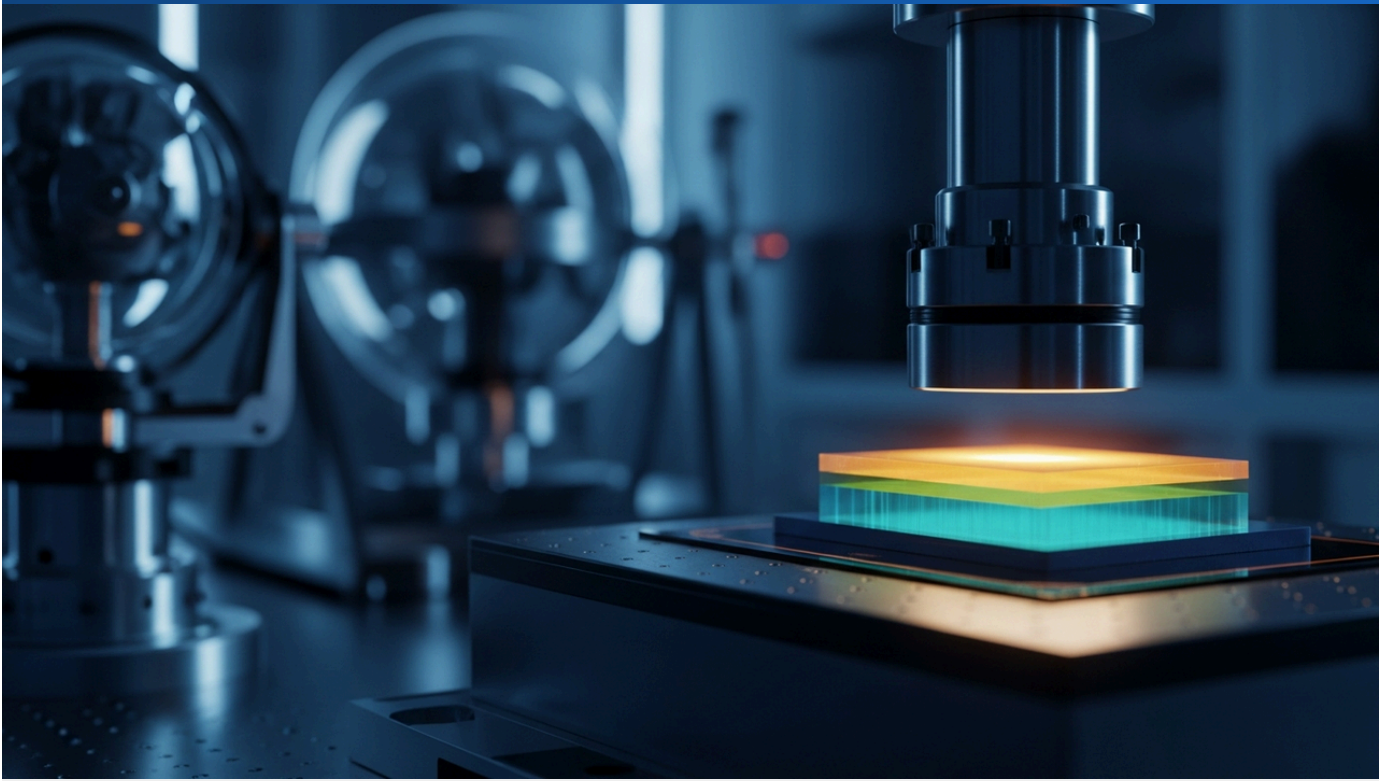
#24 Swiss Perovskia Solar Raises \$2.4M Seed Funding and Secures 10 Customers for IoT Printed Perovskite Solar Technology, Expanding Production to 1 Million Cells

#25 European Solar Market Shifts Focus to Perovskite-on-Silicon Cells for Technological Sovereignty, Oxford PV Expands Production in Germany with 25% Certified Efficiency

#26 Horizon Europe 2026/2027 Call for Funding Industrial Processes and Equipment for Innovative, Reliable, and Scalable Tandem Technologies, Targeting Perovskite-Si Commercialization

#01 LONGi Sets New World Record: 35.5% Efficiency for Perovskite-Silicon Tandem Solar Cells Verified by ESTI

Published July 27, 2026 LONGi (CleanTechnicaなど複数メディアが報道) China



OVERVIEW

LONGi has achieved a groundbreaking 35.5% power conversion efficiency for its perovskite-silicon tandem solar cells, independently verified by the European Solar Test Installation (ESTI). This new world record was enabled by a dual-layer interface passivation strategy and an asymmetric textured silicon surface, significantly reducing recombination losses and optimizing light capture. The achievement underscores the immense potential of tandem technology to surpass conventional silicon limits, with commercial-sized cells reaching 30.1% and 1 m² modules achieving 25.8% efficiency, accelerating the path towards widespread adoption.

Background

The solar industry has long sought ways to overcome the theoretical efficiency limits of single-junction silicon solar cells, which typically hover around 26-27% in commercial products. Perovskite-silicon tandem cells represent a promising solution by combining two different absorbers: perovskites efficiently convert high-energy blue and green light, while silicon excels at capturing lower-energy red and infrared light. This synergistic approach allows for a broader utilization of the solar spectrum, pushing efficiencies far beyond what either material can achieve alone. LONGi's latest accomplishment solidifies the technical viability of this tandem architecture and sets a new benchmark for competitive research and development in the global photovoltaic (PV) sector. This achievement is a strong indicator of the rapid progress in perovskite technology, moving it closer to mainstream commercial deployment.

Key Findings

LONGi has announced a new world record in solar cell efficiency, achieving a remarkable 35.5% power conversion rate for its crystalline silicon-perovskite tandem solar cells. This milestone, independently certified by the European Solar Test Installation (ESTI), positions the company at the forefront of next-generation photovoltaic technology. The breakthrough signifies a critical advancement for the entire solar industry, demonstrating the potential for significantly higher energy yields from a given footprint, which is particularly vital for space-constrained applications.

Technical Details

The record-breaking efficiency stems from two key technological innovations. Firstly, a novel dual-layer interface passivation strategy was employed, meticulously designed to minimize photon loss and maximize charge carrier collection at the interface between the perovskite and silicon layers. This approach effectively suppresses non-radiative recombination, a primary barrier to higher efficiencies. Secondly, the integration of an asymmetric textured silicon surface plays a crucial role. This texture optimizes light trapping and absorption within the silicon bottom cell, particularly for longer wavelengths, by enhancing light management and ensuring the perovskite top cell receives an optimal spectrum. Beyond laboratory-scale achievements, LONGi also reported impressive efficiencies of 30.1% for commercial-sized tandem cells and 25.8% for 1 m² modules, indicating strong scalability potential for mass production.

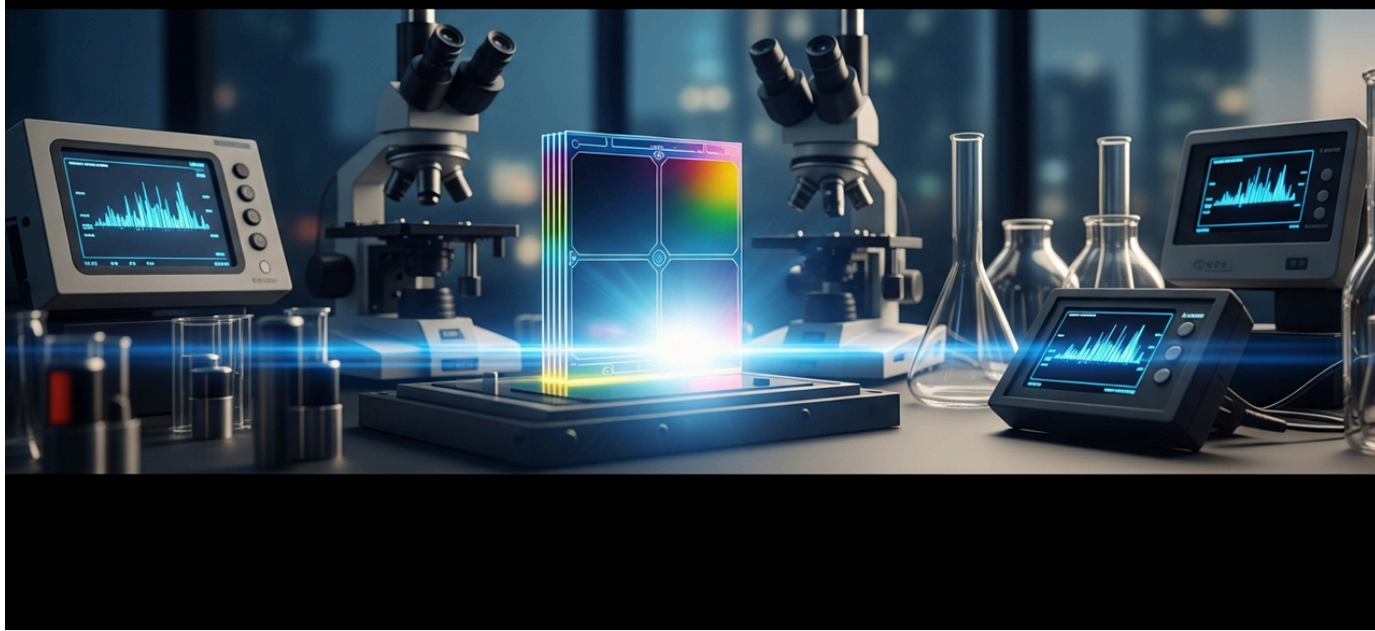
Strategic Significance & Outlook

Achieving 35.5% efficiency is not just a scientific feat; it has profound implications for the energy transition. Such high-efficiency cells can drastically reduce the physical footprint required for solar installations, making renewable energy more accessible in urban areas and for applications where space is at a premium. This advancement will likely accelerate the commercialization timeline for perovskite tandem solar cells, with companies investing heavily in scaling manufacturing processes. The next steps will involve further enhancing long-term stability and reducing manufacturing costs to ensure these high-efficiency cells become economically competitive. LONGi's breakthrough sets a new standard, driving the industry towards a future where solar energy is even more abundant and cost-effective.

Source: <https://www.longi.com/us/news/longi-breaks-world-record-for-crystalline-silicon-perovskite-tandem-solar-cell-efficiency/>

#02 University of Sydney Achieves 30.2% Efficiency in 10 cm² Perovskite-Silicon Tandem Solar Cell

Published July 28, 2026 pv magazine Global Australia



OVERVIEW

Researchers at the University of Sydney have achieved a 30.2% power conversion efficiency in a 2-terminal (2T) monolithic perovskite-silicon tandem solar cell. This result, independently confirmed by CSIRO's PV Performance Laboratory, is significant for being demonstrated on a larger 10 cm² cell area, marking a crucial step towards scaling up this high-efficiency technology. The team attributed their success to an improved hole selective layer, enabling uniform solution-processed films over large areas.

Key Findings

A team of researchers from the University of Sydney has successfully demonstrated a 30.2% power conversion efficiency for a 2-terminal (2T) monolithic perovskite-silicon tandem solar cell. This achievement, validated by CSIRO's PV Performance Laboratory, is particularly noteworthy as it was realized on a substantial cell area of 10 cm². This represents a critical advance in the scalability of high-efficiency perovskite tandem technology, moving it closer to practical applications beyond laboratory settings.

Technical / Clinical Details

The 30.2% efficiency showcases the immense potential of perovskite-silicon tandem technology to exceed the theoretical limits of single-junction silicon cells. The researchers focused on achieving uniform solution-processed films over large areas, a common challenge in scaling up perovskite devices. A key innovation involved refining the hole selective layer, which is crucial for efficient charge transport and minimizing recombination losses at the interface between the perovskite and silicon layers. This optimization led to improved device performance and stability across the larger cell area. The monolithic 2T architecture offers advantages in manufacturing simplicity compared to multi-terminal designs, which could lead to more cost-effective production in the future.

Background & Context

The quest for higher efficiency in solar cells is a continuous driver in the photovoltaic industry, aimed at reducing the levelized cost of electricity and maximizing power output per unit area. While conventional silicon solar cells are nearing their theoretical efficiency limits, perovskite-silicon tandem cells offer a pathway to significantly higher efficiencies by capturing a broader spectrum of sunlight. The perovskite layer absorbs high-energy photons, complementing the silicon layer's absorption of lower-energy photons. Historically, achieving high efficiencies in perovskite devices, especially over larger areas with uniformity and stability, has been a significant hurdle. This breakthrough by the University of Sydney team directly addresses the scalability challenge, making high-efficiency perovskite tandems more viable for commercial deployment and accelerating the transition to more powerful solar solutions.

Strategic Significance & Outlook

The demonstration of 30.2% efficiency on a 10 cm² tandem cell is a compelling indicator of the technology's readiness for diverse applications, from rooftop installations to large-scale solar farms. As this technology continues to scale up and manufacturing processes are refined, it promises to deliver more affordable and efficient solar electricity, thereby accelerating the global adoption of renewable energy. Future efforts will likely focus on further enhancing long-term stability and durability under various environmental conditions, as well as optimizing the manufacturing process for mass production. This advancement solidifies Australia's position in cutting-edge solar research and contributes significantly to the global roadmap for high-performance photovoltaics.

Source: <https://www.pv-magazine.com/2026/07/28/australian-researchers-achieve-30-2-efficiency-for-10-cm2-perovskite-silicon-tandem-solar-cell/>

Collected: July 31, 2026 | Automated Research System (Gemini API)

#03 GCL SI Achieves 33.44% Efficiency in Flexible Perovskite-Silicon Tandem Cells with Over 2,000 W/kg Power-to-Weight Ratio

Published July 26, 2026 Perovskite-Info China



OVERVIEW

Chinese solar module manufacturer GCL System Integration Technology (GCL SI) has achieved a remarkable 33.44% power conversion efficiency for its flexible perovskite-silicon tandem solar cell. Verified by the China National Center of Inspection on Solar Photovoltaic Products Quality (CPVT), this breakthrough also boasts a device-level power-to-weight ratio exceeding 2,000 W/kg. This advancement significantly expands the potential applications for flexible solar technology, opening new market opportunities in sectors requiring lightweight and adaptable power solutions.

Key Findings

GCL System Integration Technology (GCL SI), a prominent Chinese solar module manufacturer, has achieved a world-leading 33.44% power conversion efficiency in its flexible perovskite-silicon tandem solar cell. This significant milestone has been independently verified by the China National Center of Inspection on Solar Photovoltaic Products Quality (CPVT), underscoring the robustness of the technology. Furthermore, the flexible device exhibits an exceptional power-to-weight ratio exceeding 2,000 W/kg, positioning it for revolutionary applications where traditional rigid panels are unsuitable.

Technical / Clinical Details

The achievement of 33.44% efficiency on a flexible substrate highlights GCL SI's success in optimizing the tandem architecture and ensuring high-quality perovskite film formation on adaptable surfaces. This tandem configuration leverages the perovskite layer to efficiently absorb high-energy light and the silicon layer for lower-energy light, dramatically increasing the overall utilization of the solar spectrum. The innovation lies not only in the high efficiency but also in realizing it on a flexible platform, a domain notoriously challenging due to manufacturing complexities. GCL SI's progress likely involves advancements in material selection, interface engineering, and deposition techniques. The superior power-to-weight ratio is a critical advantage for niche markets such as aerospace (satellites), unmanned aerial vehicles (drones), wearable electronics, and building-integrated photovoltaics (BIPV), where mass and adaptability are paramount design considerations.

Background & Context

The solar industry is in constant pursuit of higher efficiencies and broader application versatility. Perovskite solar cells have garnered considerable attention due to their high efficiency potential and low-cost manufacturing prospects. The development of flexible perovskite solar cells, especially in a tandem configuration with silicon, addresses a crucial market need for adaptable, lightweight, and high-performance energy solutions that traditional silicon panels cannot meet. GCL SI's achievement reinforces China's leading role in renewable energy innovation and intensifies the competitive landscape of the global solar market. This breakthrough could accelerate the adoption of solar technology in previously inaccessible or impractical environments.

Strategic Significance & Outlook

A flexible tandem solar cell boasting 33.44% efficiency and over 2,000 W/kg power-to-weight ratio opens doors to new business models and applications that extend beyond conventional solar markets. For instance, the lightweight nature reduces transportation costs and simplifies installation, potentially accelerating deployment in disaster relief efforts or off-grid scenarios. Its aesthetic and conforming properties make it ideal for architectural integration (BIPV) and automotive applications. GCL SI is expected to further refine this technology, focusing on mass production and enhancing long-term durability, aiming to secure a leadership position in the flexible solar cell market. This development will undoubtedly catalyze further investment and R&D in flexible perovskite technology across the industry, contributing significantly to global energy transition efforts.

Source: <https://www.perovskite-info.com/gcl-si-achieves-3344-efficiency-flexible-perovskite-silicon-tandem-cell>

Collected: July 31, 2026 | Automated Research System (Gemini API)

#04 Chinese Researchers Develop Novel Interface Strategy to Stabilize Perovskite/C60 Interface, Achieving 27.43% Efficiency with Enhanced Durability

Published July 27, 2026 Perovskite-Info (Joule誌掲載) China



OVERVIEW

Researchers have developed a novel 'corrugated polycarbonyl interlocking (CPI) layer' to stabilize the C60 electron transport layer in inverted perovskite solar cells, preventing aggregation and enhancing durability. This breakthrough achieves a high power conversion efficiency of 27.43% and remarkable stability, retaining 92.1% efficiency after 1,000 hours under harsh damp heat conditions.

Background

Perovskite solar cells have rapidly advanced, achieving efficiencies comparable to or even surpassing conventional silicon technologies. However, their widespread commercialization remains hindered by persistent challenges in long-term stability. Degradation stemming from combined environmental stressors like heat, humidity, and light has made it difficult to produce truly reliable products for practical applications. While organic materials such as fullerene (C60) offer advantages in device flexibility and low-cost processing, they can also introduce critical instability issues. This research aims to address such fundamental instability by employing precise materials science and interface engineering.

Key Findings

Chinese researchers have achieved a significant breakthrough in perovskite solar cell technology, demonstrating a novel interface strategy that delivers both high efficiency and remarkable long-term stability. Their inverted perovskite solar cells achieved an impressive **27.43% power conversion efficiency**. Critically, encapsulated devices retained **92.1% of their initial efficiency after 1,000 hours of demanding damp heat testing** (85°C and 85% relative humidity). This advancement is primarily attributed to a new 'corrugated polycarbonyl interlocking (CPI) layer,' specifically designed to address the critical issue of fullerene (C60) aggregation within the device structure.

Technical Details

A core challenge in inverted perovskite solar cells, particularly those employing C60 as an electron transport layer, is the propensity of C60 to aggregate under environmental stress, leading directly to device degradation. The research team engineered the innovative CPI layer to overcome this by physically interlocking C60 molecules, thereby preventing their detrimental aggregation. Simultaneously, the CPI layer effectively passivates the interface between the perovskite and C60 layers. This sophisticated dual-action mechanism significantly enhances the device's resilience against both thermal and moisture-induced degradation. The resulting improvement in interface quality effectively mitigates non-radiative recombination pathways, directly boosting overall photovoltaic performance. The robust stability demonstrated under severe damp heat conditions (85°C/85%RH for 1,000 hours) is a crucial validation of practical reliability, setting a new benchmark for perovskite device durability and addressing a major hurdle for widespread commercial viability.

Strategic Significance & Outlook

The synergy of 27.43% efficiency with exceptional long-term stability under harsh operating conditions significantly broadens the potential applications for perovskite solar cells. This includes diverse scenarios such as conventional rooftop installations, advanced building-integrated photovoltaics (BIPV), and even flexible or wearable electronic devices. The novel interface engineering strategy, centered around the CPI layer, holds promise beyond solar cells; it could be broadly applied to enhance the performance and stability of other perovskite-based optoelectronic devices, such as perovskite light-emitting diodes (PeLEDs). Future research and development efforts will likely concentrate on scaling up this technology for larger active areas, streamlining manufacturing processes, and further reducing production costs. This breakthrough marks a pivotal moment, illuminating a brighter future for perovskite technology as a key component in the global transition towards sustainable energy solutions.

Source: <https://www.perovskite-info.com/new-strategy-stabilizes-perovskite-c60-interface-delivering-2743-efficiency>

#05 Hong Kong PolyU Develops Next-Gen Perovskite-Organic Tandem Solar Cell Maintaining 97% Efficiency Under Shading and Enhanced Durability

Published July 29, 2026 Premium Times (AllAfrica.com) Hong Kong



OVERVIEW

Researchers at Hong Kong Polytechnic University have developed a novel perovskite-organic tandem solar cell capable of retaining 97% efficiency even under partial shading. This advanced technology significantly improves resistance to reverse bias stress, a major factor limiting the long-term performance of conventional solar panels. This breakthrough broadens installation possibilities for solar cells and substantially enhances their practicality in challenging environmental conditions.

Key Findings

A research team at Hong Kong Polytechnic University has successfully developed a next-generation perovskite-organic tandem solar cell that maintains an impressive 97% of its efficiency even when partially shaded. This innovative device also demonstrates significantly improved resistance to reverse bias stress, a long-standing technical challenge that has limited the long-term performance and durability of conventional solar panels. This breakthrough promises to expand the practical application of solar energy, particularly in urban environments and complex architectural settings where shading is often unavoidable.

Technical / Clinical Details

Traditional solar panels suffer from substantial performance degradation and potential damage when subjected to partial shading. The shaded cells can enter a reverse bias condition, impeding current flow, leading to localized heating (hot spots), and accelerating degradation. The novel perovskite-organic tandem solar cell developed by the Hong Kong PolyU team is engineered to withstand such reverse bias stress more effectively. While specific architectural details are not fully elaborated in the summary, the success likely stems from optimized interface engineering and careful integration of the perovskite and organic layers. This design allows for more efficient current pathways under non-uniform illumination, minimizing energy loss and preventing the severe efficiency drops seen in standard PV modules. The result is a more resilient and consistently performing solar device, even in sub-optimal light conditions.

Background & Context

The widespread adoption of solar photovoltaics requires not only higher efficiencies but also greater adaptability to diverse installation environments and improved long-term reliability. The issue of shading has been a persistent Achilles' heel for solar panels, leading to reduced energy yield and shortened operational lifetimes, which in turn inflate the overall cost of solar electricity. Perovskite solar cells are heralded as a transformative next-generation technology due to their high power conversion efficiencies and potential for flexible manufacturing. However, their long-term stability and durability under real-world conditions have been areas of intensive research. This development from Hong Kong PolyU addresses a critical practical hurdle, significantly enhancing the robustness and applicability of perovskite technology by mitigating one of the most common performance detractors.

Strategic Significance & Outlook

A solar cell capable of high-efficiency retention under shading and boasting enhanced durability has significant strategic importance. It opens up previously unfeasible installation sites, such as building facades, irregularly shaped rooftops, and agricultural structures, thereby expanding the overall renewable energy generation potential. This can accelerate localized power generation and the development of distributed energy systems, crucial for energy security and sustainability. Future research will undoubtedly focus on scaling up this technology for mass production, optimizing manufacturing costs, and conducting extensive long-term field tests under various environmental conditions to fully validate its commercial potential. This innovation represents a major step towards making solar power more reliable and universally applicable.

Source: <https://allafrica.com/stories/202607290130.html>

#06 UV-Ozone Processed P3HT Interface Engineering Boosts Indoor Perovskite Solar Cell Performance

Published July 23, 2026 ACS Publications Unknown



OVERVIEW

Research has demonstrated that UV-ozone treatment of dopant-free P3HT hole transport material (HTM) improves the interface properties of wide-bandgap perovskite indoor photovoltaics (IPVs) operating under indoor light conditions. This treatment successfully reduces interface recombination, enhancing indoor performance. However, it also revealed that under 1 sun illumination, degraded charge transport limits performance, suggesting a need for application-specific optimization.

Key Findings

A study highlights the effectiveness of UV-ozone processed dopant-free P3HT (Poly(3-hexylthiophene-2,5-diyl)) as a hole transport material (HTM) for enhancing the performance of indoor perovskite solar cells (IPVs). This interface engineering approach significantly reduces interface recombination in wide-bandgap perovskite IPVs, leading to improved power conversion efficiency under typical indoor lighting conditions. This development is crucial for advancing self-powered Internet of Things (IoT) devices and other low-light energy harvesting applications.

Technical / Clinical Details

The research focused on optimizing perovskite solar cell performance in low-light environments by modifying the surface of the P3HT HTM using UV-ozone treatment. This process was found to increase the density of polar groups on the P3HT surface, thereby improving the interface quality between the perovskite layer and the HTM. The enhanced interface facilitates more efficient extraction of charge carriers and suppresses recombination losses, which are critical for maximizing device output. Consequently, the open-circuit voltage and fill factor of wide-bandgap perovskite IPVs were improved under indoor illumination, such as fluorescent and LED light sources. However, the study also revealed a trade-off: under full 1 sun illumination, the UV-ozone treatment caused a degradation in the intrinsic charge transport properties of the P3HT layer, which in turn limited the device's performance. This finding underscores the necessity for application-specific optimization of interface treatments, distinguishing between indoor and outdoor requirements.

Background & Context

The rapid proliferation of IoT devices demands sustainable power solutions that can circumvent the limitations of battery replacement or wired power supplies. Indoor photovoltaics (IPVs) are emerging as a leading technology to meet this demand, with perovskite solar cells being particularly promising due to their high light absorption coefficients and tunable bandgaps, making them suitable for efficient energy harvesting in low-light environments. Nevertheless, challenges persist regarding the stability of perovskite materials and the optimization of their interfaces. This study contributes a practical approach to improving IPV performance by combining dopant-free materials with a straightforward surface treatment technique. This marks a significant step towards enabling more autonomous power supplies for IoT sensors, smart home devices, and wearable electronics, thereby fostering a more self-sufficient smart society.

Strategic Significance & Outlook

The optimization of P3HT interface engineering using UV-ozone treatment offers a promising pathway to further enhance the efficiency and reliability of indoor perovskite solar cells. Future research will need to focus on meticulously controlling the UV-ozone treatment conditions to minimize adverse effects on P3HT charge transport while effectively reducing interface recombination. Additionally, exploring combinations with different HTMs and perovskite compositions is crucial for developing devices that exhibit stable, high efficiency across a broad range of indoor lighting conditions. The advancement of this technology is expected to accelerate the widespread adoption of battery-less IoT devices, significantly contributing to the realization of a truly smart and interconnected society.

Source: <https://pubs.acs.org/doi/10.1021/acs.jpcc.6b01010>

#07 Uniform Potential Reconstruction Strategy Achieves 25.06% Efficiency and 1,000-Hour Durability in Perovskite Solar Cells

Published July 31, 2026 OAE Publishing Inc. Unknown



OVERVIEW

A new strategy has been introduced to suppress non-radiative recombination caused by surface defects and non-uniform surface potentials in perovskite films, involving the introduction of (Ferrocenylmethyl)trimethylammonium chloride (FTAC). This method achieved a power conversion efficiency of 25.06% and a low voltage loss of 0.32V in perovskite solar cells. Furthermore, the devices demonstrated excellent stability, maintaining 91.16% of their initial efficiency after 1,000 hours at 85°C in a nitrogen atmosphere, marking a significant advance towards commercialization.

Key Findings

A novel strategy has been unveiled that significantly boosts both the efficiency and durability of perovskite solar cells, achieving a high power conversion efficiency of 25.06% and a remarkably low voltage loss of 0.32V. This innovative approach involves introducing (Ferrocenylmethyl)trimethylammonium chloride (FTAC) to mitigate non-radiative recombination stemming from surface defects and non-uniform surface potentials within the perovskite film. Crucially, the devices demonstrated exceptional long-term stability, maintaining 91.16% of their initial efficiency after 1,000 hours under 85°C in a nitrogen atmosphere, representing a major milestone for practical applications.

Technical / Clinical Details

A primary factor limiting perovskite solar cell performance is non-radiative recombination, often originating from surface defects and uneven potential distribution on the perovskite film. To address this, the research team developed a method involving the introduction of an FTAC layer between the hole transport layer and the perovskite layer. FTAC, an organometallic compound with a ferrocene backbone, effectively uniformizes the potential across the perovskite surface and provides a passivation effect. This dual action suppresses inefficient charge carrier recombination at defect sites, leading to an increase in open-circuit voltage and a reduction in voltage loss. This precisely engineered interface resulted in the impressive 25.06% power conversion efficiency and the ultra-low 0.32V voltage loss. Furthermore, this interface modification significantly contributes to the device's long-term stability, with over 90% of initial performance retained after 1,000 hours of continuous operation at a high temperature of 85°C, providing robust evidence for its commercial viability.

Background & Context

Perovskite solar cells are considered a promising next-generation photovoltaic technology due to their high efficiency potential and low manufacturing costs. However, achieving both high efficiency and long-term stability simultaneously has been a significant hurdle for commercialization. Vulnerability to moisture and heat, along with charge carrier losses at internal interfaces, have been identified as key degradation mechanisms. The FTAC-mediated strategy for surface potential uniformization and defect passivation offers an effective solution to these challenges. This approach is advantageous as it improves device reliability simply and effectively, without requiring complex multi-layer structures or expensive dopants, potentially offering a competitive edge over existing technologies. This innovation provides a crucial foundation for expanding perovskite solar cells into residential, commercial, and specialized applications.

Strategic Significance & Outlook

This FTAC strategy, which harmonizes 25.06% efficiency with outstanding long-term stability, represents a substantial leap forward for the commercialization of perovskite solar cells. Future work will focus on scaling up this technology for larger areas, assessing its compatibility with high-throughput manufacturing processes like roll-to-roll production, and further reducing manufacturing costs. Extensive validation through outdoor field testing under various environmental conditions will also be crucial to confirm its robustness. This breakthrough is an essential step for perovskite solar cells to gain competitiveness in the existing photovoltaic market and establish themselves as a sustainable energy source. Ultimately, more efficient and reliable perovskite devices are expected to make a significant contribution to the global energy transition.

Source: <https://www.oaepublish.com/articles/2397-9476/solarmaterials/2026/1/smp-2026-0001.html>

#08 Chinese Academy of Sciences Develops Perovskite-CIGS Tandem Solar Cell with 29.71% Efficiency and 2,000-Hour Stability through 2PyS Engineering

Published July 30, 2026 pv magazine International China



OVERVIEW

Researchers at the Chinese Academy of Sciences (CAS) have developed a 4-terminal perovskite/CIGS tandem solar cell with enhanced wide-bandgap perovskite stability, achieved through bis(2-pyridylmethyl)sulfide (2PyS) coordination engineering. This device boasts an overall efficiency of 29.71% and demonstrates exceptional stability, maintaining over 91% of its initial efficiency after 2,000 hours of continuous operation. This represents a significant advancement in the commercialization potential of perovskite technology.

Key Findings

Researchers at the Chinese Academy of Sciences (CAS) have engineered a 4-terminal perovskite/CIGS (copper indium gallium selenide) tandem solar cell that achieves a remarkable 29.71% power conversion efficiency. This innovative device leverages bis(2-pyridylmethyl)sulfide (2PyS) coordination engineering to significantly enhance the stability of the wide-bandgap perovskite layer. Crucially, the tandem cell demonstrated outstanding long-term stability, retaining over 91% of its initial efficiency after an impressive 2,000 hours of continuous operation, marking a substantial step towards the practical implementation of next-generation solar technologies.

Technical / Clinical Details

The breakthrough hinges on improving the stability of the wide-bandgap perovskite layer. The CAS team utilized 2PyS coordination engineering to optimize the perovskite material's crystal structure and interface properties. 2PyS not only controls the growth of perovskite crystals and reduces defect density but also acts as a barrier against degradation factors from the external environment. This enhanced perovskite top cell efficiently absorbs high-energy, short-wavelength light, while the CIGS bottom cell absorbs longer-wavelength light, maximizing the utilization of the entire solar spectrum. The 4-terminal architecture offers the advantage of independent optimization for each sub-cell, mitigating current matching constraints and facilitating higher overall efficiency. The combination of 29.71% efficiency and over 91% stability after 2,000 hours signifies a high level of achievement in addressing the critical challenge of high efficiency and long-term durability in perovskite technology.

Background & Context

In the photovoltaic industry, tandem solar cells are gaining significant attention as next-generation technology to overcome the efficiency limits of conventional silicon solar cells. CIGS solar cells, a type of thin-film solar cell, have a proven track record with high absorption coefficients and flexibility, but their standalone efficiency improvement has limitations. Perovskite solar cells, on the other hand, boast high efficiencies but have struggled with stability, particularly in wide-bandgap materials. This CAS research has successfully complemented the weaknesses of both perovskites (instability) and CIGS (efficiency limits), creating a high-performance tandem solar cell that harnesses the strengths of both. This underscores China's leadership in new materials science and device design amid intense competition in renewable energy technologies.

Strategic Significance & Outlook

A perovskite/CIGS tandem solar cell with 29.71% high efficiency and excellent long-term stability holds great promise for a wide range of practical applications. It is expected to accelerate adoption in areas where traditional silicon solar cells have been challenging, such as Building-Integrated Photovoltaics (BIPV), flexible solar cells, and power generation in low-light environments. While the 4-terminal structure can introduce manufacturing complexity, the benefits in efficiency and stability are substantial. Future research will likely focus on further optimizing manufacturing processes and reducing costs. This breakthrough is poised to make a significant contribution to the development of clean energy technologies and serve as a crucial driving force towards achieving a sustainable society.

Source: <https://www.pv-magazine.com/2026/07/30/chinese-researchers-build-29-71-perovskite-cigs-tandem-solar-cell-based-on-sulfide/>

#09 Polish Scientists Develop 21.87% Efficient Semi-Transparent Perovskite PV Cell for Tandem Applications, Mitigating ITO Sputtering Damage

Published July 29, 2026 pv magazine International ポーランド



OVERVIEW

Researchers at Gdańsk University of Technology have developed a novel manufacturing strategy for semi-transparent perovskite solar cells (ST-PSCs), successfully preventing critical damage to the perovskite layer during indium tin oxide (ITO) sputtering. This innovation has yielded a device with a record 21.87% power conversion efficiency, poised for seamless integration with commercial crystalline silicon cells in high-efficiency 4-terminal tandem architectures. The breakthrough significantly advances building-integrated photovoltaics (BIPV) and the broader quest for more efficient solar energy conversion.

Background

To accelerate the adoption of renewable energy, it is essential to diversify solar power installation sites and deepen their integration into urban spaces. Building-integrated photovoltaics (BIPV) are a key technology addressing this need, allowing solar energy generation to be seamlessly incorporated into architectural elements. Traditional opaque solar panels, however, present limitations in design and functionality for such applications. Semi-transparent perovskite solar cells (ST-PSCs), with their appealing transparency and high power generation efficiency, are considered a next-generation technology for BIPV, offering the potential to transform windows and facades into energy-producing surfaces. Despite their immense promise, manufacturing complexities and stability issues have historically hindered their widespread adoption, with a critical challenge being the plasma damage inflicted on the sensitive perovskite layer during the sputtering deposition of indium tin oxide (ITO), a commonly used transparent electrode.

Key Findings

Researchers at Gdańsk University of Technology in Poland have successfully developed a novel manufacturing strategy that effectively prevents this critical damage to the delicate perovskite stack during ITO sputtering. This optimized process has yielded a single-junction semi-transparent perovskite device with a remarkable power conversion efficiency (PCE) of 21.87%. While specific technical details are not fully disclosed in the summary, the team likely achieved this breakthrough through optimizations in deposition conditions or the strategic introduction of a protective interlayer, enabling the formation of a highly conductive and transparent ITO film without compromising the perovskite. This achievement not only delivers excellent efficiency but also maintains crucial visible light transmittance, a prerequisite for BIPV applications. The technology demonstrates clear potential for seamless integration as a top cell with commercial crystalline silicon bottom cells, paving the way for advanced 4-terminal tandem solar cell applications that can further boost overall power conversion efficiency. This research resolves a significant manufacturing bottleneck, bringing ST-PSCs closer to commercial reality and reinforcing Europe's continued role in clean energy technology innovation.

Strategic Significance and Outlook

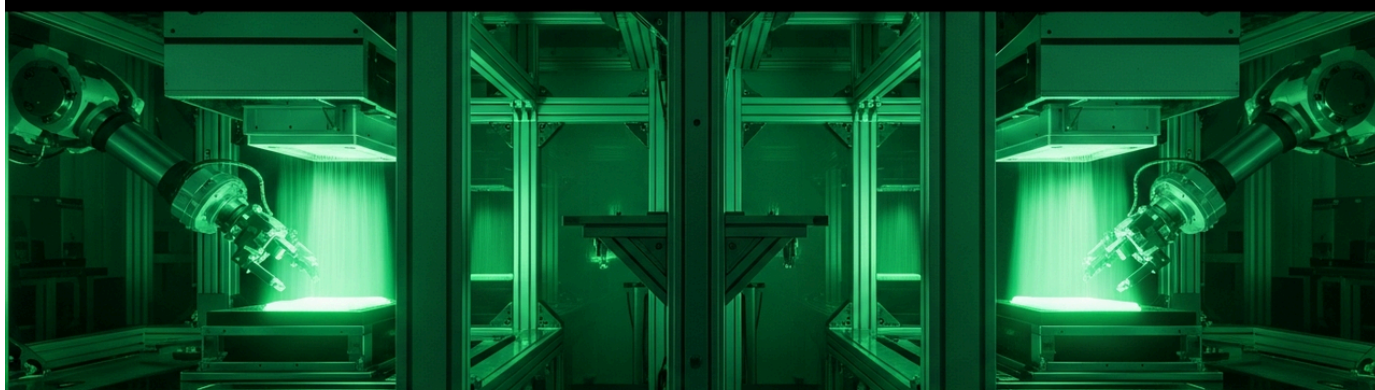
The development of these 21.87% efficient semi-transparent perovskite PV cells holds significant implications for the BIPV market. Power-generating devices that function as windows or skylights can substantially enhance building energy self-sufficiency and contribute to energy savings, transforming urban infrastructure. Furthermore, their application as top cells in tandem solar cells is expected to significantly elevate the efficiency of existing high-performance silicon solar cells, pushing the boundaries of solar energy conversion. Future efforts will focus on demonstrating long-term durability, achieving uniform manufacturing over large areas, and further reducing production costs to facilitate widespread adoption. This breakthrough represents a crucial step towards expanding the applicability of solar power and realizing more sustainable buildings and energy systems globally.

Source: <https://www.pv-magazine.com/2026/07/29/polish-scientists-build-21-87-semi-transparent-perovskite-pv-cell-for-tandem-applications/>

Collected: July 31, 2026 | Automated Research System (Gemini API)

#10 Arginine-Mediated Buried-Interface Regulation Enables Highly Efficient and Air-Processed Green Perovskite Light-Emitting Diodes

Published July 31, 2026 ACS Publications Unknown



OVERVIEW

An interface engineering strategy utilizing L-arginine (L-Arg) modified PEDOT:PSS as a hole transport layer has been reported to effectively tailor the nucleation behavior of air-processed FAPbBr₃ perovskite films. This technique generates high-density, high-quality films, resulting in high-performance green perovskite light-emitting diodes (PeLEDs) with a peak luminance of 47,100 cd m⁻², a current efficiency of 24.9 cd A⁻¹, and a peak external quantum efficiency of 6.62%. Furthermore, the operational stability of these devices is significantly improved, marking a major advance in air-processed PeLED manufacturing.

Key Findings

An innovative interface engineering strategy, employing L-arginine (L-Arg) modified PEDOT:PSS as a hole transport layer, has been developed to dramatically improve the quality of air-processed FAPbBr₃ perovskite films. This technique facilitates the formation of high-density, uniform perovskite films, leading to the realization of one of the highest-performing green perovskite light-emitting diodes (PeLEDs) reported to date, with a peak luminance of 47,100 cd m⁻², a current efficiency of 24.9 cd A⁻¹, and a peak external quantum efficiency of 6.62%. Crucially, these devices also demonstrate significantly enhanced operational stability, a vital metric for commercial viability.

Technical / Clinical Details

Perovskite light-emitting diodes (PeLEDs) are highly anticipated for next-generation display technologies due to their high color purity and wide color gamut. However, achieving high performance and stability hinges on optimizing both the perovskite film quality and interfacial properties. This research adopts a straightforward approach: introducing L-arginine into PEDOT:PSS, a widely used hole transport layer. L-arginine, an amino acid, modifies the surface properties of PEDOT:PSS, allowing for precise control over the nucleation behavior of the FAPbBr₃ perovskite precursor solution deposited on it. This controlled nucleation facilitates the formation of more uniform, defect-free, and high-density perovskite crystalline films under ambient air conditions. The result is improved light extraction efficiency and suppressed non-radiative recombination, leading to substantial enhancements in key performance indicators such as peak luminance, current efficiency, and external quantum efficiency (EQE). The achievement of high performance via an air-processing route is particularly significant, directly translating to substantial reductions in manufacturing costs and improvements in scalability.

Background & Context

Traditional organic light-emitting diode (OLED) displays, despite their superior visual characteristics, still face challenges in terms of cost, stability, and luminescence efficiency. Perovskite light-emitting diodes are rapidly advancing as a technology with the potential to overcome these limitations. However, air-processing of perovskite materials has been problematic due to their inherent vulnerability to moisture, leading to performance degradation. The L-arginine-mediated interface control presented in this study addresses this air-processing challenge, offering a crucial pathway for manufacturing high-performance PeLEDs more affordably and at scale. This breakthrough is set to accelerate the application of perovskite technology in diverse fields, including next-generation displays, lighting, and even bio-imaging.

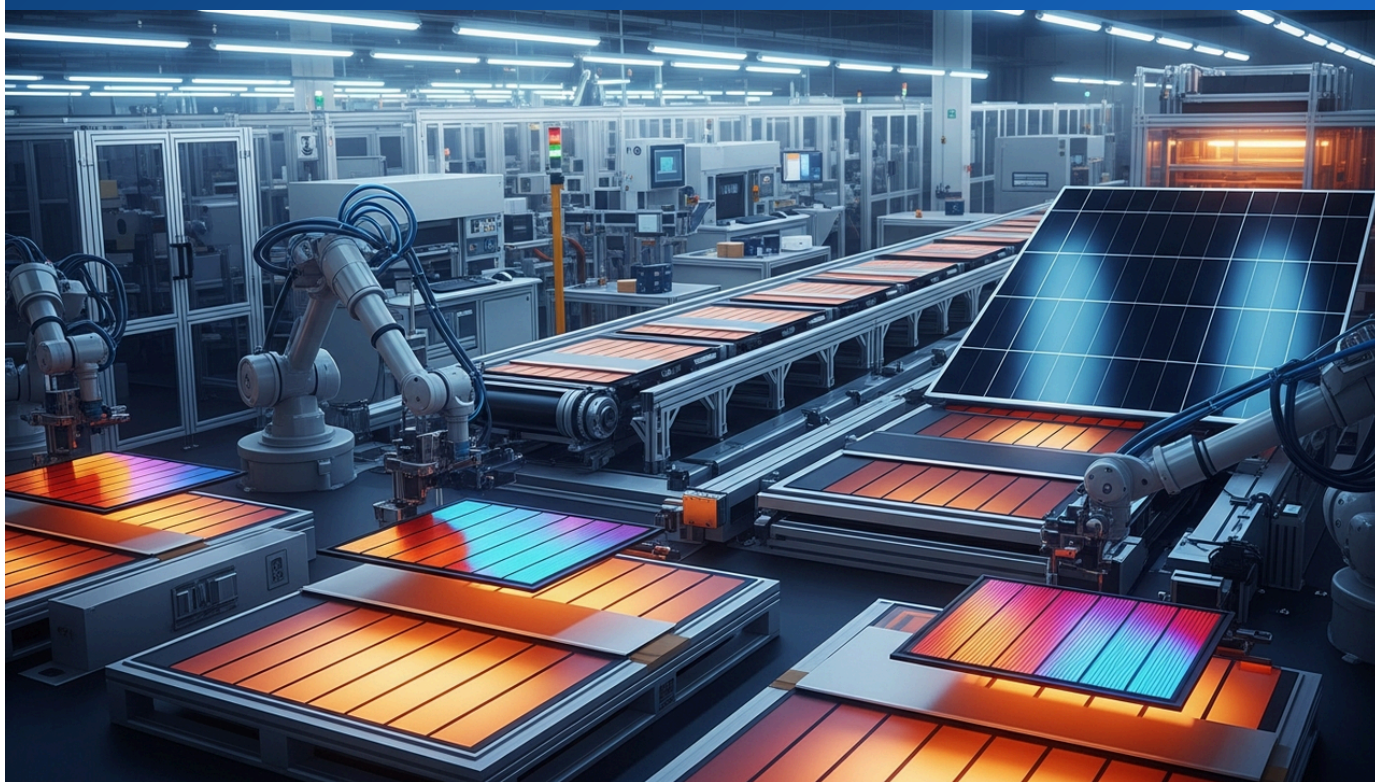
Strategic Significance & Outlook

The L-arginine-mediated buried-interface regulation technique is highly promising for improving the performance and air stability of green PeLEDs. Future research will likely focus on extending this approach to blue and red PeLEDs to achieve full-color display capabilities. Further efforts will also concentrate on large-area fabrication, validating long-term durability, and streamlining manufacturing processes for cost reduction. The realization of high-performance PeLEDs through air-processing could drive the creation of innovative products such as flexible displays, wearable devices, and IoT lighting, potentially ushering in a major transformation for the display industry.

Source: <https://pubs.acs.org/doi/10.1021/acs.nanolett.6b01010>

#11 Oxford PV Initiates Commercial Production and Shipment of Perovskite-Silicon Tandem Solar Cells in 2026, Achieving 24-27% Module Efficiency

Published July 29, 2026 EIN Presswire UK



OVERVIEW

Oxford PV, a UK pioneer, officially commenced commercial production and shipment of perovskite-silicon tandem solar cells in 2026, achieving module efficiencies of 24% to 27%. This marks a critical milestone in the commercialization of next-generation PV technology, demonstrating significant progress toward market entry. This move is expected to accelerate the transition towards high-efficiency technologies in the solar energy market.

Key Findings

Oxford PV, a leading UK-based innovator, has announced the official commencement of commercial production and shipment of its perovskite-silicon tandem solar cells in 2026. The company reports achieving module efficiencies between 24% and 27% at this initial production phase, marking a crucial milestone in the commercialization of next-generation photovoltaic technology. This significant development accelerates the market introduction of high-efficiency solar solutions and introduces a new level of competitiveness to the existing solar energy landscape.

Technical / Clinical Details

The perovskite-silicon tandem solar cells being commercialized by Oxford PV utilize a layered architecture, with a thin perovskite layer deposited on top of a conventional silicon solar cell. This tandem design allows the perovskite layer to efficiently absorb high-energy blue light, while the underlying silicon cell captures lower-energy red light. This synergistic approach enables the device to utilize a broader spectrum of sunlight compared to standalone silicon cells, resulting in significantly higher power output from a given footprint and achieving impressive module efficiencies of 24% to 27%. Through years of dedicated R&D, Oxford PV has addressed critical challenges related to the stability and manufacturability of this technology. Particular emphasis has been placed on achieving uniform perovskite film formation during mass production and developing robust encapsulation techniques to ensure long-term durability under real-world conditions.

Background & Context

The global solar energy market is expanding rapidly, but conventional silicon solar cells are approaching their theoretical efficiency limits. Consequently, there is growing anticipation for next-generation technologies that can deliver even higher power conversion efficiencies, with perovskite solar cells emerging as the most promising candidate. Oxford PV has positioned itself as a frontrunner in this field, aiming to bridge the gap between laboratory-based efficiency records and commercial-scale production. The initiation of commercial production is a symbolic event, transitioning perovskite technology from a research topic to a practical energy solution. This advancement is poised to make a substantial contribution to global efforts in meeting renewable energy targets and further enhancing the cost-effectiveness of solar power.

Strategic Significance & Outlook

The launch of commercial production of perovskite-silicon tandem solar cells by Oxford PV has the potential to revolutionize the solar photovoltaic industry. Module efficiencies of 24% to 27% present a highly attractive option, particularly for space-constrained residential and commercial rooftop installations, as well as for large-scale power plants contributing to grid stability. The company aims to supply this technology globally, thereby accelerating the widespread adoption of solar power. Future efforts will focus on expanding manufacturing scale, further improving efficiency, and accumulating long-term reliability data. This commercialization initiative is expected to stimulate other perovskite developers, fostering increased competition and technological innovation across the entire market, ultimately driving the energy transition forward.

Source: <https://www.einpresswire.com/article/733000000/thin-film-solar-cell-market-to-reach-usd-39-5-billion-by-2035-at-7-5-cagr>

#12 Halocell Energy Partners with South Korea's MSWay to Accelerate Scale-Up of Roll-Printed Perovskite Solar Modules

Published July 24, 2026 PV Tech (Halocell Energyのプレスリリース) Australia



OVERVIEW

Australian perovskite solar developer Halocell Energy has inked a Memorandum of Understanding with South Korea's MSWay, a leading flexible electrode manufacturer, to accelerate the mass production of roll-printed perovskite solar modules. This strategic collaboration will integrate MSWay's proprietary flexible transparent electrode materials into Halocell's innovative roll-to-roll manufacturing process, aiming to rapidly introduce lightweight, high-performance flexible photovoltaic solutions for satellites, drones, and IoT devices.

Background

The global energy transition, coupled with rapid digitalization, is fueling an unprecedented demand for lightweight and flexible power sources. Emerging sectors such as space exploration, autonomous drone operations, and expansive IoT sensor networks present unique power requirements that traditional rigid and heavy solar panels cannot adequately address. Perovskite solar cells, recognized for their impressive power conversion efficiency and inherent suitability for thin-film and flexible fabrication, have emerged as a compelling candidate to penetrate these nascent yet rapidly expanding markets. The newly announced partnership between Halocell Energy and MSWay signifies a concrete, commercialization-focused step toward deploying flexible perovskite solar cells, effectively combining Australian innovation in material science with South Korean expertise in advanced manufacturing to meet these specific market demands. This collaboration also underscores the increasing strategic importance of global supply chain partnerships in the realm of advanced energy technologies.

Key Findings

Halocell Energy, a vanguard Australian developer specializing in advanced perovskite solar cells, has formally announced a strategic partnership with MSWay, a prominent South Korean manufacturer of flexible electrodes. This Memorandum of Understanding (MOU) is specifically designed to facilitate the mass production and subsequent scale-up of Halocell's roll-printed perovskite solar modules. By integrating MSWay's proprietary high-performance flexible transparent electrode (FTE) materials directly into Halocell's innovative roll-to-roll manufacturing process, this collaboration is poised to significantly accelerate the market introduction of lightweight and high-performance flexible photovoltaic solutions.

Technological Synergy and Implementation

Halocell Energy is at the forefront of pioneering technology for manufacturing low-cost, high-efficiency perovskite solar cells on flexible substrates utilizing a continuous roll-to-roll process. This manufacturing paradigm offers immense potential for applications demanding curved surfaces or ultra-lightweight power solutions, areas where conventional silicon-based solar cells are typically unsuitable due to their rigidity and mass. MSWay's specialized expertise in flexible transparent electrodes is a cornerstone of this partnership. FTEs are absolutely critical for efficient charge carrier collection from the perovskite layer while simultaneously ensuring high optical transparency, which is paramount for device performance. MSWay's advanced materials are engineered to meet these rigorous requirements, demonstrating both the requisite durability and processability essential for seamless integration into a high-throughput roll-to-roll manufacturing line. The synergistic combination of both companies' proprietary technologies is anticipated to overcome persistent challenges in perovskite solar cell development, including the hurdles of large-area fabrication, overall cost reduction, and crucial enhancement of long-term operational stability. This will establish a significant competitive advantage for applications where a superior power-to-weight ratio is a critical performance metric, such as in satellites, unmanned aerial vehicles (drones), and mobile IoT devices.

Strategic Significance and Future Outlook

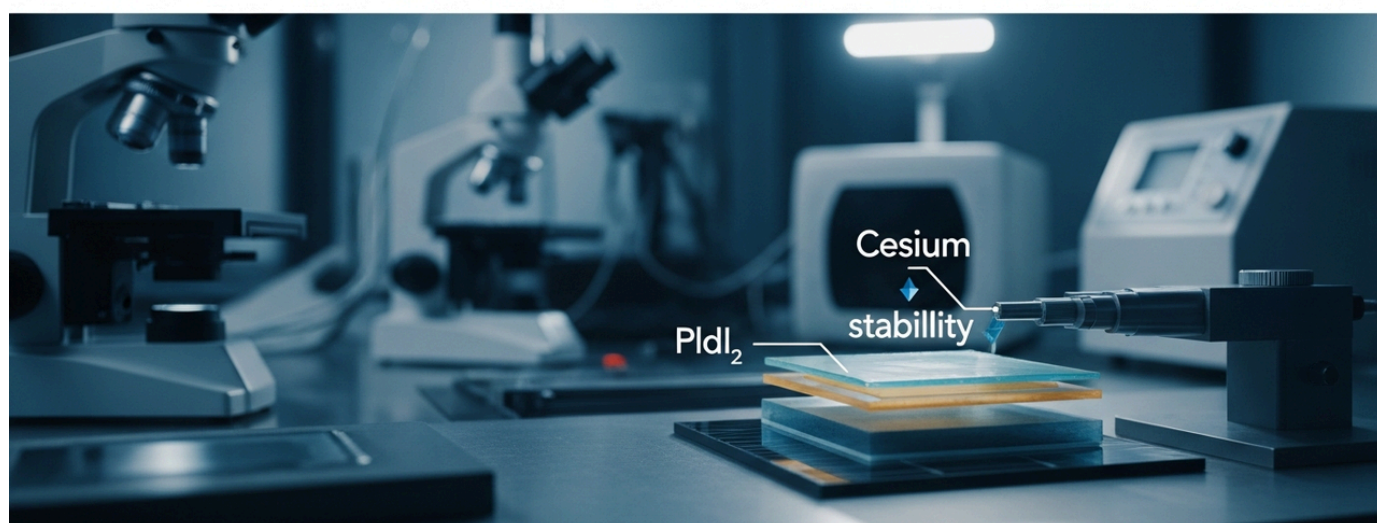
This collaboration represents a significant leap towards the full commercialization of roll-printed flexible perovskite solar cells, substantially enhancing their competitive positioning within high-value, specialized markets. Applications in demanding sectors like satellite power generation and drone propulsion require exceptionally high levels of performance and reliability compared to conventional solar cell technologies, making success in these domains a powerful validation of perovskite technology's broader potential. Future joint efforts will strategically focus on further optimizing the integrated manufacturing processes, systematically expanding production capacity to meet anticipated demand, and conducting extensive, long-term reliability testing under diverse environmental conditions. Should this groundbreaking technology achieve widespread adoption, it is expected to dramatically broaden the applicability of solar power as a truly sustainable energy source, stimulating profound innovation across a multitude of industries and contributing significantly to a more energy-resilient global future.

Source: <https://www.pv-tech.org/halocell-energy-partners-with-south-koreas-msway-to-scale-roll-printed-perovskite-solar-modules/>

Collected: July 31, 2026 | Automated Research System (Gemini API)

#13 Cesium Cation Additive Boosts Air-Processed MAPbI₃ Perovskite Solar Cell Efficiency to 23.17% with Enhanced Stability

Published July 23, 2026 RSC Advances Unknown



OVERVIEW

A simple two-step intercalation strategy, directly premixing cesium iodide (CsI) into the PbI₂ precursor, has been shown to effectively regulate crystal growth and carrier dynamics in air-processed methylammonium lead iodide (MAPbI₃) perovskite solar cells. This method achieved a power conversion efficiency of 23.17%. Unencapsulated devices demonstrated excellent stability, maintaining 97.7% of initial efficiency under continuous operational illumination and 82% after 30 days of environmental storage.

Key Findings

A novel two-step intercalation strategy has been developed, revolutionizing the performance and stability of air-processed MAPbI₃ (methylammonium lead iodide) perovskite solar cells. This strategy employs a simple method of directly premixing cesium iodide (CsI) into the PbI₂ precursor layer, which effectively regulates perovskite crystal growth and charge carrier dynamics. As a result, the devices achieved a high power conversion efficiency of 23.17% and demonstrated excellent operational stability, with unencapsulated devices retaining 97.7% of their initial efficiency under continuous operational illumination. Furthermore, durability was confirmed, maintaining 82% efficiency after 30 days of environmental storage, indicating a promising pathway to overcome the stability challenges critical for perovskite solar cell commercialization.

Technical / Clinical Details

MAPbI₃ perovskite, while possessing high light absorption capabilities, has been plagued by instability issues, particularly its sensitivity to moisture and heat. This research fundamentally improves the perovskite crystalline film formation process by adding CsI to the PbI₂ precursor layer. The Cs cations influence the nucleation and growth rate of the perovskite crystals, leading to the formation of denser, less defective crystalline structures. This reduction in charge carrier recombination losses enhances both open-circuit voltage and fill factor, culminating in a final power conversion efficiency of 23.17%. Crucially, these devices were fabricated under ambient air conditions. Achieving high performance and excellent stability (97.7% under continuous illumination, 82% after 30 days of environmental storage) in such a relatively simple environment directly translates to reduced manufacturing costs and improved scalability. Traditionally, perovskite solar cells required strict atmospheric control during fabrication, but this technology significantly contributes to simplifying the manufacturing process.

Background & Context

Perovskite solar cells are garnering significant attention as a next-generation photovoltaic technology due to their potential to achieve efficiencies comparable to or even surpassing silicon solar cells. However, challenges related to humidity sensitivity during manufacturing and long-term stability have hindered their widespread commercialization. Air-processing, in particular, is highly attractive for cost reduction and scalability but often comes with the risk of performance degradation. The control of crystal growth and carrier dynamics through CsI addition demonstrated in this study offers a groundbreaking approach to resolve this stability issue under air-processing conditions. This technology has the potential to drastically reduce manufacturing costs by eliminating the need for expensive equipment like gloveboxes, thereby significantly boosting the market competitiveness of perovskite solar cells.

Strategic Significance & Outlook

This CsI intercalation strategy, combining 23.17% high efficiency with excellent air-processed stability, is poised to be a crucial technology accelerating the commercialization of perovskite solar cells. Future work will focus on scaling up this technology for larger areas, conducting further long-term durability tests under various environmental conditions, and assessing its applicability to mass production processes. The ability to manufacture in ambient air is particularly important, as it can facilitate solar power adoption in a wider range of regions, including developing countries, significantly contributing to the spread of sustainable energy sources. This breakthrough represents a decisive step for perovskite solar cells to fully enter the mainstream market.

Source: <https://pubs.rsc.org/en/content/articlelanding/2026/ra/d6ra00000a>

#14 U.S. Department of Energy Commits \$29 Million in R&D Funding to Advance Solar Manufacturing, PV Recycling, and Perovskite Development

Published July 28, 2026 U.S. Department of Energy (DOE) Solar Energy Technologies Office (SETO) USA



OVERVIEW

The U.S. Department of Energy (DOE) has announced a \$29 million R&D funding initiative to promote enhanced PV recyclability, reduced manufacturing costs, and the production of PV cells from perovskites. This funding includes a July 28 deadline for the American-Made Perovskite Startup Prize, with \$200,000 awarded to competitors advancing to the next stage. The effort aims to strengthen the domestic U.S. solar industry and accelerate technological innovation.

Key Findings

The U.S. Department of Energy's (DOE) Solar Energy Technologies Office (SETO) has announced a significant research and development funding allocation of \$29 million. This substantial investment is earmarked for projects aimed at enhancing photovoltaic (PV) recyclability, reducing manufacturing costs, and advancing the production of PV cells from perovskites. This funding initiative represents a critical step towards bolstering the competitiveness and sustainability of the entire U.S. solar industry, with a particular focus on accelerating the commercialization of next-generation perovskite technology.

Technical / Clinical Details

The \$29 million in funding will be distributed across several key areas. Specifically, projects focused on innovating recycling technologies for end-of-life solar panels, increasing the recovery rate of critical materials, and reducing environmental impact will receive support. Funds will also be directed towards R&D efforts aimed at improving the efficiency and reducing the cost of existing PV manufacturing processes. Of particular note is the significant investment in the development of perovskite solar cell manufacturing technologies. This includes research addressing challenges such as improving perovskite material stability, scaling up device areas, and enhancing the scalability of manufacturing processes. Furthermore, the DOE is sponsoring the 'American-Made Perovskite Startup Prize,' an initiative designed to foster perovskite-related startups and facilitate the market entry of innovative ideas. The application deadline for this prize is set for July 28, with \$200,000 awarded to competitors who advance to the next stage.

Background & Context

The U.S. has made strengthening domestic clean energy manufacturing capabilities and reducing reliance on foreign supply chains a national strategic priority. Solar power is central to this energy transition, but the industry currently faces the challenge of significant dependence on overseas manufacturing supply chains. The DOE's latest funding initiative is designed to address this challenge by strengthening the entire domestic ecosystem, from R&D to manufacturing and recycling within the U.S. Perovskite solar cells, in particular, hold immense potential not only to surpass the efficiency limits of conventional silicon solar cells but also to offer advantages such as lower energy consumption in their manufacturing processes. They are thus expected to play a crucial role in both U.S. energy security and economic growth.

Strategic Significance & Outlook

The DOE's \$29 million funding allocation is set to powerfully drive technological innovation and industrial development within the U.S. solar sector. Accelerating the development of perovskite solar cells, in particular, will enable the early market introduction of high-efficiency, versatile next-generation PV technologies. Advancements in recycling technologies will offer solutions to the growing problem of solar panel waste, contributing to the realization of a circular economy. These investments are viewed as crucial strategic moves for the U.S. to establish global leadership in clean energy technologies and accelerate the transition to a sustainable future. Support for startups will also foster an environment for new business models and technological breakthroughs, further enhancing the competitiveness of the U.S. energy sector.

Source: <#>

#15 U.S. Department of Energy Unveils Research Strategy Focused on Stability, Large-Area Scalability, and Manufacturability of Perovskite Solar Cells

Published July 26, 2026 U.S. Department of Energy (DOE) USA



OVERVIEW

The U.S. Department of Energy (DOE) has announced a strategy focusing on stability, large-area scalability, and manufacturability—three critical research areas for enabling commercial production of perovskite solar cells. The strategy emphasizes the establishment of standardized testing methods, aligned with IEC 61215 and ISOS protocols, and addressing manufacturing process challenges such as roll-to-roll production and vacuum deposition. This roadmap aims to accelerate the commercial realization of perovskite technology.

Key Findings

The U.S. Department of Energy (DOE) has unveiled a comprehensive strategy focusing on three critical research and development areas: stability, large-area scalability, and manufacturability, all essential for enabling the widespread commercial production of perovskite solar cells. This strategy not only targets technological breakthroughs but also emphasizes the establishment of standardized testing methodologies and the resolution of scalable manufacturing process challenges, thereby providing a clear roadmap to accelerate the practical implementation of perovskite technology.

Technical / Clinical Details

The DOE's strategy promotes the establishment of rigorous testing methods compliant with the International Electrotechnical Commission (IEC) 61215 standards (UV exposure, thermal cycling, damp heat, PID (Potential Induced Degradation)) and the International Solar Energy Society (ISOS) protocols. These standards are crucial for accurately evaluating the real-world performance and lifespan of perovskite devices under various environmental conditions. Furthermore, the strategy highlights efforts towards large-area scaling technologies to achieve uniform performance in large modules, and cost-effective mass production processes, specifically roll-to-roll manufacturing and vacuum deposition. These processes hold the potential to surpass existing solar cell manufacturing in terms of thin-film uniformity, material utilization efficiency, and production speed, but they also present unique challenges specific to perovskite materials. The DOE intends to concentrate funding and resources on research aimed at overcoming these hurdles.

Background & Context

Perovskite solar cells are garnering significant attention as a next-generation technology with the potential to achieve power conversion efficiencies comparable to or exceeding conventional silicon solar cells, coupled with expectations for low-cost manufacturing. However, transitioning laboratory-scale achievements into commercial products requires decades of operational stability and manufacturing technologies capable of gigawatt-scale production. Until now, stability, large-area scalability, and manufacturability have been major bottlenecks for the commercialization of perovskite solar cells. The DOE's strategy directly and systematically addresses these challenges, marking a crucial step for the U.S. to establish leadership in clean energy technology and enhance energy security. This initiative also contributes to global efforts to further reduce the cost of solar power and accelerate the adoption of renewable energy.

Strategic Significance & Outlook

This research strategy announced by the DOE will play an extremely vital role in the future development of perovskite solar cells. The introduction of standardized testing methods will build market confidence and enable developers to evaluate products against common benchmarks. Furthermore, investments in advanced manufacturing technologies such as roll-to-roll production and vacuum deposition are expected to dramatically reduce the cost of perovskite solar cells, enhancing their competitiveness in the existing photovoltaic market. The R&D efforts conducted under this strategy are anticipated to contribute to the realization of more durable, efficient, and affordable perovskite solar cells, serving as a key driving force to accelerate the global energy transition. This also sends a strong signal to strengthen the U.S. economic competitiveness in the energy sector and support the transition to a sustainable future.

Source: <https://www.energy.gov/eere/solar/perovskite-research-directions>

#16 DOE PVRD2 Project Drives Research on Interconnection Design and Reliability Enhancement for Perovskite-Silicon Tandem Modules

Published July 26, 2026 U.S. Department of Energy (DOE) USA



OVERVIEW

The U.S. Department of Energy's (DOE) 'Photovoltaics Research and Development 2: Modules and Systems (PVRD2)' project focuses on interconnection design and material properties research for perovskite-silicon tandem modules. Key objectives include enhancing stability in damp heat tests to achieve reliable cells that show no performance degradation after 1,000 hours at 85°C and 85% relative humidity, fabricating top cells with optimal bandgaps, and developing modeling for outdoor performance prediction. This is a critical step towards the practical implementation of next-generation solar technology.

Key Findings

The U.S. Department of Energy's (DOE) 'Photovoltaics Research and Development 2: Modules and Systems (PVRD2)' project is intensively addressing critical challenges for the practical implementation of perovskite-silicon tandem solar cell modules, specifically focusing on interconnection design and material property optimization. The primary goal of this project is to achieve highly reliable cells demonstrating exceptional stability, particularly under damp heat testing (no performance degradation after 1,000 hours at 85°C and 85% relative humidity), thereby ensuring the long-term viability of next-generation photovoltaic technology.

Technical / Clinical Details

Perovskite-silicon tandem solar cells are highly anticipated as the ultimate pathway to higher efficiency, but their module integration presents numerous technical hurdles. The PVRD2 project is conducting research to overcome these challenges. Specifically, it focuses on the following key technical areas:

- **Optimization of Interconnection Design:** Developing designs to electrically connect the perovskite and silicon layers efficiently while preventing degradation due to mechanical stress and environmental factors, thereby enhancing overall module performance and reliability.
- **Material Property Enhancement:** Developing materials that maintain high stability under harsh environmental conditions such as damp heat testing, and optimizing interfacial properties. The aim is to achieve highly reliable cells that show no performance degradation after 1,000 hours under the stringent conditions of 85°C and 85% relative humidity.
- **Fabrication of Top Cells with Optimal Bandgaps:** Precisely tuning the bandgap of the perovskite layer (top cell) to optimize sunlight spectrum absorption between it and the silicon bottom cell, maximizing the overall tandem conversion efficiency.
- **Modeling for Outdoor Performance Prediction:** Developing physical models and simulation tools to accurately predict the behavior of solar cells in real-world outdoor environments. This will shorten the development cycle for new modules and enable reliable product design.

This research lays the essential foundation for perovskite-silicon tandem technology to transition from laboratory scale to gigawatt-scale production.

Background & Context

As global energy demand shifts towards renewable sources, solar power plays a central role. However, the efficiency of conventional silicon solar cells is approaching physical limits, making tandem technology indispensable for further high-efficiency gains. Perovskite-silicon tandem solar cells hold the potential to significantly surpass the efficiency of standalone silicon, but their complex layered structure and differing material properties have posed major challenges for module stability, durability, and manufacturability. The DOE's PVRD2 project addresses these industry needs and is part of a strategic initiative for the U.S. to establish leadership in clean energy technology. It aims to further improve the cost-effectiveness of solar power and enhance energy security.

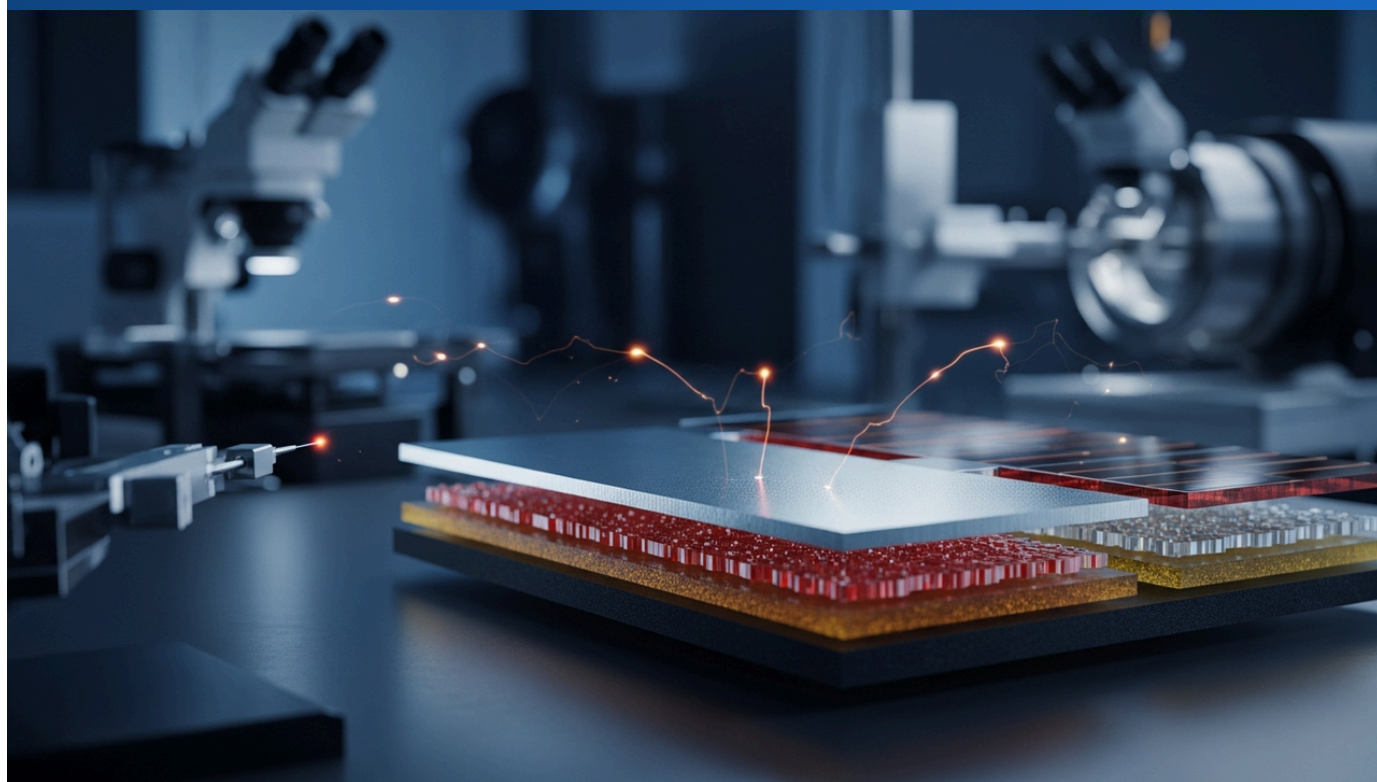
Strategic Significance & Outlook

The PVRD2 project's research into interconnection design and material properties will significantly accelerate the commercialization of perovskite-silicon tandem solar cell modules. Particularly, improved damp heat stability is crucial for addressing market concerns regarding reliability for installations in hot and humid environments and long-term operation. Achieving optimal bandgaps will enable further enhancements in power generation efficiency, and outdoor performance prediction modeling will streamline the development process. These outcomes are expected to bring more affordable, highly efficient, and reliable solar power solutions to the market, dramatically accelerating the adoption of renewable energy. Ultimately, DOE's support will help position perovskite tandem technology at the heart of the global energy transition.

Source: <https://www.energy.gov/eere/solar/photovoltaics-research-and-development-2-modules-and-systems-pvrd2>

#17 Multifunctional Titanium Oxynitride Layers Boost Performance and Durability in Perovskite-Silicon Tandem Solar Cells

Published July 26, 2026 Bioengineer.org (Nature Energy掲載) Unknown



OVERVIEW

A new study published in Nature Energy reports a strategy utilizing TiOxNy (titanium oxynitride) as a multifunctional recombination interlayer in monolithic perovskite/silicon tandem solar cells. This TiOxNy layer simultaneously facilitates efficient charge recombination, maintains optical transparency, and significantly enhances interfacial chemical robustness, thereby improving device durability and scalability. This is a crucial breakthrough towards the commercialization of next-generation high-efficiency solar cells.

Background

To further reduce the cost of solar power and maximize power output per unit area, technologies capable of surpassing the efficiency limits of current silicon solar cells are essential. Perovskite/silicon tandem solar cells emerge as a promising candidate to meet this demand, yet their commercialization has been hindered by issues such as device stability, manufacturing complexity, and scalability. The design of the intermediate layer within tandem structures is particularly crucial, as it fulfills vital optical, electrical, and chemical functions that profoundly influence overall performance. The development of the TiOxNy layer introduces a groundbreaking approach that simultaneously tackles these multifaceted challenges, representing a significant milestone toward the practical implementation of perovskite tandem solar cells. This underscores the critical role of materials science innovation in shaping the future of solar energy technology.

Key Findings

A recent study highlights the utilization of multifunctional titanium oxynitride (TiOxNy) layers, which demonstrably boost both the performance and durability of monolithic perovskite/silicon tandem solar cells. This TiOxNy layer effectively facilitates charge carrier recombination, maintains excellent optical transparency, and substantially enhances the chemical robustness of the interface. This synergistic combination of properties leads to improved overall device durability and greater manufacturing scalability, directly addressing critical hurdles in the practical deployment of next-generation high-efficiency solar cells.

Technical Details

Perovskite/silicon tandem solar cells are widely regarded as a promising technology to overcome the efficiency limitations of conventional solar cells, owing to their high theoretical conversion efficiency. Nevertheless, stability and manufacturing scalability have persisted as significant obstacles. The TiOxNy layer introduced in this research serves as a crucial recombination interlayer within the tandem structure. Its multifunctional nature enables it to fulfill several critical roles:

- **Enhanced Charge Recombination:** The layer efficiently facilitates the recombination of electrons and holes generated between the top perovskite cell and the bottom silicon cell, ensuring smooth current flow. This minimizes internal losses and contributes to an improved overall device efficiency.
- **Maintained Optical Transparency:** Exhibiting high transparency, the TiOxNy layer allows a broad spectrum of sunlight to pass through unimpeded, ensuring optimal light delivery to the underlying silicon cell. This optical characteristic is vital in tandem architectures, enabling each sub-cell to absorb its designated portion of the solar spectrum.
- **Improved Interfacial Chemical Robustness:** Given the sensitivity of perovskite materials to moisture and heat, the TiOxNy layer functions as a robust protective barrier. This significantly enhances the chemical stability of the interface, thereby dramatically improving the device's long-term durability and mitigating performance degradation under challenging environmental conditions.

By integrating these distinct characteristics, the TiOxNy layer successfully maintains the high efficiency of monolithic tandem devices while simultaneously extending their operational lifespan and enhancing their suitability for large-area manufacturing processes.

Strategic Significance & Outlook

The strategy of integrating a TiOxNy layer as a multifunctional recombination interlayer is poised to significantly accelerate the commercialization pathway for perovskite/silicon tandem solar cells. This technology, which expertly balances high performance with enhanced durability, is expected to find widespread adoption across diverse applications, from residential rooftops and large-scale solar farms to building-integrated photovoltaics (BIPV). Future research and development will focus on optimizing the large-area deposition processes for TiOxNy, reducing manufacturing costs, and conducting extensive long-term durability tests under real-world outdoor conditions. This breakthrough is anticipated to furnish the market with more efficient and reliable solar power solutions, thereby making a substantial contribution to the global adoption of renewable energy.

Source: <https://www.bioengineer.org/multifunctional-titanium-oxynitride-layers-power-high-performance-perovskite-silicon-tandem-solar-cells/>

Collected: July 31, 2026 | Automated Research System (Gemini API)

#18 University of Sheffield and Partners Launch International Project for Lightweight Solar Power, Targeting Underutilized Rooftops and Building Sides

Published July 30, 2026 University of Sheffield UK



OVERVIEW

The University of Sheffield, in collaboration with Power Roll (UK) and Dyenamo AB (Sweden), has launched an international project focused on lightweight solar power. This initiative aims to leverage Power Roll's patented micro-groove solar film technology to unlock untapped markets, such as lightweight commercial rooftops and building facades, previously inaccessible to conventional PV. This is a crucial endeavor to accelerate renewable energy deployment in urban environments.

Key Findings

The University of Sheffield, in partnership with UK-based Power Roll and Sweden's Dyenamo AB, has launched a new international project dedicated to the development and deployment of lightweight solar photovoltaic (PV) solutions. This collaboration aims to harness Power Roll's patented micro-groove solar film technology to unlock vast, previously unexploited markets such as lightweight commercial rooftops and building facades, which are often inaccessible to conventional PV panels due to weight and installation constraints. The project holds significant potential to accelerate the adoption of renewable energy in urban settings.

Technical / Clinical Details

At the core of this project is Power Roll's unique micro-groove solar film technology. This technology enables the formation of solar cells on an extremely thin and flexible film, achieving dramatic weight reduction and flexibility compared to traditional glass-based silicon panels. The micro-groove structure is designed to enhance light capture efficiency, allowing for high power generation with minimal material usage. This makes it ideal for existing buildings with limited load-bearing capacity, curved structures, and even mobile applications where traditional solar PV installation has been challenging. Dyenamo AB contributes its expertise in perovskite solar cell materials, aiding in performance enhancement and ensuring the stability of the films. Researchers at the University of Sheffield will leverage their knowledge in materials science, device physics, and manufacturing process optimization to further boost the efficiency and lifespan of these innovative films. This three-party collaboration establishes an integrated approach from R&D to practical implementation.

Background & Context

As the global transition towards carbon neutrality accelerates, solar power is gaining prominence as a key renewable energy source. However, the weight and rigidity of conventional solar panels have posed significant challenges for deployment, particularly in urban areas on existing buildings and architecturally sensitive structures. Many commercial buildings and factories have load-bearing limitations on their roofs, preventing the installation of large-scale solar PV systems. Lightweight and flexible thin-film solar cells have the potential to fill this market gap, but they have faced challenges in terms of cost, efficiency, and durability. This international project seeks to provide a comprehensive solution to these issues by combining cutting-edge perovskite technology with innovative film manufacturing techniques. It exemplifies Europe's proactive engagement in clean energy technological innovation and market expansion.

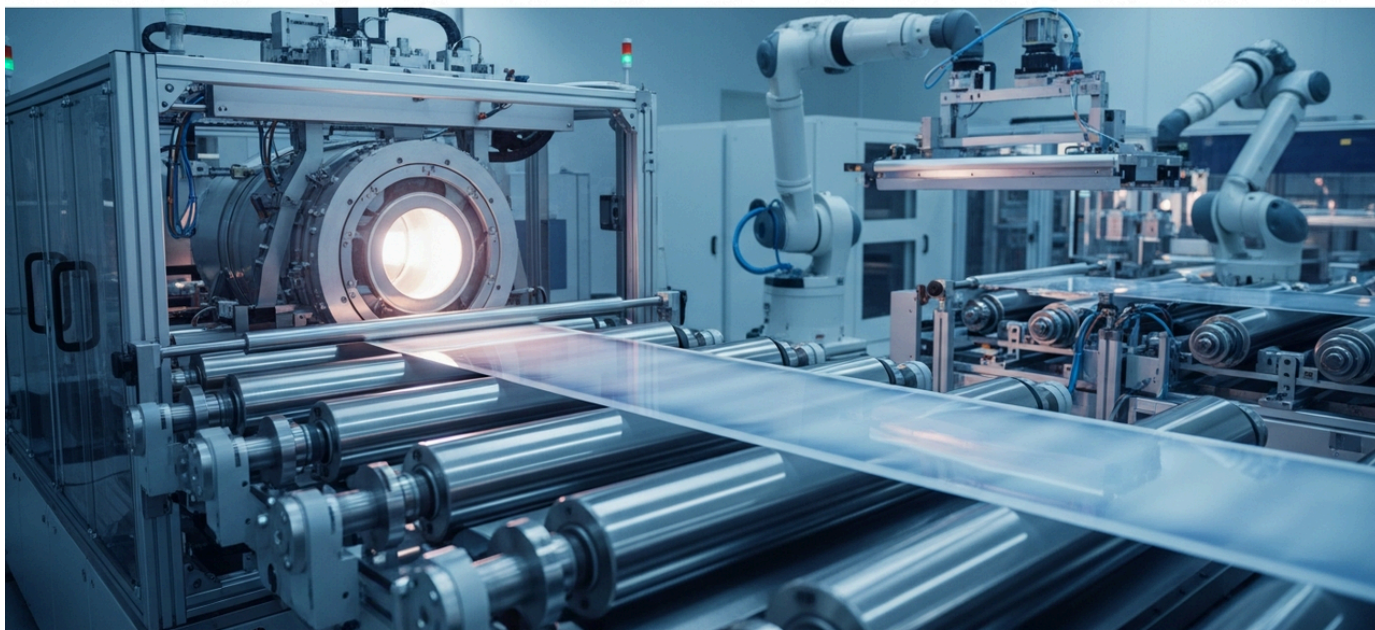
Strategic Significance & Outlook

Lightweight solar film technology is expected to see significant growth across a wide range of applications, including Building-Integrated Photovoltaics (BIPV), off-grid solutions, and mobile applications such as automotive and drones. This project aims to further mature Power Roll's technology and develop market-ready products to establish competitiveness in these sectors. Future focus areas will include demonstrating long-term film durability, scaling up manufacturing processes, and further reducing production costs. This international collaboration has the potential to dramatically broaden the applicability of solar power and accelerate the adoption of renewable energy in urban environments, thereby making a substantial contribution to achieving a sustainable society.

Source: <https://www.sheffield.ac.uk/news/new-international-project-targets-lightweight-solar-power-underused-rooftops-and-sides-buildings>

#19 Intellivation LLC Reports Roll-to-Roll PVD Coating Advances Critical for Enhancing Stability of Flexible Perovskite Solar Cells

Published July 28, 2026 Intellivation LLC USA



OVERVIEW

Intellivation LLC reports that advancements in PVD (Physical Vapor Deposition) coating within roll-to-roll manufacturing processes play a crucial role in addressing the long-term stability, a major hurdle for commercializing flexible perovskite solar cells (PSCs). This technology significantly enhances the reliability, lifetime, and overall performance of flexible PSCs through advanced environmental barrier films and current collector materials. This marks a vital manufacturing breakthrough for the mass production and widespread adoption of perovskite solar cells.

Key Findings

Intellivation LLC has reported that recent advancements in Physical Vapor Deposition (PVD) coating technology within roll-to-roll (R2R) manufacturing processes offer a decisive solution to the long-standing challenge of long-term stability, a major barrier to the commercialization of flexible perovskite solar cells (PSCs). This innovative PVD coating significantly enhances the reliability, operational lifetime, and overall power generation performance of flexible PSCs through high-performance environmental barrier films and optimized current collector materials. This is hailed as a critical manufacturing technological breakthrough for the mass production of perovskite solar cells.

Technical / Clinical Details

Flexible perovskite solar cells hold immense promise for diverse applications such as Building-Integrated Photovoltaics (BIPV), wearable devices, and IoT sensors, owing to their lightweight, flexibility, and high-efficiency potential. However, the inherent vulnerability of perovskite materials to moisture and oxygen, coupled with their limited long-term stability against light and heat stress, has been a primary obstacle to their commercialization. The PVD coating advancements highlighted by Intellivation LLC directly address this challenge. PVD technology involves evaporating and depositing materials in a vacuum to form extremely dense and uniform thin films. Applying this technology to R2R processes offers several benefits:

- **Enhanced Environmental Barrier Films:** High-quality PVD barrier layers effectively block the ingress of water vapor and oxygen to extreme levels, suppressing perovskite layer degradation. This is crucial for ensuring the long-term stability of devices.
- **Optimized Current Collector Materials:** PVD-formed current collectors (electrodes) provide excellent conductivity and good ohmic contact with the perovskite layer, contributing to efficient charge carrier collection and reduced internal resistance.
- **Improved Uniformity and Reproducibility:** The combination of R2R processing and PVD technology enables high-speed, continuous deposition of uniform thickness and composition films over large-area flexible substrates, leading to improved manufacturing yields and cost reduction.

These technological advancements pave the way for flexible PSCs to transition from the laboratory to the market.

Background & Context

To broaden the application scope of solar power and provide sustainable energy solutions in diverse forms, lightweight and flexible power generation devices, distinct from conventional rigid solar panels, are essential. Perovskite solar cells have attracted attention as a next-generation thin-film PV technology, but establishing manufacturing scalability and long-term stability has been the primary impediment to their commercialization. Intellivation LLC's report, from the perspective of a manufacturing equipment supplier, suggests that the evolution of PVD technology is crucial for overcoming these barriers. This underscores how critical innovations in manufacturing process technology, in addition to materials development, are in shaping the future of perovskite solar cells.

Strategic Significance & Outlook

Advances in roll-to-roll PVD coating technology are set to significantly accelerate the commercialization of flexible perovskite solar cells. With more reliable and durable flexible PSCs becoming a reality, countless applications previously challenging for solar power—such as building facades, tents, automotive, aerospace, and IoT devices—will become feasible. Such announcements from manufacturing equipment suppliers like Intellivation LLC indicate the maturation of production technologies across the industry, marking a crucial step towards gigawatt-scale production of perovskite solar cells. Future efforts are expected to focus on further optimizing this technology and reducing manufacturing costs to establish competitiveness in the flexible solar cell market.

Source: <https://www.intellivation.com/news/roll-to-roll-vacuum-web-coating-developments-in-pvd-coatings-of-flexible-substrates>

#20 Researchers Boost Vacuum-Deposited Perovskite Solar Cell Efficiency to 25.53% with Acetate-Driven Crystallization Control and High Stability

Published July 28, 2026 Perovskite-Info Unknown



OVERVIEW

Researchers have elevated the efficiency of vacuum-deposited perovskite solar cells (PSCs) to 25.53% using an acetate-driven crystallization control technique. This method utilizes the direct reaction between formamidinium acetate and lead iodide (PbI_2) to form an FAPbI_3 seed layer, guiding precise crystal growth. Devices fabricated through this process exhibit minimal non-radiative losses and demonstrate high operational stability, maintaining over 95% of initial efficiency after 1,000 hours under the ISOS-L-1 protocol.

Key Findings

Researchers have successfully improved the power conversion efficiency of vacuum-deposited perovskite solar cells (PSCs) to an impressive 25.53% through the introduction of a novel technique: acetate-driven crystallization control. This innovative approach leverages the direct reaction between formamidinium acetate and lead iodide (PbI₂) to form an FAPbI₃ seed layer, which precisely guides the growth of perovskite crystals. Devices fabricated using this process exhibit remarkably low non-radiative losses and demonstrate exceptional operational stability, retaining over 95% of their initial efficiency after 1,000 hours under the ISOS-L-1 protocol.

Technical / Clinical Details

Vacuum deposition is a promising manufacturing technique for perovskite solar cells, offering high potential for large-area fabrication and mass production. However, it has historically faced challenges in controlling crystal quality compared to solution-based processes. To overcome this, the current research introduced an acetate-driven crystallization control technique. Specifically, formamidinium acetate (FAC) is directly evaporated onto a PbI₂ layer. The acetate ions react with PbI₂ to form an FAPbI₃ seed layer. This seed layer acts as a template, guiding the subsequent growth of the FAPbI₃ perovskite layer, thereby promoting the formation of a denser, more uniform, and less defective high-quality crystalline film. This significantly suppresses charge carrier recombination losses, leading to improvements in open-circuit voltage and fill factor, ultimately achieving the high efficiency of 25.53%. Furthermore, this improved crystal quality contributes to device stability. The devices demonstrated excellent long-term stability in the ISOS-L-1 protocol (continuous light illumination), a standardized accelerated degradation test, maintaining over 95% of initial efficiency after 1,000 hours. This marks a substantial advance towards the practical implementation of vacuum-deposited PSCs.

Background & Context

Perovskite solar cells are garnering significant attention as a next-generation photovoltaic technology due to their potential to achieve efficiencies comparable to conventional silicon solar cells and their promise of low-cost manufacturing. While solution processes are commonly used, they face challenges in large-area uniformity and mass production. Vacuum deposition, conversely, is well-suited for industrial-scale production and can achieve more uniform film formation, but has historically lagged behind solution processes in terms of efficiency. The acetate-driven crystallization control technique presented in this study offers a groundbreaking approach that combines the mass production advantages of vacuum deposition with the high efficiency potential of solution processing. This has the potential to simultaneously improve the cost-effectiveness and performance of perovskite solar cells, significantly enhancing their competitiveness in the solar energy market.

Strategic Significance & Outlook

The realization of vacuum-deposited perovskite solar cells with 25.53% efficiency and excellent operational stability will significantly accelerate their commercialization. Vacuum deposition allows for precise film thickness control and is highly compatible with continuous production processes like roll-to-roll manufacturing. Should this technology be scaled up for mass production, it is expected to lead to the widespread adoption of more affordable and high-performance perovskite solar cells. Future work will focus on applying this acetate-driven crystallization control technique to large-area substrates, conducting further long-term durability tests, and reducing manufacturing costs. This breakthrough represents a critical step for perovskite solar cells to fully enter the mainstream market, making a substantial contribution to the spread of renewable energy and the realization of a sustainable society.

Source: <https://www.perovskite-info.com/researchers-boost-vacuum-deposited-pscs-2553-efficiency-using-acetate-driven-crystallization-control>

#21 JA Solar to Invest 210 Million Yuan in New 0.6 GW Perovskite Tandem Module Production Line at Yangzhou Factory

Published July 24, 2026 Perovskite-Info China



OVERVIEW

JA Solar announced it will add 0.6 gigawatts (GW) of perovskite tandem module production capacity to its Yangzhou facility, following environmental impact assessment approval. The project, utilizing existing infrastructure, involves a total investment of 210 million yuan (approximately \$29 million). Perovskite tandem manufacturing will be concentrated at its Jinhui Road factory, signaling the company's aggressive move towards mass production of next-generation high-efficiency solar cells.

Key Findings

JA Solar, a leading Chinese solar manufacturer, has announced plans to establish a new 0.6 gigawatt (GW) perovskite tandem module production line at its existing Yangzhou facility. This decision follows the approval of the environmental impact assessment by the Yangzhou Economic and Technological Development Zone management committee. The expansion project represents a total investment of 210 million yuan (approximately 29 million USD) and marks a significant step in accelerating the commercialization of the company's next-generation high-efficiency solar cell technology. This move is expected to catalyze the mass production of perovskite tandem technology and profoundly reshape the competitive landscape of the photovoltaic market.

Technical / Clinical Details

The production line to be installed by JA Solar will be dedicated to perovskite-crystalline silicon tandem solar cell modules. The tandem structure achieves higher conversion efficiencies by utilizing a broader spectrum of sunlight that conventional single-material solar cells cannot absorb. A production capacity of 0.6 GW per year is substantial for an initial phase of this innovative technology, suggesting that the company is positioning perovskite tandem technology as one of its flagship products. This investment will likely focus on resolving key technical challenges in mass production, such as perovskite film deposition techniques, interconnection technology, and module encapsulation. Ensuring long-term stability and reliability is paramount for commercial production, and this new line is expected to incorporate state-of-the-art manufacturing processes to overcome these challenges. By leveraging existing facilities, JA Solar aims to optimize the time and cost required for new construction, targeting rapid market entry.

Background & Context

The global solar energy market is expanding rapidly, driven by the need for high-efficiency, low-cost technologies to combat climate change and enhance energy security. While perovskite solar cells have achieved impressive efficiencies at the laboratory level, mass production and establishing long-term reliability have been major hurdles for commercialization. The substantial investment by a major player like JA Solar clearly indicates that perovskite solar cell technology has reached a stage of maturity where its commercial viability is high. This is also part of China's strategy to maintain global leadership in renewable energy technology manufacturing and innovation. This announcement is expected to encourage other solar cell manufacturers to invest in perovskite technology, thereby accelerating technological innovation across the industry.

Strategic Significance & Outlook

The establishment of JA Solar's 0.6 GW per year perovskite tandem module production line will have a significant impact on the solar photovoltaic industry. This production capacity will increase the supply of high-efficiency modules, accelerating the adoption of perovskite tandem technology, particularly in residential, commercial, and industrial applications where maximum power generation from limited space is critical. The 210 million yuan investment demonstrates JA Solar's long-term commitment to this technology, with further expansions in production capacity and technology development for cost reduction expected in the future. This move will serve as a crucial driving force for perovskite solar cells to play a central role in the global energy transition.

Source: <#>

#22 Hanwha Qcells to Supply Perovskite-Silicon Tandem Solar Cells for NASA Lunar Power Project, Bolstering US Manufacturing Capabilities

Published July 26, 2026 Troy Technical / EnkiAI South Korea



OVERVIEW

Hanwha Qcells has secured a strategic contract to supply perovskite-silicon tandem solar cells for NASA's lunar power demonstration project. This partnership will validate Qcells' advanced solar technology for high reliability and performance in extreme space environments. Concurrently, Qcells is leveraging a \$1.45 billion loan from the U.S. Department of Energy (DOE) to strengthen its domestic solar supply chain capabilities in the U.S., expanding clean energy frontiers both in space and on Earth.

Key Findings

Hanwha Qcells has entered into a strategic agreement to supply its advanced perovskite-silicon tandem solar cells for NASA's lunar power demonstration project. This landmark partnership not only underscores the high reliability and performance of Qcells' photovoltaic technology in the exceptionally harsh environment of space but also solidifies the company's position in the space energy sector. This initiative contributes to humanity's ambitious goal of establishing sustainable power for lunar bases and simultaneously pioneers new application areas for clean energy technologies.

Technical / Clinical Details

NASA's lunar power project aims to establish sustainable energy solutions to enable long-term lunar exploration and habitation. The lunar surface presents incredibly challenging conditions for solar cells, including extreme temperature fluctuations, high radiation exposure, and micrometeoroid impacts. The perovskite-silicon tandem solar cells provided by Hanwha Qcells offer significantly higher energy conversion efficiency compared to conventional monocrystalline silicon solar cells, as they can capture a broader spectrum of sunlight. This high efficiency is particularly advantageous for space applications where maximizing power from a limited installation area is crucial.

Furthermore, Qcells is expected to be implementing specialized designs and material technologies to enhance the radiation hardness, thermal cycling stability, and mechanical robustness of these solar cells to meet the unique demands of the space environment. This technology will serve as a critical foundation, not only for addressing energy issues on Earth but also for supporting humanity's expansion into space.

Background & Context

In recent years, nations are accelerating lunar exploration plans, making reliable power supply indispensable for sustainable lunar activities. Traditional space solar cells have been high in cost with limited efficiency. Perovskite solar cells, with their high efficiency, lightweight properties, and manufacturing flexibility, are highly anticipated as a next-generation solar cell for space applications. The entry of a major company like Hanwha Qcells into this field through a partnership with NASA demonstrates the reliability and applicability of perovskite technology globally, accelerating innovation in the space solar cell market. Concurrently, Qcells is also advancing plans to strengthen the U.S. domestic solar supply chain capabilities with a \$1.45 billion loan from the U.S. Department of Energy (DOE), showcasing the company's diversified strategy to lead in clean energy manufacturing both on Earth and in space.

Strategic Significance & Outlook

The partnership between Hanwha Qcells and NASA proves that perovskite-silicon tandem solar cells can demonstrate their value not only on Earth but also in the most extreme environments of outer space. Success in the lunar power project could establish a new standard for solar power technology in future space exploration, including Mars missions and deep-space ventures. This technological development will also feedback into improving the reliability of high-efficiency solar cells on Earth, accelerating their adoption in a wide range of applications such as residential, commercial, and large-scale power plants. Furthermore, strengthening manufacturing capabilities in the U.S. with DOE financing will contribute to supply chain resilience and economic job creation, further solidifying Qcells' global leadership in the clean energy sector.

Source: #

#23 Navitas Solar and Caelux Form Partnership for 5 GW Perovskite-Silicon Hybrid Tandem Module Development and Manufacturing in India

Published July 30, 2026 Renewables Now India



OVERVIEW

Indian solar PV module manufacturer Navitas Solar has formed a 5-year strategic partnership with U.S. firm Caelux Corporation to develop and manufacture hybrid tandem solar modules combining perovskite and silicon layers in India. This collaboration targets 5 gigawatts (GW) of commercialization, planning to produce modules with up to 28% efficiency by integrating Caelux's energy-generating glass technology with Navitas's N-type TOPCon solar cell technology. This initiative will supply India's solar market with highly efficient and innovative products.

Key Findings

Navitas Solar, a leading Indian photovoltaic module manufacturer, has forged a five-year strategic partnership with U.S.-based Caelux Corporation. The objective of this collaboration is to develop and manufacture hybrid tandem solar modules, integrating both perovskite and silicon solar layers, within India, targeting a commercialization scale of 5 gigawatts (GW). The two companies plan to combine Caelux's energy-generating glass technology with Navitas's N-type TOPCon (Tunnel Oxide Passivated Contact) solar cell technology to produce innovative hybrid tandem modules capable of achieving up to 28% conversion efficiency, which is expected to significantly impact India's renewable energy sector.

Technical / Clinical Details

At the core of this partnership is the hybrid tandem module technology, integrating a perovskite layer with a silicon layer. Caelux's 'energy-generating glass' technology, while maintaining transparency, efficiently absorbs sunlight and functions as the top cell in the tandem structure. Navitas's expertise lies in N-type TOPCon solar cells, which will serve as the high-efficiency silicon-based bottom cell. By combining these two technologies, the perovskite layer will optimally absorb high-energy, short-wavelength light, while the TOPCon silicon layer will capture longer-wavelength light, maximizing the utilization of the entire solar spectrum to achieve conversion efficiencies of up to 28%. The ambitious commercialization target of 5 GW implies that joint R&D efforts in materials development, manufacturing process optimization, and scale-up will contribute to long-term reliability and cost-efficiency improvements for these modules.

Background & Context

India, facing rapid economic growth and population expansion, is experiencing a surge in energy demand. Concurrently, the nation is committed to accelerating renewable energy deployment as a critical measure against climate change. While solar power plays a central role in this transition, there is a growing need for next-generation technologies that offer higher efficiency and adaptability to diverse installation environments.

Perovskite solar cells, with their high conversion efficiency and potential for low-cost manufacturing, are highly attractive for large markets like India. The partnership between Navitas Solar and Caelux is a strategic move to accelerate the region's clean energy transition by linking advanced U.S. technology with India's manufacturing capabilities and market needs. This serves as an excellent example of how global technological cooperation can contribute to achieving sustainable development goals.

Strategic Significance & Outlook

The Navitas Solar and Caelux partnership is poised not only to supply innovative, high-efficiency products to the Indian solar market but also to play a crucial role in promoting the global adoption of perovskite tandem technology. Hybrid tandem modules with up to 28% efficiency and a 5 GW commercialization target will reduce the cost of electricity and maximize power generation per unit area across a wide range of applications, from residential rooftops to large-scale solar farms and building-integrated photovoltaics (BIPV). Over the next five years, both companies are expected to focus on further optimizing manufacturing processes, conducting long-term product durability tests, and ensuring rapid market deployment. This partnership is anticipated to be a significant driving force for India to establish itself as a clean energy powerhouse and make substantial contributions to the global energy transition.

Source: #

#24 Swiss Perovskia Solar Raises \$2.4M Seed Funding and Secures 10 Customers for IoT Printed Perovskite Solar Technology, Expanding Production to 1 Million Cells

Published Date unknown Global Smart Energy Federation Switzerland

Swiss Perovskia Solar Printed perovskite solar cells for IoT expand production capacity



OVERVIEW

Swiss startup Perovskia Solar has secured \$2.4 million in seed funding for its printed perovskite solar cell technology targeting IoT devices. The company has already acquired 10 customers and plans to scale its production capacity to 1 million cells. This funding will be primarily invested in back-end automation of the production process to ensure high quality, marking a significant step towards providing sustainable power solutions in the IoT market.

Key Findings

Perovskia Solar, an innovative Swiss startup, has successfully raised \$2.4 million in seed funding for its printed perovskite solar cell technology, specifically designed for Internet of Things (IoT) devices. The company has already secured 10 customers and plans to significantly expand its production capacity to 1 million cells annually with this investment. This move clearly demonstrates the commercial potential of perovskite technology in delivering sustainable and autonomous power supply solutions for the burgeoning IoT market.

Technical / Clinical Details

Perovskia Solar's core technology centers on printed perovskite solar cells that operate efficiently in low-light conditions. These cells possess the unique ability to generate high power conversion efficiency even under weak indoor lighting or artificial light, a challenge for traditional silicon solar cells. The company's printing technology significantly reduces manufacturing costs and allows for the fabrication of solar cells on flexible substrates, making them easily integratable into a diverse range of IoT devices such as sensors, smart tags, electronic shelf labels, and wearable electronics, regardless of their shape or size. The raised capital will be used to expand production capacity from tens of thousands to 1 million cells per year. A particular focus will be on investing in back-end automation of the production process to ensure consistent quality and high yield. This will improve reliability and cost-efficiency in mass production, facilitating the widespread adoption of perovskite solar cells.

Background & Context

The rapid proliferation of IoT devices has highlighted challenges related to battery life and power supply. In an era where millions, if not billions, of devices are networked, the cost and environmental impact of battery replacement are considerable. Consequently, there is growing demand for indoor photovoltaics (IPVs) that can generate electricity from ambient light. Perovskite solar cells, with their high power conversion efficiency and tunable bandgaps, are considered the most promising candidates for IPVs in low-light environments. Perovskia Solar's successful seed funding and early customer acquisition indicate that this market is reaching technological maturity and gaining commercial traction. As a spin-off from Empa (Swiss Federal Laboratories for Materials Science and Technology), the company benefits from a robust technological foundation.

Strategic Significance & Outlook

Perovskia Solar's investment in expanding production capacity and back-end automation will accelerate the market entry of perovskite solar cells for IoT devices. The target of 1 million cells annually will promote the adoption of battery-less devices within the IoT ecosystem, contributing to the realization of maintenance-free smart devices. Future efforts will focus on further fundraising, expanding the product portfolio, and expanding into global markets. The company's success demonstrates that perovskite technology can become a strong alternative to existing power solutions in niche, high-value markets, and is expected to play a crucial role in building a sustainable IoT future.

Source: <#>

#25 European Solar Market Shifts Focus to Perovskite-on-Silicon Cells for Technological Sovereignty, Oxford PV Expands Production in Germany with 25% Certified Efficiency

Published Date unknown Enki AI Germany



OVERVIEW

The European solar market is strategically shifting its focus from broad PV farm deployment to establishing technological sovereignty in next-generation perovskite-on-silicon cells. This move is exemplified by Oxford PV, which achieved 25% certified efficiency in commercial-sized tandem solar cells between 2024-2025 and is expanding production at its Brandenburg, Germany factory. This demonstrates Europe's path to compete through technology rather than traditional silicon panel price wars, aiming to re-establish leadership in clean energy.

Key Findings

The European solar energy market is undergoing a significant strategic pivot, shifting its primary focus from mere deployment of large-scale PV farms to establishing technological sovereignty in next-generation perovskite-on-silicon solar cells. This strategic realignment is prominently exemplified by Oxford PV, which achieved a certified efficiency of 25% in commercial-sized tandem solar cells between 2024 and 2025 and is now expanding production at its Brandenburg factory in Germany. This signals Europe's ambition to carve out a new competitive path in the global solar market through technological innovation, rather than being drawn into the price competition of conventional silicon panels.

Technical / Clinical Details

Perovskite-on-silicon tandem solar cells are considered the most promising technology to break through the efficiency limits of traditional silicon solar cells. The perovskite layer efficiently absorbs high-energy, short-wavelength light that silicon struggles with, while the silicon layer absorbs the remaining longer-wavelength light, thus utilizing the entire solar spectrum more effectively. Oxford PV's technology has already achieved a high conversion efficiency of 25% in commercial-sized modules, which translates into significant practical power yield improvements. At its production facility in Brandenburg, Germany, process optimization for the mass production of this cutting-edge technology is underway. This technological superiority extends beyond mere efficiency, promising future reductions in manufacturing costs, efficient resource utilization, and high-power generation from smaller footprints, contributing to Europe's energy independence and sustainability.

Background & Context

Historically, Europe has been heavily reliant on imports of inexpensive silicon solar cell modules, primarily from China. This dependence has led to the decline of the domestic European manufacturing industry and raised concerns about energy security. The European Commission is actively working to reverse this trend and regain technological sovereignty in the renewable energy sector, vigorously promoting investment in R&D and domestic manufacturing of advanced technologies. Perovskite-on-silicon technology is positioned as a strategic choice for Europe to reopen the frontier of solar power technology and differentiate itself in the international market through high-value-added products. Oxford PV's achievements serve as concrete evidence that this strategy is becoming a reality, bringing hope for the restructuring of Europe's clean energy industry.

Strategic Significance & Outlook

Europe's strategic shift to focus on perovskite-on-silicon technology will have a significant impact on the global solar market. This technological innovation will accelerate the adoption of high-efficiency solar cells, promoting their deployment particularly in urban areas with limited installation space and in Building-Integrated Photovoltaics (BIPV) markets where design aesthetics are crucial. Oxford PV's production expansion will strengthen manufacturing capabilities within Europe and contribute to supply chain diversification. Future efforts will focus on further enhancing the stability of this technology, reducing manufacturing costs, and conducting long-term field tests under various environmental conditions. This strategy represents a crucial step for Europe to build a sustainable energy future and strengthen its role in the global energy transition.

Source: #

#26 Horizon Europe 2026/2027 Call for Funding Industrial Processes and Equipment for Innovative, Reliable, and Scalable Tandem Technologies, Targeting Perovskite-Si Commercialization

Published Date unknown MIC EU



OVERVIEW

The Horizon Europe 2026/2027 work program outlines key topics related to next-generation thin-film and tandem PV, particularly perovskite solar cells. The flagship call, 'INDUSTRIAL PROCESSES AND EQUIPMENT FOR INNOVATIVE, RELIABLE AND SCALABLE TANDEM TECHNOLOGIES,' specifically aims at the industrialization of perovskite-Si tandems, including funding for manufacturing equipment and process lines. This represents a clear European strategy to establish technological sovereignty in next-generation solar cell technology.

Key Findings

The Horizon Europe 2026/2027 work program, a flagship research and development initiative by the European Union (EU), has announced a call for proposals titled 'INDUSTRIAL PROCESSES AND EQUIPMENT FOR INNOVATIVE, RELIABLE AND SCALABLE TANDEM TECHNOLOGIES.' This significant call aims to vigorously promote the industrialization of innovative, reliable, and scalable next-generation thin-film and tandem PV technologies, particularly perovskite-silicon tandem solar cells, by providing direct funding for the development of manufacturing equipment and process lines. This announcement clearly signifies Europe's strategic intent to establish technological sovereignty in clean energy technologies.

Technical / Clinical Details

This call for proposals focuses on resolving technical challenges associated with the mass production of perovskite-silicon tandem solar cells. Specifically, it seeks to transition high-efficiency laboratory-scale achievements to gigawatt (GW) scale manufacturing through the development of process technologies and equipment. This includes the following key technical areas:

- **Optimization of Manufacturing Processes:** Development and improvement of efficient and cost-effective thin-film deposition techniques, such as roll-to-roll (R2R) manufacturing, vacuum deposition, and solution coating.
- **Development of Manufacturing Equipment:** Design and construction of next-generation manufacturing machinery and lines capable of stably producing large-area perovskite-Si tandem modules.
- **Reliability and Quality Control:** Development of robust encapsulation technologies for long-term stability, in-line quality control systems to reduce defect rates, and standardized testing protocols compliant with international standards.
- **Material Sustainability:** Exploration of environmentally friendly material compositions, such as lead-free alternatives, and diversification and strengthening of the supply chain.

These technological breakthroughs will form an essential foundation for Europe to establish global leadership in the perovskite solar cell sector.

Background & Context

Europe has placed climate change mitigation and enhanced energy security at the core of its national strategy, accelerating investment in renewable energy technologies. In the solar photovoltaic sector, breaking away from significant reliance on imports, primarily from Asia, and boosting internal manufacturing and innovation capabilities have become urgent priorities. Perovskite-silicon tandem solar cells hold the potential to significantly exceed the efficiency limits of conventional silicon solar cells and are considered one of the most promising means for Europe to establish technological sovereignty in this field. This funding from Horizon Europe demonstrates concrete action to bridge the 'valley of death' from laboratory-scale achievements to industrial scale, thereby enhancing Europe's economic competitiveness and accelerating the clean energy transition.

Strategic Significance & Outlook

This large-scale call for proposals from Horizon Europe is expected to dramatically accelerate the industrialization of perovskite-silicon tandem solar cells. Direct investment in manufacturing equipment and process lines will expand production capacity and reduce the cost of final products, thereby promoting market adoption. Strengthening the manufacturing ecosystem within Europe will contribute to job creation, economic growth, and supply chain resilience. If successful, this initiative is anticipated to establish Europe's position as a global innovator in next-generation solar cell technology and significantly contribute to the global energy transition. Future focus will be on how quickly and efficiently the selected projects can develop concrete manufacturing solutions.

Source: <#>