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Near-invisible solar cells 10,000 times thinner than human hair turn sunlight to power

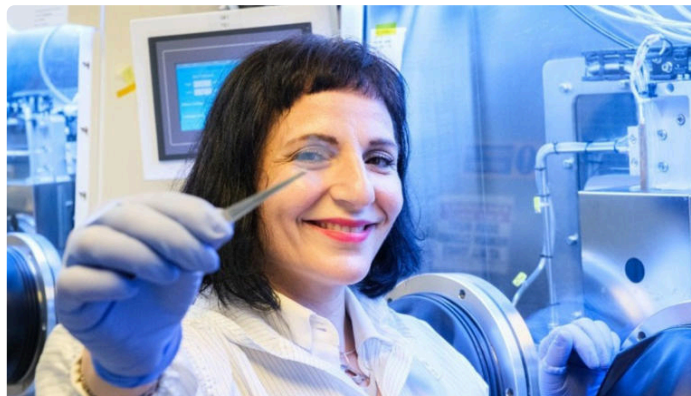
Story by Aamir Khollam • 3d • [3 min read](#)

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[Near-invisible solar cells 10,000 times thinner than human hair turn sunlight to power](#)

Scientists in Singapore have developed ultrathin solar cells that could one day turn car windows, skyscraper glass, and even smart glasses into power-generating surfaces. Researchers at Nanyang Technological University created semi-transparent perovskite solar cells that measure roughly 10,000 times thinner than a human hair.

Despite their tiny size, the devices delivered some of the strongest efficiencies reported for ultrathin perovskite solar technology.



The findings highlight a growing push to turn everyday surfaces into clean energy sources. Researchers said the technology could eventually help buildings, vehicles, and wearable electronics generate electricity without major design changes. The work also points to a future where cities can produce more renewable energy without adding extra land or bulky rooftop infrastructure.

Solar hidden in glass

The research team, led by Annalisa Bruno, designed the solar cells to stay nearly invisible while still producing electricity. Because the cells remain semi-transparent and color-neutral, they could blend into office towers, windows, and glass façades more easily than conventional solar panels. That could make the technology more attractive for architects and developers looking to add renewable energy systems without changing a building's appearance.

The cells use perovskite, a material known for absorbing sunlight efficiently at lower production costs than silicon. Unlike traditional solar panels, the new devices can also generate electricity under indirect and diffuse light conditions. That makes them useful in dense cities where tall buildings often block direct sunlight.

Researchers said large office towers with glass exteriors could eventually offset part of their electricity demand using the technology. Early estimates suggest some buildings could generate hundreds of megawatt-hours of electricity each year if the solar cells scale successfully.

Vacuum-built ultrathin layers

To manufacture the cells, the team used thermal evaporation, an industrial process that heats materials inside a vacuum chamber until they vaporize and settle into thin films. The method allowed researchers to create highly uniform perovskite layers as thin as 10 nanometers. It also avoided toxic solvents commonly used in solar-cell manufacturing, which could simplify future large-scale production.

The scientists produced both opaque and semi-transparent versions by adjusting the thickness of the perovskite layer. Opaque models achieved efficiencies between 7 percent and 12 percent, depending on thickness. A semi-transparent version allowed 41 percent of visible light to pass through while converting sunlight into electricity.

Researchers said the results rank among the strongest reported performances for semi-transparent perovskite cells made with similar materials. Luke White, the study's first author, said the technology could support electricity-generating tinted windows and other forms of sustainable architecture.

Push toward commercial use

Independent experts said the manufacturing approach could help move [transparent](#) solar technology closer to large-scale production. Sam Stranks from the University of Cambridge said researchers still need to prove long-term durability and stability before commercial deployment becomes practical.

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This video shows what it would take for the United States to go 100% solar

The NTU team has filed a patent for the technology through NTUitive and is working with industry partners to refine the production process. Researchers now plan to improve durability and expand the technology to larger surfaces before bringing it to market. They believe the technology could eventually help transform windows, vehicles, and consumer electronics into quiet sources of renewable power.

The study is published in the journal [ACS Energy Letters](#).

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