

Spectrally Engineered Cooling Covers for Sustainable Energy and Water Management in Greenhouses

Tech ID: 34638 / UC Case 2026-371-0

ABSTRACT

Researchers at the University of California, Davis have developed a multilayer coating designed to increase photosynthetically active radiation transmission while reflecting near-infrared light to reduce heat in controlled agricultural environments.

FULL DESCRIPTION

This technology provides a greenhouse glazing structure with multiple alternating layers of zinc oxide, calcium fluoride, and silver, engineered to enhance the transmission of photosynthetically active radiation (PAR) beneficial for plant growth while reflecting near-infrared wavelengths (NIR) that generate excess heat. The multilayer coating reduces internal greenhouse temperature, minimizes cooling demands, and enhances water efficiency, particularly in arid climates. The coating is fabricated using scalable, low-cost thin-film deposition methods, optimized layer thicknesses, and optional adhesion and wetting layers to maintain durability and optical performance under humid agricultural conditions.

APPLICATIONS

- ▶ Greenhouse glazing panels for sustainable controlled-environment agriculture.
- ▶ Protective coatings for glass or polymer substrates in agricultural buildings.
- ▶ Agricultural produce facilities aiming to increase crop yield and reduce resource consumption.
- ▶ Commercial greenhouse operations in hot or arid climates with high cooling loads.
- ▶ Energy and water-efficient horticulture installations worldwide.

FEATURES/BENEFITS

- ▶ Maximizes crop growth efficiency by transmitting high levels of photosynthetically active radiation (PAR).
- ▶ Reflects substantial near-infrared radiation (NIR) to reduce unwanted greenhouse heat accumulation.
- ▶ Lowers energy and water consumption by minimizing cooling requirements.
- ▶ Maintains durability and humidity resistance in agricultural environments.
- ▶ Enables cost-effective, large-scale thin-film fabrication.
- ▶ Allows precise optical tuning through layer thickness adjustments without complex inverse design.
- ▶ Improves film clarity and conductivity using specialized wetting, adhesion, and annealing layers.

CONTACT

Andrew M. Van Court
amvancourt@ucdavis.edu
 tel: .



INVENTORS

- ▶ Ahamed, Md Shamim
- ▶ Thakur, Amrit K.

OTHER INFORMATION

KEYWORDS

agricultural system,
 calcium fluoride,
 controlled environment
 agriculture, greenhouse
 glazing, near-infrared
 reflection,
 photosynthetically active
 radiation, silver metallic
 layer, spectral selectivity,
 water conservation, zinc
 oxide

CATEGORIZED AS

- ▶ **Agriculture & Animal Science**
- ▶ Devices
- ▶ Plant Traits

- ▶ Prevents excessive heat build-up in greenhouses from near-infrared solar radiation.
- ▶ Reduces high energy and operational costs for greenhouse cooling.
- ▶ Reduces excessive water consumption in controlled agriculture due to evaporative cooling.
- ▶ Protects crops from yield loss caused by temperature stress and thermal damage.
- ▶ Prevents coating degradation from humidity and environmental exposure.
- ▶ Addresses complexity and cost barriers in manufacturing scalable, effective spectrally selective coatings.

▶ **Energy**

▶ Solar

▶ **Materials & Chemicals**

▶ Thin Films

RELATED CASES

2026-371-0

PATENT STATUS

Patent Pending

University of California, Davis

Technology Transfer Office

1 Shields Avenue, Mrak Hall 4th Floor,
Davis, CA 95616

Tel:

530.754.8649

techtransfer@ucdavis.edu

<https://research.ucdavis.edu/technology-transfer/>

Fax:

530.754.7620

© 2026, The Regents of the University of California

[Terms of use](#)

[Privacy Notice](#)