TECH OFFER

Passive Radiative Cooling Film for Heat Reduction

KEY INFORMATION

TECHNOLOGY CATEGORY:
Green Building - Façade & Envelope
Logistics - Transportation
Materials - Composites
Sustainability - Sustainable Living

TECHNOLOGY READINESS LEVEL (TRL): TRL8
COUNTRY: JAPAN
ID NUMBER: TO175501

OVERVIEW

With global warming intensifying, cooling demands for buildings, equipment, vehicles, and outdoor infrastructure are rising rapidly. Conventional cooling solutions—such as air conditioning, mechanical ventilation, and electrically powered thermal management—are energy-intensive and contribute significantly to operational costs and greenhouse gas emissions. As countries seek to reduce energy consumption while maintaining thermal comfort and system reliability, passive radiative cooling solutions are gaining traction to lower operational energy use while improving thermal stability in heat-exposed environments.

This technology is a film-based radiative cooling material with a reflective layer engineered for passive outdoor thermal management. Designed with high solar reflectivity and efficient thermal emission, the film incorporates silver within the reflective layer to maximise reflection of near-infrared solar radiation, thereby reducing heat absorption. At the same time, it enables effective radiation of infrared heat through the atmospheric window to the environment, allowing the applied surfaces to

remain cooler than the surrounding air even under direct sunlight. The combined effect is a reduction of temperature rise on applied surfaces, lowering heat stress for buildings, machinery, and cargo spaces. The film is applicable across different sectors, including the built environment, industrial facilities, logistics and transportation, and public infrastructure.

The technology owner is seeking co-development and pilot collaboration partners to conduct test-bedding and performance optimisation in tropical operating environments such as Singapore, supporting energy efficiency, heat resilience, and decarbonisation objectives across diverse sectors. Partners with film manufacturing capabilities are also welcomed for joint development and scale-up opportunities.

TECHNOLOGY FEATURES & SPECIFICATIONS

This technology is a polymeric passive radiative cooling film material designed for outdoor thermal management.

Key technical features include:

- Enhanced solar reflectivity through integration of silver within the reflective layer to maximise near-infrared solar reflection
- High solar heat reflectance, with measured solar heat reflection in the range of approximately 88–95%
- Designed for long-term outdoor use, with durability under continuous exposure to direct sunlight for up to 7 years through an internal evaluation method on accelerated weathering test.
- Substrate compatibility with common materials such as steel and resin-based surfaces
- Flexible supply formats, available in sheet or roll form with an adhesive layer for ease of installation, with options for basic surface customisation e.g., markings or text on the top layer

Performance validation:The film has been evaluated through pilot deployments in Japan. When applied to the external façade of a residential building, the film demonstrated surface temperature reductions of up to 25°C under summer conditions, alongside energy savings of up to 40%. In a separate pilot involving application on a refrigerated truck, the film achieved approximately 20% reduction in fuel consumption over a two-month summer period compared to the previous year.

POTENTIAL APPLICATIONS

The radiative cooling film can be applied across a wide range of heat-exposed surfaces and assets where passive temperature reduction can improve energy efficiency, operational reliability, and user comfort.

Potential applications of the film include (but not limited to):

- Built environment e.g., roofs, façades, and external walls of buildings
- Logistics, transportation and storage e.g., shipping containers, reefer trucks, storage facilities for temperature-sensitive goods
- Public infrastructure and urban assets e.g., outdoor public facilities and urban installations

UNIQUE VALUE PROPOSITION

- Energy-free heat mitigation – provides passive cooling without electricity or active systems, helping to reduce energy consumption, operating costs, and carbon emissions in heat-exposed environments.
- Simple retrofit for existing assets – film-based form factor enables easy integration onto existing buildings, equipment,

and infrastructure without major redesign or disruption.

- Designed for outdoor and tropical conditions – Engineered for continuous exposure to direct sunlight, supporting improved thermal stability and asset protection in hot and humid climates such as Singapore.