

**TECH OFFER**

## Sustainable Passive Radiative Cooling Paint for Sub-Ambient Cooling



### KEY INFORMATION

TECHNOLOGY CATEGORY:

**Green Building** - Heating, Ventilation & Air-conditioning

**Chemicals** - Coatings & Paints

**Sustainability** - Sustainable Living

**Waste Management & Recycling** - Industrial Waste Management

TECHNOLOGY READINESS LEVEL (TRL): **TRL9**

COUNTRY: **SINGAPORE**

ID NUMBER: **TO175186**

### OVERVIEW

As global temperatures rise, the increasing demand for cooling has become a critical challenge, particularly in tropical regions. Conventional cooling methods, such as air-conditioning and mechanical ventilation systems, consume significant amounts of electricity and release greenhouse gases, exacerbating global warming. Radiative cooling offers a promising zero-energy alternative by utilizing selective emission of thermal radiation (infrared) to dissipate heat into outer space, effectively lowering the temperature of terrestrial surfaces without heavily relying on air conditioning.

The technology offer is a high-performance passive radiative cooling paint (PRCP) with nanoparticles dispersed in a polymeric matrix. Unlike conventional paints, this innovative cooling paint combines high solar reflectivity with high thermal emissivity, reducing surface temperatures below ambient (i.e. below surrounding air temperature). It can reflect incoming solar radiation

while simultaneously emit thermal radiation, achieving effective cooling even under direct sunlight. The paint can be applied to buildings and any sky-facing objects to reduce surface temperatures and thereby lower energy consumption and the demand for air-conditioning. When adopted on a large scale, it helps mitigate the urban heat island effect by significantly reducing pedestrian-level air temperatures, improving thermal comfort. In Singapore's challenging hot and humid climate, this cooling paint has demonstrated the ability to reduce surface temperatures by up to 3°C below ambient, providing a proven zero-energy cooling solution.

The technology owner is seeking R&D collaboration and test-bedding opportunities with real estate and building owners, developers, architects, facility owners, industrial plant operators, building designers and contractors, and cold chain logistic providers. The technology is also available for licensing to paint developers and manufacturers.

## TECHNOLOGY FEATURES & SPECIFICATIONS

The innovative technology combines principles from physics and materials science to optimize heat transfer, effectively lowering surface temperatures. Key advantages include:

- **High reflectance:** solar reflectivity exceeds 95% in the solar spectrum
- **High infrared emittance:** emissivity exceeds 95% in the atmospheric window of 8-13  $\mu\text{m}$  where thermal radiation can be emitted to the outer space without being absorbed
- **Energy savings:** lowers surface/façade temperatures, reducing indoor cooling requirements and energy demand for air conditioning
- **Improved thermal comfort:** lowers surrounding outdoor air temperatures, mitigating the urban heat island effect
- **Enhanced performance:** offers self-cleaning properties and high durability for long-term effectiveness
- **Versatility:** can be easily applied to different forms of building surfaces
- **Sustainability:** coatings can be made from recycled materials, promoting eco-friendliness

## POTENTIAL APPLICATIONS

Potential applications of this radiative cooling technology include, but are not limited to:

- **Building exteriors:** roof tops, exterior walls, etc.
- **Windows and façade:** in the form of film
- **Industrial facilities:** containers, tanks, piping, etc.
- **Supply chain systems:** cold-chain transportation, outdoor storage system, etc.
- **Other infrastructures in hot climates:** roads, pavements, etc.

## UNIQUE VALUE PROPOSITION

The innovative technology goes beyond the current "State-of-the-Art" with its exceptional reflectance and emittance characteristics, providing superior cooling power for various applications.

- Superior cooling performance for a variety of surface types
- Outperforms commercially available cooling paints by lowering surface temperatures
- Processes self-cleaning properties, ensuring long-lasting performance
- Effective even in harsh tropical climates with high solar irradiance and humidity

- Can be fabricated using recycled materials, offering due benefits:
  - Reduces reliance on virgin plastic feedstocks
  - Upcycles polymer waste for higher-value applications