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Enhanced Thermal Insulation with Colorful Low-Emissivity Paints: A Game-Changing Solution for Energy Efficiency

This technology is a category of colorful low-emissivity paints that form bilayer coatings, designed to enhance thermal insulation. Maintaining optimal thermal environments poses significant challenges for human comfort, energy efficiency, and sustainability. The excessive energy consumption and greenhouse gas emissions associated with regulating temperatures in buildings, transportation, and storage require novel solutions. Conventional approaches often trade aesthetics for enhanced thermal insulation, limiting their widespread adoption.

To address these challenges, a breakthrough solution has been developed by Stanford researchers in the form of colorful low-emissivity paints. These paints consist of bilayer coatings with high mid-infrared reflectance (up to 80%), enabling efficient reduction of both heat gain and heat loss through thermal radiation. The unique properties of these coatings provide enhanced thermal insulation while preserving the desired visual appearance comparable to conventional paints. They can be applied to various surfaces, including building envelopes, cargo containers for cold-chain transportation, and storage rooms, allowing for versatile and widespread use. With impressive hydrophobicity, environmental durability, and easy cleaning features, these coatings offer practical and sustainable solutions for achieving optimal thermal insulation without compromising aesthetics.

Applications

- Commercial paint products
- Building Envelopes

- Transportation
- Storage Facilities
- Automotive Industry
- Electronics and Electrical Devices
- Energy-Saving Initiatives

Advantages

- Lightweight and Space-Saving
- Aesthetic Appeal
- Versatile Application
- High Mid-Infrared (MIR) Reflectance: reflectance of up to approximately 80%, enabling efficient reduction of both heat gain and heat loss through thermal radiation.
- Hydrophobicity and Environmental Durability
- Wide Range of Applications
- Sustainable Solution

Publications

- Peng, Y., Lai, J., Xiao, X., et al. Colorful low-emissivity paints for space heating and cooling energy savings. *PNAS* (2023).
- Golden, Mark. New paint gives extra insulation, saving on energy, costs, and carbon emissions. *Stanford News* (2023).

Patents

- Published Application: 20230416537

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