A sustainable and scalable bioinspired material with tunable heat-managing properties

Tech ID: 33157 / UC Case 2022-938-0

BRIEF DESCRIPTION

Researchers at UC Irvine have developed a sustainable and low-cost insulation material with the ability to dynamically manage heat exchange. This technology circumvents the limitations of previous thermal management systems by offering low-cost manufacturing, straightforward implementation, energy efficiency, and control of heat exchange.

SUGGESTED USES

·Food packaging

·Wearables

·Clinical warming devices

·Shipping

·Conformable electronic skin

FEATURES/BENEFITS

·Potential to shift modern energy consumption paradigms

·Low-cost: ~$0.1 USD per square meter

·Size: ~0.35m2 (comparable to common metallized plastic films)

·Tunable: can modulate infrared light transmittance >20-fold and heat fluxes by >30 W/m2 upon actuation with mechanical strain

· Advantages: combines the benefits of “passive” insulation (low-cost, easy implementation, energy efficient) with tunability of “active” insulation

TECHNOLOGY DESCRIPTION

Managing heat transfer is required for many technologies including electronic circuits, aircraft components, clinical warming devices, and building environmental control systems. Building operation accounts for ~40% of the global energy consumption, with heating and colling alone requiring ~36% of this amount. One solution to reducing this type of energy consumption is to develop a thermal management system that can be worn by users. This was somewhat accomplished by NASA in the 1960s with the invention of the space blanket, which consists of a plastic sheet overlaid with a thin continuous layer of metal that was effective at mitigating temperature fluctuations in space. Since its invention, this technology has been extended to various industries such as a packaging, emergency portable shelters, clinical warming devices, and protective or performance apparel. However, one key limitation of the “space blanket” material is its ability to be tuned.

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

» **Environment**
» Other
» **Materials & Chemicals**
» Storage
» Textiles
» **Medical**
» Devices

RELATED CASES

2022-938-0

Researchers at UC Irvine have developed a novel material inspired both by NASA's space blanket and squid skin. The material contains a soft and stretchable transparent layer with an overlayed array of light-reflecting metal domains, allowing for tunable thermoregulation via physical deformation. The material is low-cost (~ $0.1 USD per square meter) and can maintain temperatures between 14.5°C- 22.7°C depending on the degree of stretching, which is among the largest reported setpoint temperature window for any comparable passive material. This technology may have numerous applications in a variety of industries including food packaging, wearables, clinical warming devices, shipping, and conformable electronic skin. Overall, it combines the advantages of "passive" thermoregulation (low-cost, easy to implement, and energy efficient) and "active" thermoregulation (tunability) into one material, offering the potential to transform modern energy consumption paradigms.

STATE OF DEVELOPMENT

Working prototype

RELATED MATERIALS

» A dynamic thermoregulatory material inspired by squid skin Erica M. Leung, Melvin Colorado Escobar, George T. Stiubianu, Steven R. Jim, Alexandra L. Vyatskikh, Zhijing Feng, Nicholas Garner, Priyam Patel, Kyle L. Naughton, Maurizio Follador, Emil Karshalev, Matthew D. Trexler & Alon A. Gorodetsky Nature Communications volume 10, Article number: 1947 (2019) - 04/29/2019

PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	WO 2023/168460	09/07/2023	2022-938

Additional Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Material For Thermal Regulation
- Cephalopod-Inspired Adaptive Infrared Camouflage Materials and Systems

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