



TECHNOLOGY SOLUTION

Materials and Coatings



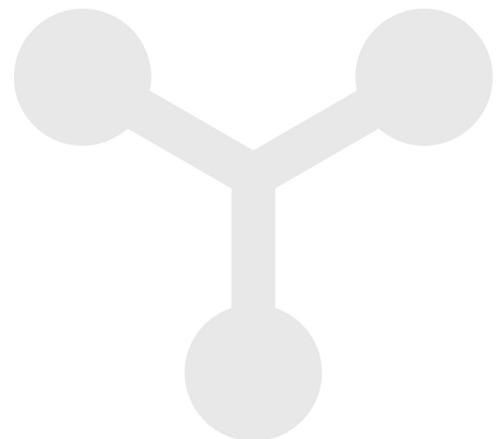
Adaptive Thermal Management System

A unique way to autonomously regulate the temperature of a structure or vessel

NASA Kennedy Space Center seeks partners interested in the commercial application of the Adaptive Thermal Management System (ATMS). Developed at the John F. Kennedy Space Center, the ATMS provides a way to regulate heat transfer and enable thermal management between two opposing surfaces in either direction. The system has the capability to adapt to provide conductive or insulative functionality depending on environmental conditions or applied stimuli. The ATMS can be designed for use in manufacturing, storage vessels, fluid transfer, aerospace and building architectures, and many other applications to reduce unwanted heat transfer, lower energy usage, or maintain environments at a specific temperature. The ATMS is part of NASA's technology transfer program, which seeks to promote the commercial use of NASA-developed technologies.

BENEFITS

- The system can be applied to broad planar areas for controlling heat transfer between two materials. It enables thermal conduction to provide heat dissipation to adjacent spaces.
- ATMS has the capability of switching functionality between conductive and insulative
- Passive system with no external activation required the system automatically reacts to environmental conditions
- Can be embedded into the designs of new systems or added to existing systems
- Flexibility in architectural design could allow for operation in a broad temperature range (from -150 C to 180 C)
- Energy Savings Since no mechanical or electrical activation is required, the system can autonomously regulate the temperature of a structure or vessel.



THE TECHNOLOGY

Efficient thermal management has long been an issue in both commercial systems and in the extreme environments of space. In space exploration and habitation, significant challenges are experienced in providing fluid support systems such as cryogenic storage, life support, and habitats; or thermal control systems for launch vehicle protection, environmental heat management, or electronic instruments. Furthermore, these systems operate in dynamic, transient modes and often under extremes of temperature or pressure. The current technical requirements associated with the thermal management of these systems result in control issues as well as significant life-cycle costs.

To combat these issues, the Adaptive Thermal Management System (ATMS) was developed to help provide the capability for tanks, structural walls, or composite substrate materials to switch functionality (conductive or insulative) depending on environmental conditions or applied stimuli. As a result, the ATMS provides the ability to adapt between both heating and cooling modes within a single system. For example, shape memory alloy (SMA) elements are used to actuate at certain design temperatures to create a conductive bridge between two metal plates allowing broad-area heat rejection from the hotter surface. Upon cooling to the lower design set-point, the SMA elements return to their original shapes, thereby breaking the conductive path and returning the system to its overall insulative state.

This technology has the potential to be applied to any system that would have the need for a self-regulating thermal management system that allows for heat transfer from one side to another.

APPLICATIONS

The technology has several potential applications:

- Manufacturing Process Equipment
- Storage Vessels & Fluid Transfer
- Architecture/Housing and Habitats
- Commercial Building Envelopes
- Refrigerated Transport
- Aerospace Launch Vehicles and Tank Walls
- Power Plant Vessels
- Medical Imaging Equipment
- Airframes and Aircraft Integrated Structures
- Computers and Data Server Farms

PUBLICATIONS

Patent No: 9,982,661

National Aeronautics and Space Administration

Agency Licensing Concierge

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