

TECH OFFER

Innovative Heat Sink / Heat Storage Component Made of Aluminum Foam and Phase Change Material (PCM)



KEY INFORMATION

TECHNOLOGY CATEGORY:

Energy - Thermal Power System

Materials - Composites

TECHNOLOGY READINESS LEVEL (TRL): **TRL4**

COUNTRY: **SLOVAKIA**

ID NUMBER: **TO175001**

OVERVIEW

The continuous growth of the demand for primary energy, predominantly derived from fossil sources, is causing severe environmental problems. However, over two-thirds of this energy is immediately dissipated as waste heat, released into the environment without any utilisation, such as during electricity production, combustion engines, and metallurgy. Paradoxically, instead of harnessing such excess heat, additional primary energy sources are used for heating purposes in buildings. Furthermore, the waste heat might pose a high risk of overheating, resulting in frequent failure of high-powered electrical and electronic devices.

This technology addresses the issue by capturing and storing the heat in a special heat sink or battery. The stored energy can be easily transported (by land transport without pipelines) and utilised at specific locations when required. The waste heat with lower temperature can be re-used, leading to substantial savings in primary energy. When integrated into the packaging of heat-generating devices (e.g., battery chargers, power electronics, etc.), excess heat is efficiently absorbed without a significant

increase in device temperature. The absorbed heat is gradually emitted into the surroundings as the device's power diminishes. Charging the package with heat can maintain the optimal working temperature during cold season, enhancing the overall performance.

The ideal collaboration partners include manufacturers of thermal batteries, heating or cooling systems, and components that generate high levels of heat, such as chargers and electronic devices. Potential partners also encompass companies involved in the production of waste heat, seeking viable alternatives to supply to suitable customers.

TECHNOLOGY FEATURES & SPECIFICATIONS

This innovative technology combines phase change material (PCM) and aluminium foam to enable efficient absorption and radiation of significant amounts of thermal energy while minimising the temperature change. The reversible process involves absorbing heat to melt the PCM and radiating the heat as the PCM solidifies. The technology exhibits the following features:

- The exchange of latent heat occurs within a narrow temperature interval (+/- 2°C)
- Aluminium foam constitutes only about 20% of the total volume, with the remaining 80% filled by PCM
- Aluminium foam serves a dual purpose by acting as a heat distributor for effective thermal transfer and providing mechanical properties for the component
- Existing PCMs compatible with aluminium foam exhibit a latent heat of 250 kJ/kg and have an adjustable phase change temperature ranging from -10°C to 70°C
- The component can be fabricated in any desired shape and size
- It can directly act as device cases or covers to absorb excess heat or maintain stable operating temperatures
- It can function as a charging module for thermal batteries or a heating/cooling panel for room temperature control

POTENTIAL APPLICATIONS

The technology can be applied wherever efficient heat management is needed. Possible applications include (but are not limited to):

- Packaging for power electronic components, superchargers, and LED screens
- Machine housings (compressors, reactors, engines, etc.)
- Housings for braking systems
- Packaging for batteries, fuel cells, hydrogen storage materials, etc.
- Packaging for temperature-sensitive foods such as chocolate, biological tissues, chemicals, measuring instruments
- Room heating and cooling systems
- Heating packs for heat exchangers
- Electric vehicles (EV) body structures (independent heating and AC)
- Outdoor cooling or heating for beverages and food

UNIQUE VALUE PROPOSITION

- Smart material combination of PCM and Al foam
- Rapid heat transfer with a thermal conductivity of 10 W/mK
- High porosity and low density (about 1 kg per litre)
- Excellent mechanical properties

- Non-toxic and recyclable