Phase Change Material (PCM) Heatsinks

KULR™
Carbon Fiber Cooling

About KULR

KULR Technology has over 20 years of experience in the high-performance aerospace industry having won over 500 contracts with NASA, Raytheon, Boeing and JPL. KULR's carbon fiber based thermal management solutions have been utilized in the International Space Station, Mars Rover, and Mercury Messenger.

Product Highlight

KULR's proprietary carbon fiber based PCM Heatsinks utilizes the latent heat of a working fluid's phase transition(s) to absorb or provide heat. Sometimes regarded as a "Thermal Capacitor"

Key Features

- Benign PCMs are non-toxic and stable under cycling
- Finely-dispersed conductor in core allows fast heat transfer at reduced gradients
- Main core architecture is strong and CTE-matched to aluminum housings to provide structural support to light-weight enclosures
- Fine-pore carbon fiber core controls PCM distribution, reducing phase-change stresses, allowing thin enclosures and long life.
- Commonly achieve PCM volume fractions above 80%

Benefits

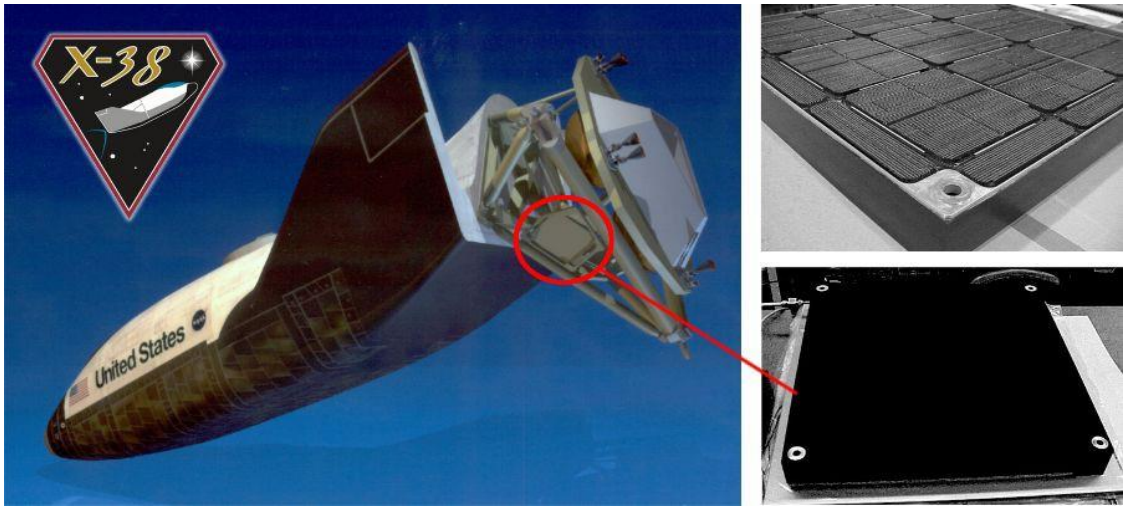
- Reduces system temperature excursions, extending life of key components
- Saves weight/volume by reducing or even eliminating the need for active cooling
- Lengthens system operating times
- Much lighter and more compact than solid metal for providing thermal capacity

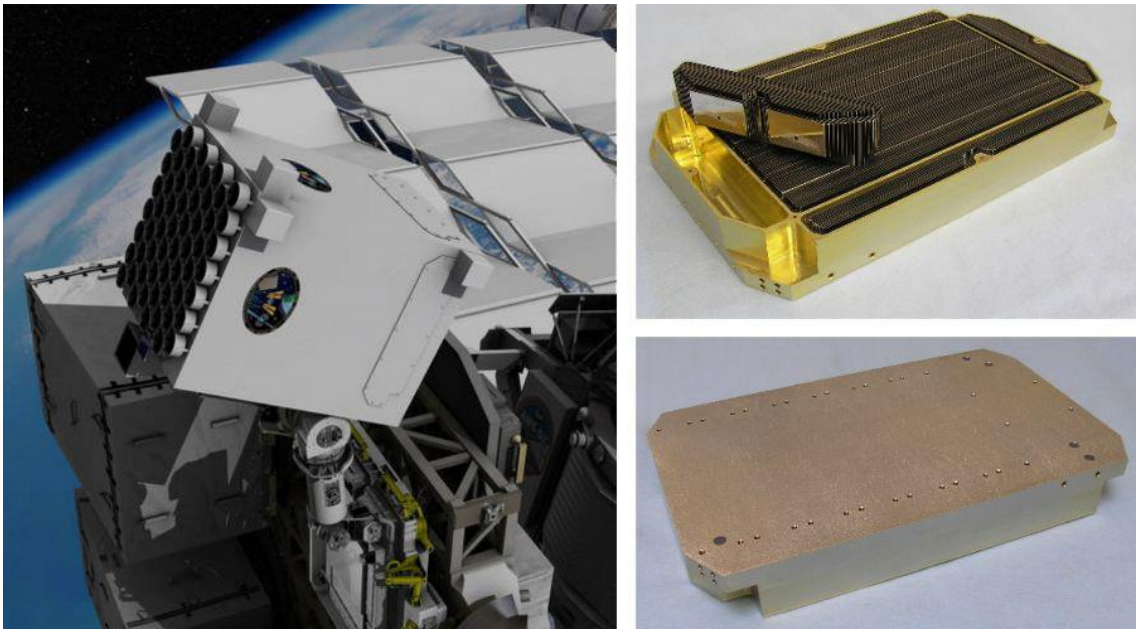
E-mail: contact@kulrtechnology.com Phone: +1 408-675-7002 x 101

Applications

- Missiles; other systems with “buried” components
- Processor with variable workcycle
- Satellite with intermittent operation or where radiator faces occasional hot attitudes
- Image acquisition where pumped cooling causes jitter
- Electric vehicle where temperature extremes need to be moderated
- Lasers requiring tight temperature control

PCM Battery Module Base for De-propulsion Stage NASA X-38 Crew Return Vehicle
3.6 MJ (1 kWhr) Latent Heat Capacity Combined Thermal-Structural Component





PCM Avionics and Instrument Decks provided heat to keep
NICER Instrument warm during transfer to location of operation

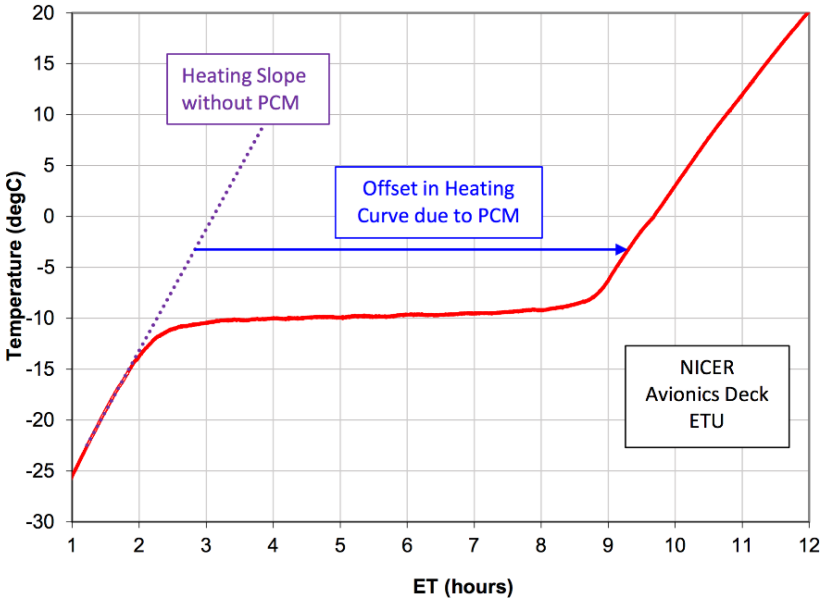
E-mail: contact@kulrtechnology.com Phone: +1 408-675-7002 x 101

More Info

Please call or email us with details about your thermal management needs and we can start the process of customizing the best solution according to your product specifications

Characteristics

Typical Heating Curve for PCM Heatsink (MP= - 10°C)



PCM Heatsink Characteristic	Demonstrated Capability
PCM Charge Mass	300 mg to 14.5 kg
Latent Heat Capacity (1)	75 Joules to 3.6 MJ
Melting Point Range	-50°C to 76°C (2)
Core Conductivity	As high as 230 W/m-K
Temperature Capability	-130°C to +130°C (3)
PCM Mass Fraction (4)	As high as 70%
PCM Volume Fraction (4)	As high as 84%
Environmental Pressure Range	1 atm to hard vacuum (5)
Lifetime in Space	11 years demonstrated
Cycle Life	3000 tested w/o failure; expectation is much longer
Toxicity	Our primary PCMs of choice are non-toxic and non-corrosive

(1) Demonstrated range – there is no fundamental limit to size.
(2) KULR has some experience with PCM melting at 845°C and near -70°C.
(3) This range can be extended in both directions to meet application needs.
(4) In a helium-tight hermetic enclosure – polymer enclosures under development will extend this value
(5) 10^{-8} Torr in the laboratory; UHV during interplanetary travel

E-mail: contact@kulrtechnology.com Phone: +1 408-675-7002 x 101