



Thermal Management



ERG
materials & aerospace



High Surface Area to Volume Ratio

The surface area of a 65" TV screen fits within the volume of a 2" cube of Duocel® foam



High Structural Integrity

Solid ligaments make Duocel® superior to sintered or printed structures



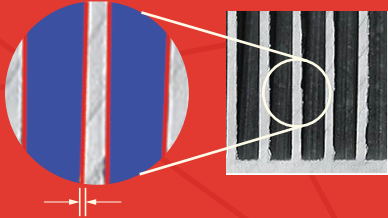
Open Celled

Fluids can easily flow through the entire structure of Duocel®



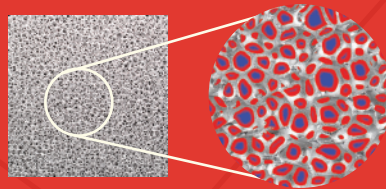
Lightweight

The low density of Duocel® makes it a lighter substitute for established applications



Initial penetration of heat into PCM is shallow due to PCM wax's poor thermal conductivity

Metal foam's high surface area allows for greater transfer of heat into the PCM



Phase Change Material (PCM)

The waxes used in PCMs tend to have low thermal conductivity, so PCMs rely on fins to distribute heat throughout the material.

Metal foam has a smaller gap between ligaments than machined fins, allowing for more complete transfer of heat from the source to the PCM wax.

Two-Phase Cooling

Metal foam's high surface area creates increased nucleation sites. These enhance boiling and reduce thermal resistance.

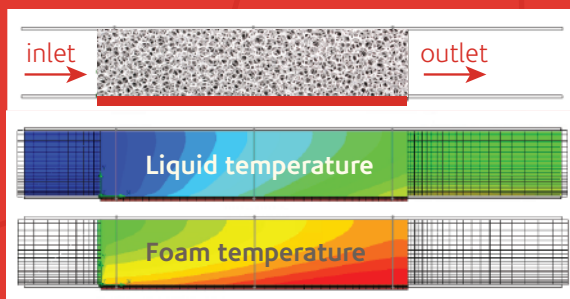
Metal foam enhances mixing, which delays dryout and extends the critical heat flux limit, allowing for much higher heat fluxes than microchannel designs.



Saturated liquid in

Heat in

Liquid + vapor mixture out



Liquid Cooling

Metal foam increases the heat transfer coefficient by enhancing mixing and restarting the boundary layer.

Manufacturing Advantage

Duocel® is great for compact, low-weight systems and conformal form factors.

Duocel® foam can be machined, plated, anodized, brazed, and soldered.



More About Duocel®

Duocel® is an open-celled rigid foam with solid ligaments and customized properties.

Base material

controls conductivity & compatibility



Aluminum



Copper



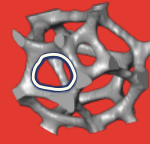
Carbon



Silicon Carbide

Pore Size

controls surface area & pressure drop



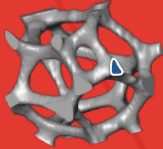
100 PPI
(~0.01")



5 PPI
(~0.20")

Ligament cross-section

controls material volume fraction, conduction area, surface area & strength



3%



6-8%



10-12%

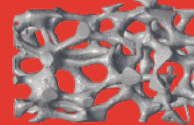


15%

Relative Density

Compression

controls conduction area, surface area & pressure drop

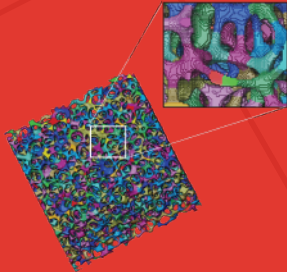


Uncompressed



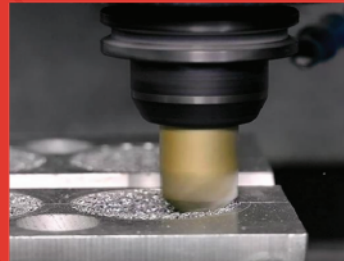
Compressed

Manufacturing Advantage



Better strength and conductivity

Unlike metal foam produced through other methods, Duocel® ligaments have fully developed grain boundaries.



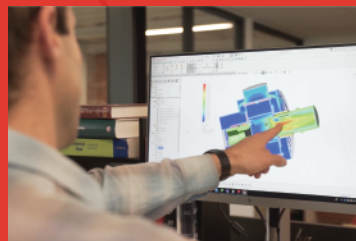
Flexible fabrication

Duocel® metal foam can be machined, formed, brazed, soldered, anodized, and coated.

ERG Engineering

With over 50 years of expertise designing and manufacturing foam components, we tailor Duocel® to get the most out of your project.

- 3D CAD
- CT Image Processing
- Correlation and Optimization
- Conjugate CFD
- Structural FEA



- Compressive and tensile testing
- Shock and random vibration
- Proof and burst pressure
- Thermal cycling
- microCT scanning
- Single phase and two-phase pressure drop
- Single phase and two-phase heat transfer



Flight Proven

ERG Aerospace has produced Duocel® foam components for thousands of projects, from heat exchangers on the ESA ExoMars lander to carbon foam for bone regeneration therapy research.

- UTC Supplier Gold
- 2019 Pratt & Whitney Most Innovative Supplier
- 2018 IHI Supplier of the Year
- 2017 Pratt & Whitney Service-Disabled Veteran Owned Supplier of the Year

