CARBON COMPOSITES INC.

"Innovations in Carbon"

Composite Sandwich Pack Insulation

Multiple layers of graphite foil sandwiched between semi-rigidized felt layers create an effective barrier to convection, making CSP an excellent material in HIP furnaces or applications where process gas infiltration of the heat pack is problematic. CSP is suitable in most high temperature applications operating up to 2,800°C (5,072°F) in an inert or vacuum environment.

CONSTRUCTION: The system uses inner and outer carbon/carbon composite shells to protect an insulation core; which is comprised of multiple layers of semi-rigidized carbon felt and foil. Optionally, foil may be bonded to C/C faces to reduce the hot face emissivity.

SIZES: CSP is produced exclusively as a cylinder. They are fabricated to customer specified sizes and are available as large as 70" in diameter and 140" in length (1780mm OD x 3560mm long).

MATERIAL ATTRIBUTES:

- Excellent Thermal Uniformity: Multiple foil layers conduct heat axially within the hot zone, reducing "hot spots" and improving process control. Foil layers also act as a diffusion barrier.
- Erosion Resistance: C/C exterior provides a robust barrier; protecting the insulating core from damage by dropped parts, melt splatter, or high velocity particle abrasion.
- Dimensional Stability: Solid C/C composite construction will not bow, warp, or crack as a result of thermal shock or cycling.
- Machinability: CSP is readily machinable using conventional methods such as cutting, drilling, sawing, and milling.
- Low Specific Heat: Allows for rapid furnace cycling and improved throughput.
- Purity: Halogen and Vacuum purification available for Semiconductor related applications.

Typical Properties	SI Units		English Units	
Density (see note)	.20	g/cm³	12.5	lb/ft³
Thermal Conductivity (Argon) 1,000°C (1,832°F) (⊥) 2,000°C (3,632°F) (⊥)	 0.47 0.88	 W/mK W/mK	 3.26 6.11	 BTU in/hr ft² BTU in/hr ft²
Thermal Conductivity (Vacuum) 1,000°C (1,832°F) (⊥) 2,000°C (3,632°F) (⊥)	 0.33 0.67	 W/mK W/mK	 2.29 4.65	 BTU in/hr ft² BTU in/hr ft²
CTE: 20 – 1,000°C (//) (68 – 1,832°F) (//)	2.5 x 10^{-6}	1/K	1.4 x 10^{-6}	1/°F
Flexural Strength (⊥)	3.5	MPa	500	psi

Note: C/C shell not included in measured density

Material Grade	Total Ash	Sulfur Content	Total Elemental Impurities	Processing Temp
CSP-230	≤ 0.1%	300 ppm	500 - 1,000 ppm	1,900°C
CSP-230H	≤ 0.01%	25 ppm	≤ 150 ppm	1,900°C
CSP-230HP	N/A	5 ppm	≤ 20 ppm	2,100°C w/ Halogen

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