TYPICAL PROPERTIES

VESPEL® CP-9800 SERIES END EFFECTORS

Vespel® CP-9800 is a clean, stiff, light-weight new end effector material. Custom parts made from this pitch-based carbon fiber and epoxy composite are designed specifically for the function required in the application. CP-9800 raw material is produced in a sheet form with a maximum area of 1x2m and a thickness of 2-20mm.

This composite is ideally suited for flat panel display and wafer handling applications. When compared to traditional ceramic and aluminum end effectors, CP-9800 is lighter weight, more durable, and deflects less under equivalent load. These properties make Vespel® CP-9800 the ideal choice for your next robotic end effector application.

CP-9800 SERIES PERFORMANCE COMPARISON – END EFFECTORS

PERFORMANCE/MATERIALS	ALUMINUM (Al)	CERAMIC ALUMINA (AL_2O_3)	CP-9800 ULTRA-HIGH MODULUS END EFFECTORS
DENSITY			
g/cm³	2.70	4.00	1.70
lb/ft³	169	250	106
FLEXURAL MODULUS			
GPa	72	400	300
psi	10 x 10^6	58 x 10^6	44 x 10^6
FINGER THICKNESS			
mm	3	3	3
inch	0.12	0.12	0.12
FINGER WEIGHT			
kg	0.81	1.20	0.50
lb	1.79	2.65	1.10
DEFLECTION			
SELF WEIGHT mm (inch)	6.01 (.24)	1.60 (.06)	0.83 (.03)
LOADING mm (inch)	1.48 (.06)	0.30 (.01)	0.30 (.01)
TOTAL mm (inch)	7.49 (.29)	1.90 (.07)	1.13 (.04)

CHOICE OF RIGIDITY	MODULUS	
TYPE	SI UNITS	ENGLISH UNITS
LOW MODULUS	160 GPa	23 x 10^6 psi
MEDIUM MODULUS	200 GPa	29 x 10^6 psi
HIGH MODULUS	250 GPa	36 x 10^6 psi
ULTRA HIGH MODULUS	320 GPa	46 x 10^6 psi

CHOICE OF RESIN	APPLICATION TEMPERATURE	
TYPE	SI UNITS	ENGLISH UNITS
REGULAR	80°C	176°F
HEAT-RESISTANCE–A	150°C	302°F
HEAT-RESISTANCE–B	200°C	392°F
HEAT-RESISTANCE–C	230°C	446°F

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OUTGASSING OF CP-9800 SERIES IN A VACUUM

SAMPLE	PROPERTIES	SI UNITS	ENGLISH UNITS
CP-9800	Flexural modulus Heat-resistance temperature	300 GPa 230˚C	44 x 10^6 psi 446˚F

MEASUREMENTS

1) Outgassing measurements by NASDA (The National Space Development Agency of Japan).
2) Temperature programmed desorption gas analysis.

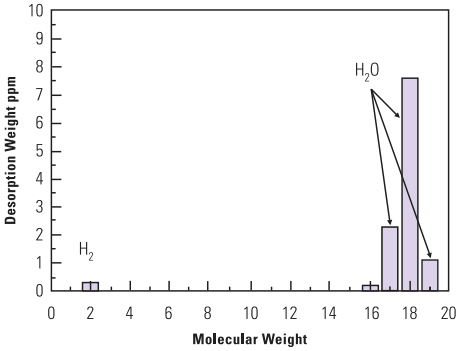
RESULTS

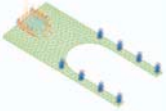
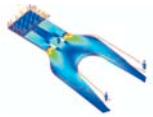
1) Outgassing measurements by NASDA:
This test is normally conducted to check the materials used for the satellites parts, especially when the outgassing is critical for the system.

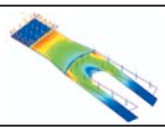
SAMPLE	PROPERTIES	SI UNITS	ENGLISH UNITS
TEST CONDITION – ASTM E595-93	Vacuum Temperature Collector plate Sample weight	7.0 x 10^{-3} Pa 125˚C 25˚C 0.25g	10^{-3} psi 257˚F 77˚F 5.5 x 10^{-4} lbs.
RESULTS	TML (Total Mass Loss) CVCM (Collected Volatile Condensable Material)	0.329% 0.002%	0.329% 0.002%
REMARKS	• Both values cleared the recommendation of NASA (TML<1%, CVCM<0.1%) for the use of satellite parts.		

2) Temperature programmed desorption gas analysis CP-9800 series:
Heat the sample from room temperature up to 250˚C (482˚F), and analyze the desorption gas by mass spectrometer.

SAMPLE	PROPERTIES	SI UNITS	ENGLISH UNITS
TEST CONDITION – TDS-M202P (ULVAC)	Temperature Ramp rate Sample weight Vacuum	Room temp-250˚C 10˚C/min. 1.0 g 10^{-5} Pa	Room temp-482˚F 10˚F 0.0022 lbs. 1.45 x 10^{-8} psi
RESULTS	The figure below shows the results of the desorption gas analysis. The main gas was identified as H_2O, and the small amount of H_2 was observed.		
REMARKS	• Although the maximum measurement temperature 250˚C (482˚F) was higher than the heat resistant temperature of CP-9800, 230˚C (446˚F), no degradation of the resin was observed.		



LCD HANDLING		CASE 1	CASE 2
MODELING			
DATA INPUT			
SIMULATION			
HAND WEIGHT kg (lbs.)		1.2 (2.65)	2.9 (6.39)
DEFLECTION mm (in.)	SELF WEIGHT	0.62 (0.0244)	0.48 (0.0189)
	LOADING BY PLATE GLASS	1.22 (0.048)	0.80 (0.0315)
	TOTAL	1.84 (0.0724)	1.28 (0.050)

WAFER HANDLING		CASE 1	CASE 2
MODELING			
DATA INPUT			
SIMULATION			
FINGER WEIGHT kg (lbs.)		0.28 (0.617)	0.24 (0.53)
DEFLECTION mm (in.)	SELF WEIGHT	0.24 (0.0094)	0.19 (0.00748)
	LOADING BY 12 IN. WAFER	0.22 (0.00866)	0.47 (0.0185)
	TOTAL	0.46 (0.01811)	0.66 (0.026)

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