SILICONE ADHESIVES FOR OUTER SPACE APPLICATIONS

Special silicones designed for outer space applications ensure that satellites are robust in service, with reliable and durable components to help improve security of data transmission and communications.

For the Toughest Demands

Materials used in satellites must permanently withstand the harsh conditions in outer space such as very low pressures, ionizing radiation, and extreme temperature changes.
WACKER, in close collaboration with major aerospace companies, has developed a range of products specifically designed for use in the construction of satellites. These products feature high radiation resistance, retain their full elasticity until glass transition and can dissipate thermo-mechanical stresses. They comply with European Space Agency (ESA) standards regarding material properties, processing and durability for solar panels and other satellite components.

WACKER® RTV-S 691

- Self-leveling two-part, addition-curing silicone rubber
- Used to laminate the solar-cell arrays, i.e. fix them onto the polyimide film that covers the honeycomb support structure
- Approved for aerospace applications by the European Space Research and Technology Centre (ESTEC)
- Listed by ECSS-Q70-71A rev1 (2004)

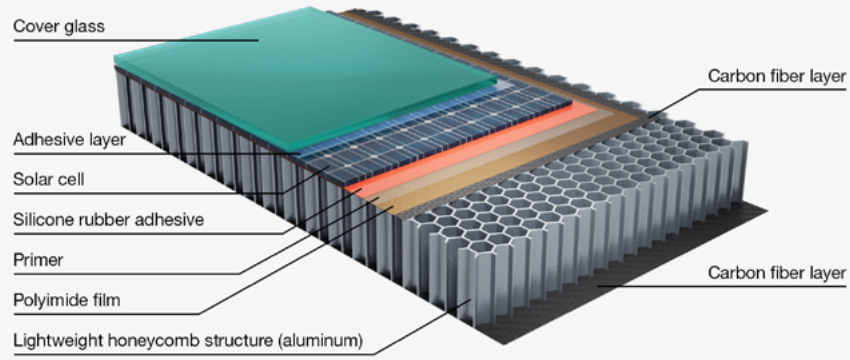
Properties of the cured material:

- Long-term radiation resistance
- Glass transition temperature: < –100 °C / –148 °F
- Particularly low volatile content

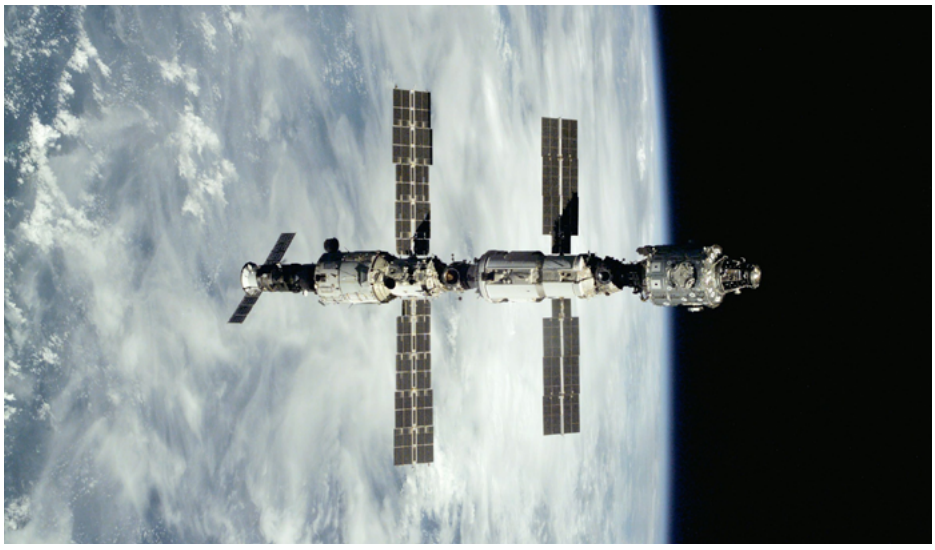
Benefits:

- Minimal outgassing rate, which avoids delamination under the low-pressure conditions in outer space (proven according to specification ECSS-Q-70-02A, which corresponds to former ESA PSS-01-701)
- Flexible at low-temperature and full elasticity until glass transition temperature

Sandwich Structure of a Solar Panel for Satellites



WACKER® RTV-S 691 can be applied by any conventional coating method such as dispensing, knife coating, transfer roller coating, screen printing, etc.



ELASTOSIL® S 692

- Self-leveling two-part addition-curing silicone rubber
- Antistatic glue for satellite components
- Suitable for grounding assemblies
- Approved for space applications acc. to specification ESA ECSS-Q-70-01A

Properties of the cured material:

- Slightly electrically conductive, thus reduced volume resistivity
- Long-term radiation and heat resistance
- Glass-transition temperature: < –100 °C / –148 °F
- Particularly low volatile content

Benefits:

- Minimal outgassing rate so as to avoid delamination under the low-pressure conditions in outer space (proven according to specification ECSS-Q-70-02A, which corresponds to former ESA PSS-01-701)
- Flexible at low temperature and retain full elasticity until glass-transition
- Prevents the accumulation of electrostatic charges through electrical dissipation
- Deep-black pigmentation allows light-proof bonding of optical equipment

Important Requirements

Before applying WACKER® RTV-S 691 or ELASTOSIL® S 692, clean and pretreat the respective substrates, e.g. with WACKER® PRIMER G790 TOLUENE FREE, plasma or corona treatment, etc.

		WACKER® RTV-S 691		ELASTOSIL® S 692	
	Method	A	B	A	B
Properties Uncured					
Color	–	Red	Colorless	Black	Colorless
Viscosity, Brookfield [mPa·s]	DIN EN ISO 2555	63,000	–	–	–
Viscosity, Ostwald [mm²/s]	–	–	220	–	–
Viscosity, rot. dyn. (D=16 1/s, 23 °C) [mPa·s]	DIN EN ISO 3219	–	–	62,000	220
Density [g/cm³]	DIN EN ISO 2811-2	1.60	0.98	1.09	0.98
Properties Catalyzed					
Mixing ratio A:B (parts by weight)	--	9:1		9:1	
Viscosity of A/B mixture, rot. dyn. (5 min after mixing, D=16 1/s, 23 °C) [mPa·s]	DIN EN ISO 3219	20,000		40,000	
Potlife, 23 °C [min]	–	100[1]		360[2]	
Properties Cured					
Color	–	Red		Black	
Density, in water [g/cm³]	DIN EN ISO 1183-1 A	1.53		1.04	
Hardness [Shore A]	DIN ISO 48-4	55		30	
Tensile strength [N/mm²]	ISO 37 Type 1	4.4		1.8	
Elongation at break [%]	ISO 37 Type 1	110		260	
Tear strength [N/mm]	ASTM D 624 B	5.5		3.4	
Glass transition temperature [°C]	–	-107		-109	
Surface resistivity [Ohm]	Based on IEC 60093	> $1.0 \cdot 10^{12}$		–	
Volume resistivity [Ohm·cm]	Based on IEC 60093	> $1.0 \cdot 10^{14}$		approx. 150	
Total mass loss (TML) [%]	ESA ECSS-Q-70-02A	< 1.0		< 1.0	
Collected volatile condensed material (CVCM) [%]	ESA ECSS-Q-70-02A	< 0.1		< 0.1	

Note: these figures are intended as a guide and should not be used in preparing specifications.

[1] Time to exceed 200,000 mPa·s

[2] Time to exceed 100,000 mPa·s

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7882en/02.24 replaces 7882e/07.21