

DuPont™ Vespel® Sealing Solutions

REPLACING METAL-TO-METAL SEALS WITH DUPONT™ VESPEL® SP AND SCP



Vespel® SP and SCP can be used for sealing components like valve seals, ferrules, and gaskets to achieve bubble-tight closure at high temperatures.

The science of DuPont™ Vespel® helps jet engines run efficiently; keeps transmissions shifting longer; helps snowmobiles run smoother; keeps tractors working longer; and helps parts endure extreme environments from reactor chambers to deep space.

Vespel® polyimide polymers are superb as material solutions for dynamic and static sealing applications. DuPont™ Vespel® polymers provide long life sealing in extreme environments where other engineering plastics fail and metal-to-metal seals were previously considered the only option.

Challenges

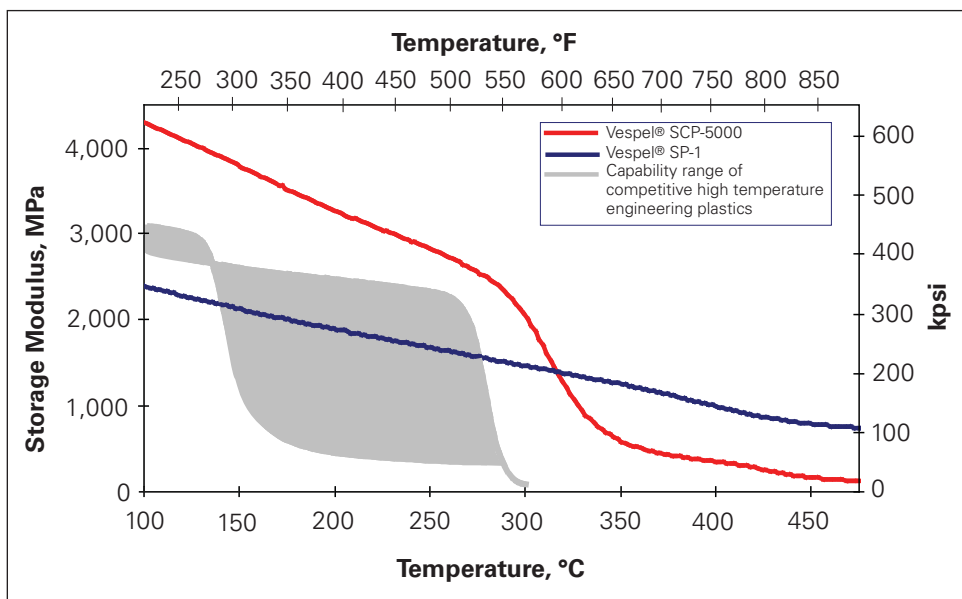
- Metal-to-metal seals are expensive to fabricate requiring hard facing and multiple lapping steps in order to achieve low leak rates
- Increasingly demanding environments such as high temperature and pressure
- Most engineering plastics deteriorate quickly at high temperatures or cannot withstand thermal cycling
- Many engineering plastics do not have high temperature compression strength and creep resistance necessary for seal longevity at higher pressures

Solutions

Sealing components made from the DuPont™ Vespel® SP and SCP families of products have the combination of capabilities to meet demanding applications.

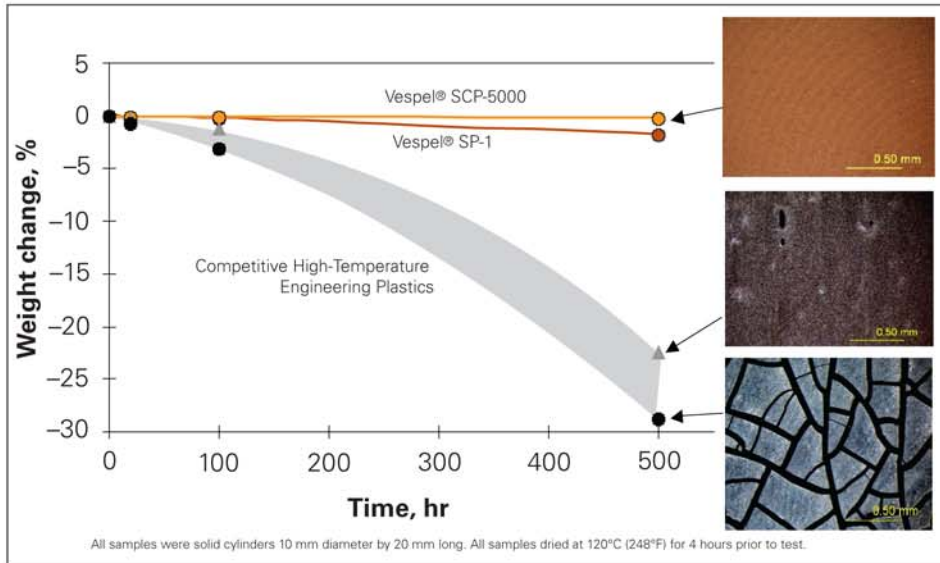
- Vespel® SP and SCP grades have consistent properties maintaining tight seals across a wide range of temperatures
- High compressive strength and low creep rate allow higher operating pressures for long durations
- Low coefficient of friction and low wear rates between mating surfaces generate longer part life and clean environments (bearing grades)
- Vespel® SP and SCP can be machined to tight tolerances and sealing surface finishes using conventional machining techniques

Flexural Stiffness by Dynamic Mechanical Analysis: DuPont™ Vespel® SP-1 and SCP-5000 versus Competitive High-Temperature Engineering Plastics Used for Seals



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Weight Loss Test Results — Exposure to Air at 662°F
DuPont™ Vespel® Retains Its Weight and Shape.



Benefits of DuPont™ Vespel®

- Reduce total cost of ownership versus metal-to-metal seals
- Thermal degradation resistance can reduce life cycle cost via longer component life
- Lower coefficients of friction lead to smaller, lighter, and less expensive actuator components

Properties

- Ability to withstand harsh environments. Temperatures up to 550°F for extended periods of time and excursions to 900°F.
- High vacuum compatible
 - Inherently clean
 - Broad chemical compatibility
 - Plasma and radiation resistant
 - Self lubricating
 - Oxygen service compatible

Typical Properties — DuPont™ Vespel® Isostatic Shape Grades

	ASTM Test	Units	Vespel® SP					Vespel® SCP		
			SP-1	SP-21	SP-22	SP-211	SP-3	SCP-5000	SCP-50094	SCP-5050*
			Unfilled	15% graphite	40% graphite	15% graphite & 10% Teflon®	Vacuum Bearing Grade	Unfilled	Graphite Bearing Grade	Graphite Bearing Grade
Mechanical										
Tensile Strength, 73°F	D1708/D638	ksi	12.5	9.5	7.5	6.5	8.2	23.4	18.0	10.3
Tensile Strength, 500°F	D1708/D638	ksi	6.0	5.5	3.4	3.5		8.9	8.0	6.0
Elongation at Break, 73°F	D1708/D638	%	7.5	4.5	3.0	3.5	4.0	7.0	4.3	1.6
Elongation at Break, 500°F	D1708/D638	%	6.0	3.0	2.0	3.0		>20	13.0	3.0
Flex Modulus, 73°F	D790	ksi	450	550	700	450	475	840	923	1,093
Flex Modulus, 500°F	D790	ksi	250	370	400	200	270	440	514	700
Compressive Stress at 1% strain, 73°F	D695	ksi	3.6	4.2	4.6	3.0	5.0			
Compressive Stress at 10% strain, 73°F	D695	ksi	19.3	19.3	16.3	14.8	18.5	33.3	31.9	22.0
Compressive Stress at 0.1% offset	D695	ksi	7.4	6.6	6.0	5.4				
Deformation Under 2,000 psi Load	D621	%	0.14	0.10	0.08	0.13	0.12			
Friction										
Coeff. of Friction at PV = 25,000 psi-ft/min**			0.29	0.24	0.20	0.12	0.25	0.26	0.25	0.21
Coeff. of Friction at PV = 100,000 psi-ft/min**				0.12	0.09	0.08	0.17	0.15	0.06	0.09
Static Coeff. of Friction in Air**			0.35	0.30	0.27	0.20				
PV Limit (unlubricated)***		ksi ft/min		350	350	100			500	
Other Properties										
Coeff. of Thermal Expansion, 73–500°F	D696	10 ⁻⁶ /in/in/°F	30	27	21	30	29	26	24	
Hardness	D785	Rock E	45–60	25–45	5–25	1–20	40–55	95	91	
Water Absorption, 24 hr at 73°F, 100% RH	D570	%	0.24	0.19	0.14	0.21	0.23	0.08	0.06	0.06

* SCP-5050 in isostatic form is a developmental product. Properties shown are typical for the direct formed process.
 ** Versus carbon steel, steady state, unlubricated, in air, thrust bearing.
 *** PV limits for any material vary with different combinations of pressure and velocity as well as other conditions.

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