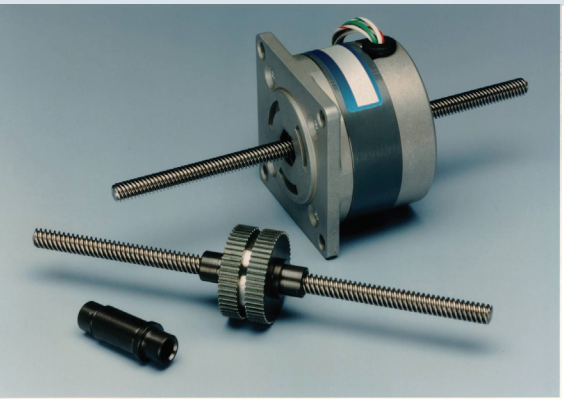
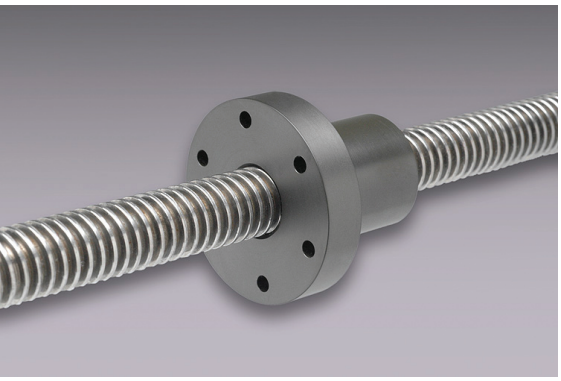
DuPont™ Vespel® Motion Solutions

LINEAR MOTION SOLUTIONS IN UNLUBRICATED SERVICE USING DUPONT™ VESPEL® SP AND SCP





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.

DuPont™ Vespel® polyimide bearing grade polymers are superb as materials for linear motion component applications providing long life, low wear and friction solutions without external lubrication.

Challenges

- Designing reliable positioners with no lubrication or when the potential for lubrication starvation exists
- Identifying a low wearing material to prevent undesired backlash, poor positioning tolerances, and environment contaminating particulates
- Choosing a material with low friction to improve efficiency
- Selecting a dimensionally stable material that will not melt or deform under high loads and high operating temperatures
- Extreme application environments such as hard vacuum, radiation, oxygen compatibility, cryogenic, and flame exposure

Applications

- Threaded Bushings
- Linear Guides
- Thrust Bearings
- Roller Bearings

Solutions

DuPont™ Vespel® SP and SCP bearing grades:

- Possess some of the highest unlubricated pressure-velocity limits of any engineering plastic
- Contain fillers that in concert with SP and SCP polyimide polymers provide low friction and low wear solutions in the most extreme environments
- Are dimensionally stable across a wide range of temperatures from cryogenic to 550°F with excursions to 900°F
- Display successful performance in extreme environments such as low outgassing in vacuum, radiation and ion degradation resistance, oxygen service compatibility, and flammability resistance

Benefits

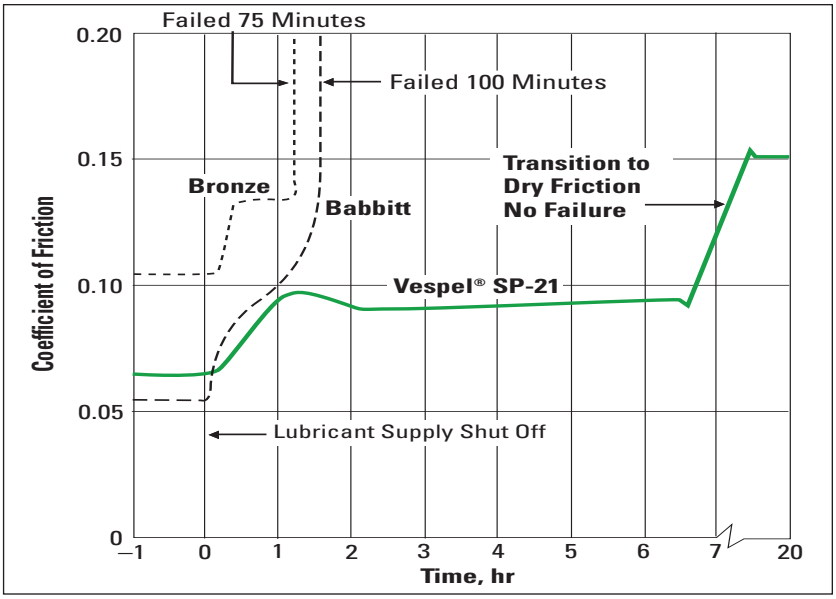
- Simple reliable designs
- Both thermal durability and dimensional stability ensure directional repeatability
- Low wear rates increase service life and reduce operating environment contamination
- High efficiencies from low friction components result in less energy consumption and reduce cost by allowing the use of smaller actuators
- Improved cost of ownership

DUPONT®

The miracles of science™

The unlubricated Pressure Velocity Limit of Vespel® SP-21 is 350 ksi-ft/min which allows grease and oil-free designs. New bearing grades based on Vespel® SCP have improved unlubricated pressure velocity limits of 500 ksi-ft/min.

Lubrication Starvation Test — Thrust Bearing



Carbon Steel, Pressure = 500 psi, Velocity = 20 ft/min

Typical Properties of DuPont™ Vespel® Isostatic Shape Bearing Grades

	ASTM Test	Units	Vespel® SP				Vespel® SCP	
			SP-21 15% graphite	**SP-22** 40% graphite	**SP-211** 15% graphite & 10% Teflon®	**SP-3** Vacuum Bearing Grade	**SCP-50094** Graphite Bearing Grade	**SCP-5050*** Graphite Bearing Grade
Mechanical								
Tensile Strength, 73°F	D1708/D638	ksi	9.5	7.5	6.5	8.2	12.8	10.5
Tensile Strength, 500°F	D1708/D638	ksi	5.5	3.4	3.5		6.6	5.8
Elongation at Break, 73°F	D1708/D638	%	4.5	3.0	3.5	4.0	2.1	1.9
Elongation at Break, 500°F	D1708/D638	%	3.0	2.0	3.0		4.6	3.9
Flex Modulus, 73°F	D790	ksi	550	700	450	475	923	1,000
Flex Modulus, 500°F	D790	ksi	370	400	200	270	513	655
Compressive Stress at 10% Strain, 73°F	D695	ksi	19.3	16.3	14.8	18.5	31.9	21.0
Friction								
Coeff. of Friction at PV = 25,000 psi-ft/min**			0.24	0.20	0.12	0.25	0.25	0.20
Coeff. of Friction at PV = 100,000 psi-ft/min**			0.12	0.09	0.08	0.17	0.06	0.09
Static Coeff. of Friction in Air**			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	27	21	30	29	19	18
Water Absorption, 24 hr at 73°F, 100% RH	D570	%	0.19	0.14	0.21	0.23	0.06	0.09

* 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.

vespel.dupont.com

DUPONT®
The miracles of science™

Call toll free:
(877) 246-7700
www.ainplastics.com

DuPont™ Vespel® Motion Solutions are distributed by:

ThyssenKrupp Materials NA
AIN Plastics Division
A ThyssenKrupp Services comapny

ThyssenKrupp