

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

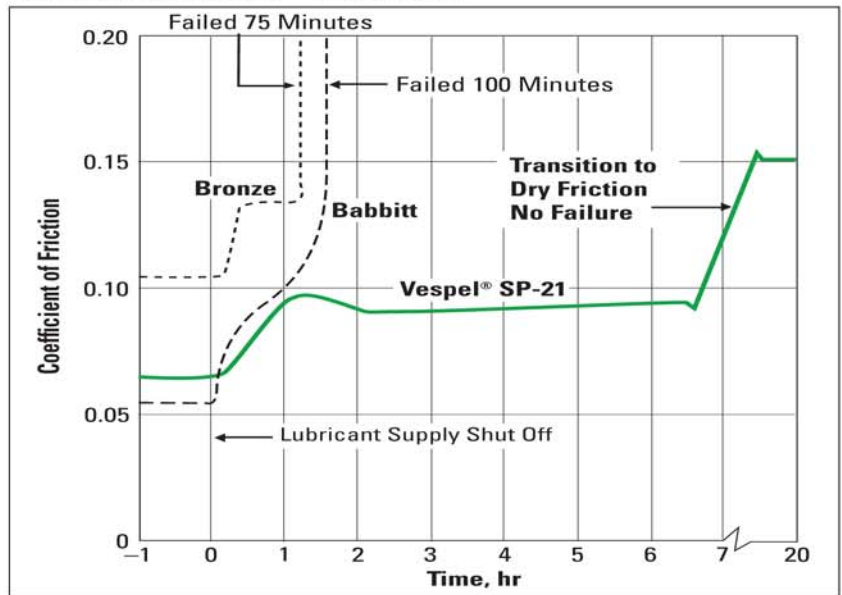
- Simple reliable designs
- Both thermal durability and dimensional stability ensure directional repeatability
- Low wear rates increase service life and reduce operating environment contamination
- High efficiencies from low friction components result in less energy consumption and reduce cost by allowing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



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.

The information set forth herein is furnished free of charge and is based on technical data that DuPont believes to be reliable. It is intended for use by persons having technical skill, at their own discretion and risk. This information corresponds to our current knowledge on the subject. It is offered solely to provide possible suggestions for your own experimentation. It is not intended, however, to substitute for any testing you may need to conduct to determine for yourself the suitability of our products for your particular purposes. The data listed herein falls within the normal range of product properties but they should not be used to establish specification limits or used alone as the basis of design. This information may be subject to revision as new knowledge and experience becomes available. Since we cannot anticipate all variations in actual end-use conditions, DuPont makes no warranties and assumes no liability in connection with any use of this information. Nothing in this publication is to be considered as a license to operate under or a recommendation to infringe any patent right.

Caution: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement," H-50102.

Copyright © 2007 DuPont. The DuPont Oval Logo, DuPont™, The miracles of science™, Teflon® and Vespel® are registered trademarks or trademarks of E.I. du Pont de Nemours and Company or its affiliates. All rights reserved.

K-16840 (11/07) Printed in the U.S.A.

vespel.dupont.com



The miracles of science™



Nationwide
1.888.CURBELL
www.curbellplastics.com