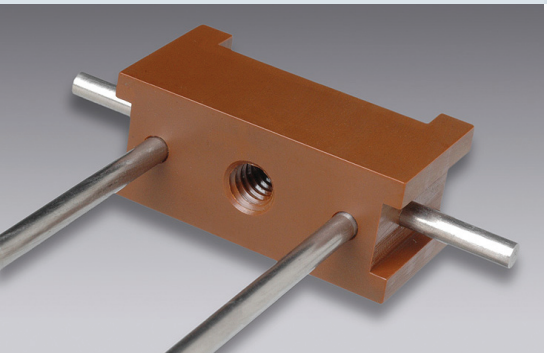
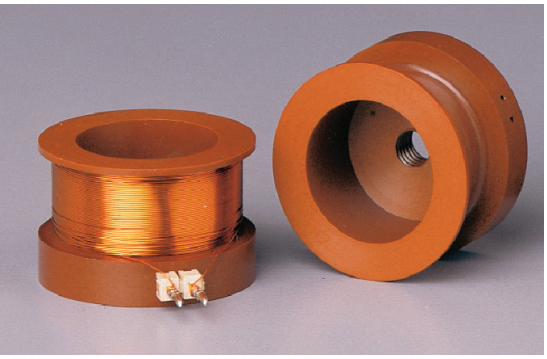
DuPont™ Vespel® Insulator Solutions

MEETING THE INSULATOR NEEDS FOR SCIENTIFIC AND ANALYTICAL EQUIPMENT USING DUPONT™ VESPEL® SP-1 AND SCP-5000



Mass spectrometry insulators require materials with high dielectric strength and low outgassing.



Down hole analytical instruments need strong thermal degradation resistance, dimensional stability, and impact toughness.

The science of DuPont™ Vespel® helps parts endure extreme environments from reactor chambers to deep space.

Vespel® polyimide polymers are superb as material solutions for insulator applications in scientific and analytical equipment. Vespel® SP-1 and SCP-5000 not only provide strong electrical and thermal insulation, but they are low weight, easy to fabricate alternatives to traditional ceramics. Vespel® polymers outperform other engineering plastics at high temperatures for extended periods of time.

Challenges

- Fabricating precise dimensions in ceramics is difficult and expensive
- Designing light electrical and thermal insulators with impact toughness
- Selecting materials with predictable properties to enable accurate and repeatable analyses
- Identifying materials with a diverse combination of characteristics to reduce design complexity and improve system reliability

Product Description

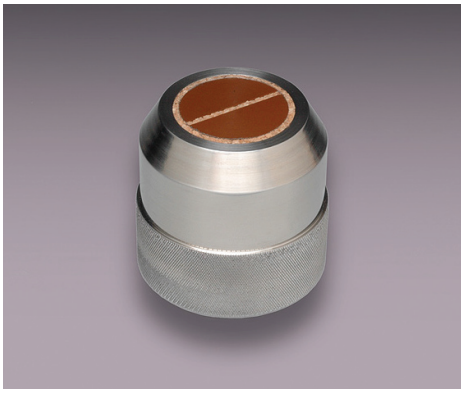
Vespel® SP-1 and SCP-5000 materials are high performance unfilled polyimides used to make tough electrical and thermal insulators. These products exhibit a unique combination of attributes:

- Excellent electrical properties: High dielectric strength, low dielectric constant
- Thermal oxidation and ion degradation resistance
- Low outgassing and inherently clean
- Broad chemical compatibility
- Ease of machining to precise dimensions with standard machining techniques

Solutions

A combination of material capabilities that transcends plastics and ceramics.

- Vespel® polymers machine easily yet they have electrical insulative properties like a ceramic. The advantage is low fabrication cost versus ceramics especially when there are precise design features such as under cuts, holes, or threads
- Vespel® materials are tough compared to traditional ceramics. This characteristic translates into lower scrap rates and better service life in high impact scenarios where cracking is an issue during fabrication, assembly, or operation
- Unlike most plastics, Vespel® SP-1 exhibits no glass transition temperature or melt point and maintains mechanical properties across a wide temperature range
- Vespel® SCP-5000 has a glass transition temperature at 626°F, but below this temperature it has higher strength, modulus, thermal oxidative stability, dimensional stability, and chemical resistance than Vespel® SP-1

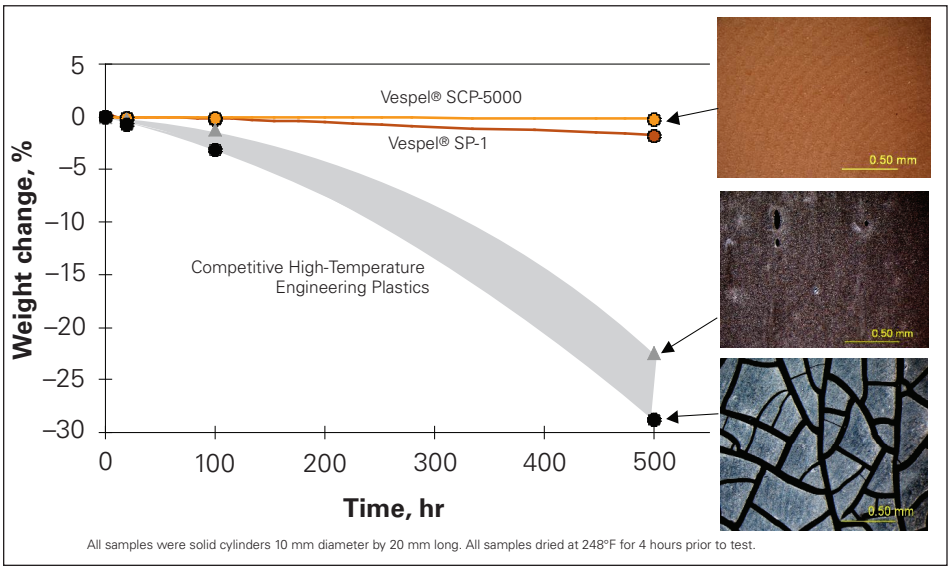


Ultrasonic Transducers in high temperature service need strong thermal insulators with consistent material properties.

DUPONT®

The miracles of science™

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



All samples were solid cylinders 10 mm diameter by 20 mm long. All samples dried at 248°F for 4 hours prior to test.

Typical Properties of DuPont™ Vespel® Isostatic Shapes versus Alumina

	ASTM Test	Units	Vespel® SP-1	Vespel® SCP-5000	99.5%* Alumina
Mechanical					
Tensile Strength, 73°F	D1708/D638	ksi	12.5	23.4	43.5
Tensile Strength, 500°F	D1708/D638	ksi	6.0	9.0	
Elongation at Break, 73°F	D1708/D638	%	7.5	7.0	~0
Elongation at Break, 500°F	D1708/D638	%	6.0	>20	
Flex Modulus, 73°F	D790	ksi	450	836	
Flex Modulus, 500°F	D790	ksi	250	436	
Comp. Stress at 10% strain, 73°F	D695	ksi	19.3	33.3	
Electrical					
Dielectric Strength, 73°F (0.080 in)		kV/mil	560–760	686–787	229–432**
Dielectric Constant, 73°F (10^4–10^6 Hz)			~3.6	~3.3	9.6–9.9**
Thermal					
Coeff. of Thermal Expansion, 73–500°F	D696	10^{-6} in/in/°F	30	24	2.6
Thermal Conductivity, 104°F		BTU in/hr/ft^2/°F	2.4	2.4	229
Other Properties					
Water Absorption, 24 hr at 73°F, 100% RH	D570	%	0.24	0.08	
Specific Gravity	D792		1.43	1.43	3.98
Hardness	D785	Rock E	45–60	95	

* Values from the National Institute of Standards and Testing.
** Unverified manufacturer data without reference to sample thickness or frequency.

K-16841 (11/07) Printed in the U.S.A.

vespel.dupont.com

DUPONT®
The miracles of science™

Where to use DuPont™ Vespel® SP-1 and SCP-5000 as an insulator?

Vespel® polyimides have been used as specialty insulators for decades in applications in scientific instrumentation, analytical equipment, avionics, communications, ultrasonics, and transformers. Although appropriate use of Vespel® products is application specific, Vespel® SP-1 and SCP-5000 are often selected in the following instances:

- Operating temperatures to 550°F with thermal excursions to 900°F
- High differential voltages
- Hard vacuum down to 10^{-9} Torr
- Designs requiring multiple functions (insulator, seal conformity, low wear and low friction)
- Impact loads where ceramics fail
- Low weight requirements
- Geometries with fine features

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

DuPont™ Vespel® Insulator Solutions are distributed by:

ThyssenKrupp Materials NA
AIN Plastics Division
A ThyssenKrupp Services comapny

ThyssenKrupp