DUPONT™ VESPEL® SP PARTS AND SHAPES

RADIATION RESISTANCE

Vespel® parts can perform well in different radioactive environments, even at relatively high dosage rates. The small losses in weight, tensile strength and elongation properties, at doses up to 10^8 rads, suggest that Vespel® parts may be used even in environments containing gamma or electron beam radiation.

Working with radiation
Radiation from various sources may be present in a number of technical and industrial applications. At high radiation levels, it is often necessary to use remote handling or automatic equipment to avoid injury to personnel. Materials used in the construction of such equipment must be able to withstand exposure to radiation.

While metals perform well in static structures, the necessity for lubrication, with the possibility of contamination from the lubricant, reduces the usefulness in bearings, bushings and sliding surfaces. For applications requiring moving parts, as in the handling systems for the production of radiochemicals, or the handling of nuclear fuel rods, self-lubricating high performance polymers such as Vespel® SP polyimide parts can overcome some of the limitations of metals.

The performance of Vespel® SP polyimide parts when subjected to different kinds and levels of radiation is described below.

Testing
To determine how well direct-formed Vespel® bars (SP-1, SP-21 and SP-22) performed after radiation exposure, three parameters were evaluated:

1. weight loss
2. change in tensile strength, and
3. change in elongation, compared to randomly selected control bars which received no radiation exposure

Gamma radiation was provided at a dosage of 3.8 x10^6 rads/hour from a cobalt 60 source. Exposure times of 16 minutes, 2.6 hours and 26.3 hours resulted in total dosages of 10^6, 10^7 and 10^8 rads.

Weight Loss	Tensile Strength	Tensile Elongation
Less than 1.0% loss	Less than 6.5% loss	19.2% loss at the maximum

Electron beam radiation from a 2,0 MV Van de Graaf generator provided a dosage rate of 4.0 $x10^6$ rads/hour. Exposure times of 1.6 minutes, 80 minutes and 2.7 hours resulted in total dosages of 10^6, 5 $x10^7$ and 10^8 rads.

Weight Loss	Tensile Strength	Tensile Elongation
Less than 2.0% loss	Less than 4.5% loss	Less than 15.0%

Neutron beam radiation was provided by a neutron flux of 5 x $10^{13}/cm^2$/second. Tensile bars were subjected to this exposure level for 100 and 150 hours respectively. Co-incident gamma radiation, at an average dosage rate of 1,2 $x10^8$ rads/hour, accompanied the neutron beam exposures.

Vespel® parts and neutron beam radiation
Although none of the test bars swelled or were noticeably distorted, tensile strength was substantially reduced after the exposure to high levels of neutron beam irradiation. Therefore, we suggest that you discuss applications involving neutron radiation with a Vespel® Applications Engineer, and that you perform specific exposure tests.

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