MINER ELASTOMER PRODUCTS CORPORATION

TecsPak®

Technical Data Sheet

Radiation Effects On TecsPak®

The increasing use of nuclear energy in power plants, military areas, medicine and other fields places new requirements on many rubber compounds as well as other materials. Some factors of importance to market development activities in this field include, for example: (1) the maximum dosage to which the material can be subjected without damaging effects; (2) the possible use of additives to provide additional stabilization to radiation; and, (3) the effect of radiation on physical properties.

Uncompounded TecsPak polyester elastomers of all three hardness grades have excellent retention of physical properties after irradiation at 23°C. (73.4°F.) in air. (The combined effect of heat-aging or steam-aging concurrent with the radiation exposure was not studied).

Injection-molded 3" x 5" x .075" slabs of the three hardness grades of TecsPak were exposed to a 2 Mev. Electron beam at High Voltage Engineering Company, Burlington, Massachusetts at a dose rate of 10^5 rads/hour. The slabs were then tested by ASTM methods.

For the most part, radiations of prime interest from the standpoint of insulation damage have energies of order of 1 Mev. These are principally gamma photons and fast neutrons. Damage is caused by collisions of the radiations with electrons and nuclei in the elastomer where the energy input from such collisions may be greater than the bond energies in the elastomer.

Most elastomers are embrittled by radiation exposure, which induces cross-links between molecules. This eventually gives a three dimensional network, such as seen in hard rubber or phenolic resins. A few polymers, notably butyl rubber, degrade by reversion to low molecular weight tars and oils.

Although upgrading changes can occur under controlled low dosage (radiation crosslinked poly-olefins), long exposures normally produce degradation. Thus, the amount of change is dependent on radiation flux rate, total radiation dose, energy of radiation, chemical composition of the polymer, environment (ambient temperature, air vs. inert gas, steam exposure, etc.) and the initial properties of the elastomer compound. The amount of change is independent of the type of radiation at equal energy (Ref. 1), whether alpha, beta, or gamma rays or neutrons. This is known as the equal-energy equal-damage concept.

The table on the next page summarizes the effect of radiation on three hardness grades of TecsPak. It will be seen that the exposure to 10^7 rads produces very little change in the properties of TecsPak. Test samples are still glossy, highly resilient and flexible after this exposure.

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Stability of TecsPak* Polyester Elastomers to Radiation Electron Beam, 2 Mev., 30ºC. (86ºF)/50% RH, Radiation Dosage in Rads			
	TecsPak 40D	TecsPak 55D	TecsPak 63D
ORIGINAL			
Tensile Strength, psi (kgf/cm^2)	3500 (246.0)	5090 (357.8)	5225 (367.3)
Elgongation at Break, %	610	570	450
100% Modulus, psi (kgf/cm^2)	1275 (86.9)	2025 (142.4)	2790 (196.1)
300% Modulus, psi (kgf/cm^2)	1620 (113.9)	2660 (187.0)	3750 (263.6)
10^5 RADS			
Tensile Strength, psi (kgf/cm^2)	3315 (233.0)	4415 (310.4)	5270 (370.5)
Elongation at Break, %	595	525	425
100% Modulus, psi (kgf/cm^2)	1185 (83.3)	1980 (13902)	2750 (193.3)
300% Modulus, psi (kgf/cm^2)	1620 (113.9)	2525 (117.5)	3830 (269.2)
10^6 RADS			
Tensile Strength, psi (kgf/cm^2)	3500 (246.0)	4280 (300.9)	4910 (345.2)
Elgongation at Break, %	600	530	430
100% Modulus, psi (kgf/cm^2)	1285 (90.3)	1980 (139.2)	2680 (188.4)
300% Modulus, psi (kgf/cm^2)	1700 (119.5)	2500 (175.8)	3900 (274.2)
10^7 Rads			
Tensile Strength, psi (kgf/cm^2)	3380 (237.6)	4220 (296.7)	5120 (359.9)
Elgongation at Break, %	535	450	415
100% Modulus, psi (kgf/cm^2)	1230 (86.5)	2150 (151.1)	2840 (199.7)
300% Modulus, psi (kgf/cm^2)	1760 (123.7)	2680 (188.4)	4000 (281.2)

REFERENCES: 1. R. B> Blodgett and R. G. Fisher, IEEE Transactions on Power Apparatus and Systems, Vol. 88, No. 5, p. 529, (may, 1969)

*Reg. U.S. Pat. Off.