DESIGN NOTE

Radiation Resistance and Outgassing of PTFE/Fiberglass Laminates

Radiation resistance - the main effect radiation has on PTFE/fiberglass laminates is on the mechanical properties. Radiation of all types reduces the molecular weight of the PTFE by breaking the large molecules into small particles. This will increase the brittleness of the laminate, while reducing the elongation, modulus, and tensile strength. In an oxygen-free atmosphere, however, the effects of radiation are reduced. Oxygen is necessary for some of the reactions to occur.

Irradiation will also affect the electrical properties of PTFE. Both the dielectric constant and the dissipation factor will temporarily increase while the material is being irradiated. This effect is less evident at the higher frequencies used in microwave applications.

Most of the information compiled on radiation resistance is based on the dosage encountered in the Van Allen radiation belt (10 rads/hour). At this rate, PTFE will operate from 5-50 years. It is generally believed that the PTFE will survive longer than many of the components.

Outgassing in vacuum - according to a NASA report dated August, 1980, PTFE/fiberglass laminates have outstanding resistance to outgassing. Because of the high temperatures necessary for the laminate manufacturing cycle, the volatiles (which would outgas) are burned off. In tests performed according to ANSI/ASTM E-595-77, PTFE/fiberglass laminates show a TML (total mass loss) of about 0.05%, and a CVCM (collected volatile condensable materials) of 0.00%. For space applications, the maximum values allowed are a TML of 1.0% and a CVCM of 0.10%. Laminates made from PTFE/fiberglass fall way below this maximum limit.

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