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# NASA TECH BRIEF



## Irradiation Improves Properties of an Aromatic Polyester

**The problem:** Films and fibers produced from certain commercially available polymers formed by condensation of ethylene terephthalate or other aromatic esters have a number of advantageous properties, such as high tensile strength and toughness and stability at elevated temperatures. When these materials are exposed to ionizing radiation (electrons, gamma rays, or neutrons), however, they undergo degradation, with a loss of their useful properties instead of a beneficial cross-linking reaction as in the case of some aliphatic polymers. Since the irradiated aliphatic polymers are still generally deficient in strength and high-temperature stability compared to the aromatic polyesters, it would be desirable to find aromatic polyesters that would retain their useful properties in a radiation environment.

**The solution:** A commercially available aromatic polyester, poly(ethylene 2,6-naphthalenedicarboxylate) (abbreviated PEN-2,6), is not degraded when exposed to relatively intense ionizing radiation. In fact, this polymer, which has properties generally similar to those of poly(ethylene terephthalate), is considerably improved through cross-linking effected by the radiation.

**How it's done:** Films of PEN-2,6 are exposed to different intensities of gamma radiation from a cobalt-60 source and then subjected to viscosity tests to obtain a measure of the molecular weight and chain length of the polymer. Test results indicate that the viscosity of the films increases linearly with radiation dosage over the range of 1 to 500 megarads. After irradiation at 1000 megarads, the film retains most of its useful properties, and in addition is completely insoluble in the usual solvents.

**Notes:**

1. PEN-2,6 films should find particular application in radiation environments.
2. Films and fibers of PEN-2,6 extruded by conventional methods can be cross-linked by radiation to effect a marked improvement in their physical and chemical properties. Oriented films of the irradiated polymer should have little tendency to delaminate. Applications of the irradiated material are suggested for any purpose requiring an aromatic polyester resin of improved properties.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Langley Research Center
   Langley Station
   Hampton, Virginia, 23365
   Reference: B65-10164

**Patent status:** NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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