



Materials Engineering Branch

TIP*



No. 110 Special Handling Requirements for Polymethyl Methacrylate

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The technology of fiber optics has reached a relatively advanced state. It is becoming more commonplace to see them in flight and flight-support equipment because of their favorable size and weight factors. Although there are several different types of fiber optic materials available, this note will only address the acrylic (polymethyl methacrylate) type.

In the course of handling flight hardware, it becomes necessary to clean the individual parts, subassemblies, and assemblies throughout the fabrication and test procedures. In this connection, the acrylic fibers have been found to be very susceptible to cracking and crazing, which makes them either highly substandard or unusable because of loss of optical transmission.

The results of numerous tests show that the more active solvents cause the most damage to the fibers. Another factor that weighs heavily in the outcome is the stress, especially bending stress, to which the fiber is subjected when it is exposed to either the liquid solvent or its vapors.

Therefore, the fibers must not be exposed to active solvents such as acetone, methylethyl ketone, methylene chloride, etc., under any circumstances. The fibers may be exposed to mild solvents, e.g., low molecular weight straight-chained hydrocarbons, such as hexane or heptane, or alcohols (isopropyl or ethyl), water, and mild detergents if they are not stressed during the exposure and the time of exposure is limited. Any system that the potential user proposes must be thoroughly tested and proven before the final fabrication is started.

Acrylics are also affected by a rather moderate elevation of temperature; for example, temperatures exceeding 50°C. Temperature degradation is manifested by a loss of physical integrity, whereby the material becomes soft and tends to flow. The maximum safe temperature must be determined for the particular optical fiber system under investigation, whether it is the acrylic type or some other plastic, prior to exposing the flight hardware.