

Materials Tip



Materials Engineering Branch

A Brief View of Plastic Optical Fibers			
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Optical fibers are predominantly made of silica and glass at the present time. However, plastic optical fibers (POFs) have become more popular as new materials in optics and optoelectronics fields. In the 1960s, the Du Pont Company introduced polymethyl methacrylate optical fiber (PMMA fiber), also known as Crofon, into the marketplace. Du Pont discontinued its manufacture in October 1985, thereby making Japan holder of more than 95% of the world market of POF. As there is not much open literature on the subject, this TIP is intended only to outline the state-of-the-art POF.

Applications. The range of POF's applications includes:

Light guide.

Image guide.

Sensors (Monitoring systems, process controls, with robots).

Scintillating sensors (e.g., nuclear applications).

Short distance data transmission (Data links, multiplexers, LAN's).

Features and advantages over silica optical fibers:

1. 3 to 10 times larger in diameter.
2. 2 to 3 times larger in numerical aperture (Hence it does not require high precision of connectors).
3. Hard to break by bending.
4. High resistance to impact and to vibration.
5. Easy to cut and to treat fiber ends.
6. Low total cost.

Improvements needed.

1. To reduce the high attenuation loss.
2. To improve heat resistance.

Structure and materials of POF.

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1. Polymethyl methacrylate (PMMA) -- It is the preferred material, giving the best transparency and mechanical properties.
2. Polystyrene (PS) -- PS is mainly for scintillating applications often with dye doping. It has a better radiation damage yield. Its mechanical strength is one of its limiting properties.
3. Polycarbonate (PC) -- It has the desirable high temperature resistance, but is vulnerable to severe environments (temperature, humidity, and stress combined).

Quality assurance

POF is in the course of rapid improvement. New products are expected to come to the market from time to time. It is important for users to know the manufacturer and its specifications. Particular attention should be paid to its thermal properties and prior to POF material selection, the user should determine the effect of thermal changes on its optical properties.

References:

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3. Du Pont Bulletin, "Designing with Du Pont Crofon Fiber Optics."