

# Polymer and Fiber Integrated Optics

## Devices

Waveguide

Light emitter

LASER

Light detector

Optical modulator/switch

Grating/Filter

Delay line

Mode converter

Coupler/Splitter

Attenuator

Array waveguide (AWG)

## Applications

Optical Add/Drop Multiplexer (OADM)

DWDM Multiplexer

Chemical detector

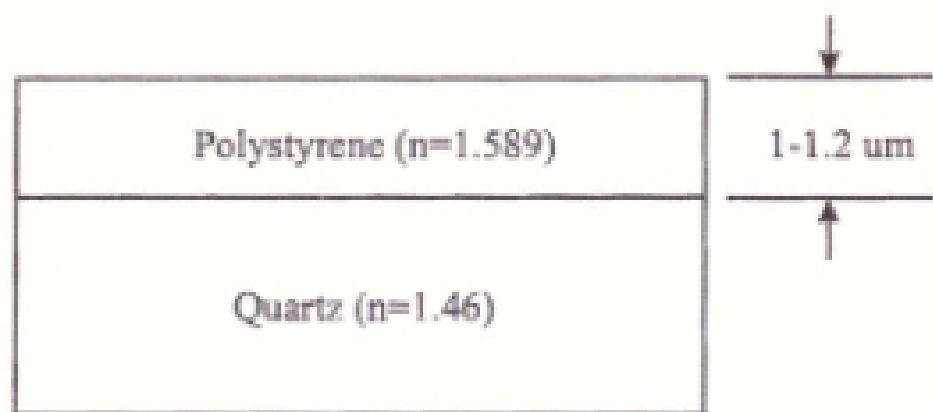
Accelerometer

TABLE I  
KEY PROPERTIES OF OPTICAL POLYMERS DEVELOPED WORLDWIDE

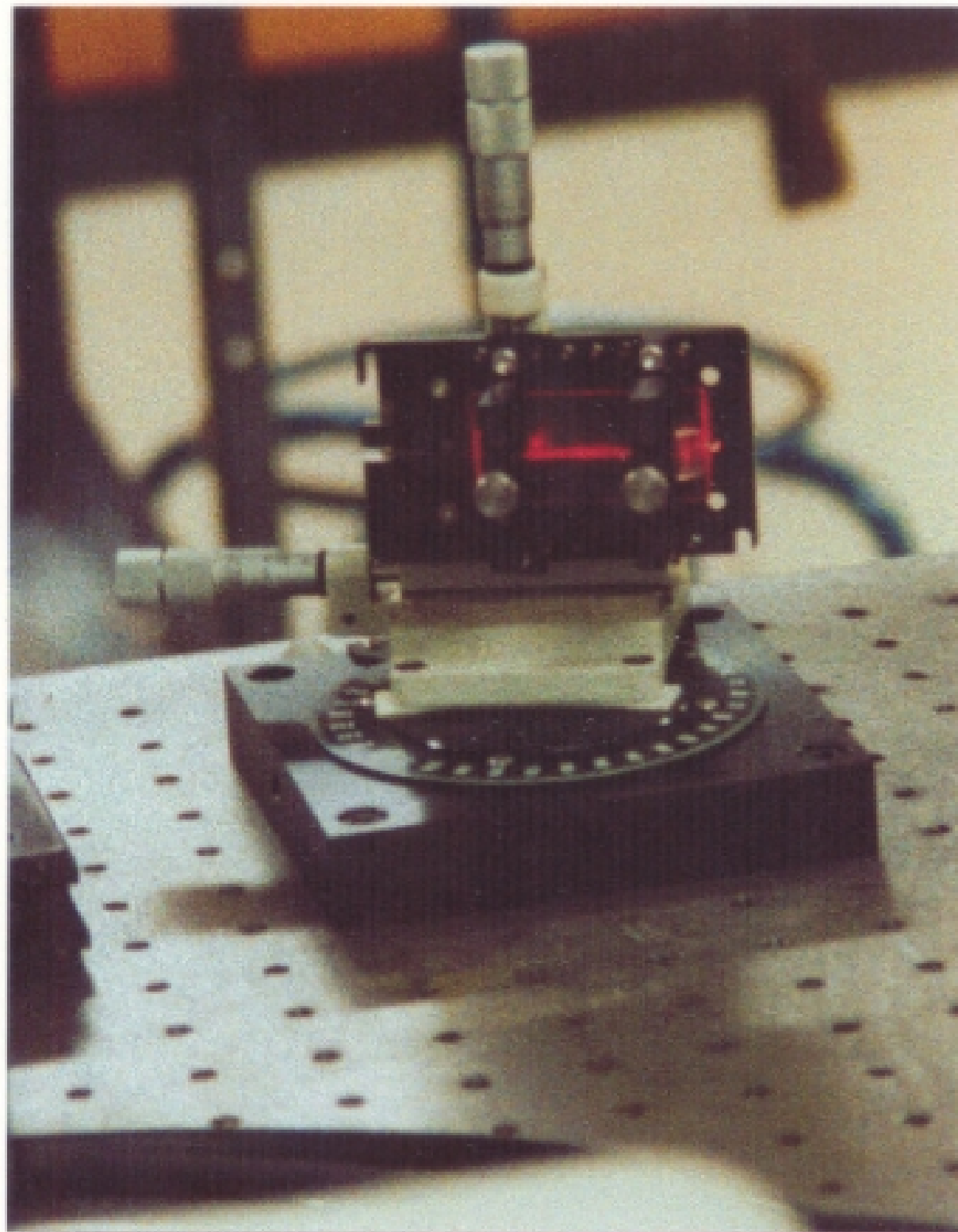
Manufacturer	Polymer Type [Trade Name]	Patterning Techniques	Optical Loss, dB/cm [at wavelength, nm]	Other Properties [at wavelength, nm]
AlliedSignal	Acrylate	Photoexposure / wet etch, RIE, laser ablation	0.02 [840] 0.2 [1300] 0.5 [1550]	Birefringence: 0.0002 [1550] Crosslinked, $T_g$ : 25°C Environmentally stable
	Halogenated Acrylate	Photoexposure / wet etch, RIE, laser ablation	<0.01 [840] 0.03 [1300] 0.07 [1550]	Birefringence: <0.000001 [1550] Crosslinked, $T_g$ : -50°C Environmentally stable
Amoco	Fluorinated Polyimide [Ultradel™]	Photoexposure / wet etch	0.4 [1300] 1.0 [1550]	Birefringence: 0.025 Crosslinked, Thermally stable
Dow Chemical	Benzocyclobutene [Cyclotene™]	RIE	0.8 [1300] 1.5 [1550]	$T_g$ : > 350°C
	Perfluorocyclobutene [XU 35121]	Photoexposure / wet etch	0.25 [1300] 0.25 [1550]	$T_g$ : 400°C
DuPont	Acrylate [Polyguide™]	Photolocking	0.18 [800] 0.2 [1300] 0.6 [1550]	Laminated sheets Excimer laser machinable
General Electric	Polyetherimide [Ultem™]	RIE, laser ablation	0.24 [830]	Thermally stable
Hoechst Celanese	PMMA copolymer [P2ANS]	Photobleaching	1.0 [1300]	NLO polymer
JDS Uniphase Photonics (form. Akzo Nobel Photonics)	[BeamBox™]	RIE	0.6 [1550]	Thermally stable
NTT	Halogenated Acrylate	RIE	0.02 [830] 0.07 [1310] 1.7 [1550]	Birefringence: 0.000006 [1310] $T_g$ : 110°C
	Deuterated Polysiloxane	RIE	0.17 [1310] 0.43 [1550]	Environmentally stable
	Fluorinated Polyimide	RIE	TE: 0.3, TM: 0.7 [1310]	Environmentally stable

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Polystyrene Waveguide



Photograph of Light Traveling Inside the Polystyrene Film

James Everhart, Masters Thesis, University of Delaware, Newark, DE (December 1998)