

Photosensitive terpolymer for all-wet-etching process

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Photosensitive terpolymer for all-wet-etching process: Material characterization and device fabrication

A photosensitive terpolymeric composition suitable for practical waveguide devices is provided. The terpolymer was produced from pentafluorostyrene, perfluoro-n-octyl acrylate, and glycidyl methacrylate. We present a fabrication process where the device structure utilizes the same class of material for the core and cladding layers and it was fabricated without a plasma etching process. Based on the developed material and process; a 16-channel arrayed waveguide grating with good performance has been realized. During temperature cycling, a slight thickness hysteresis and refractive index hysteresis was observed above the glass transition temperature and is ascribed to the fact that the terpolymer material may not completely recover its elasticity in the heating/cooling cycle.

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Table 1

List of polymer materials and related devices, all the devices operate in 1550 nm window.

Material	Patterning process	AWG	Average loss	Adjacent crosstalk	Uniformity	PDL	Refs
Terpolymer	UV lithography/wet-etching	1 × 16, 100 GHz	5 dB	28 dB	1 dB	0.2 dB	This work
Perfluoropolymer	UV lithography/RIE	1 × 16, 100 GHz	2.8 dB	30 dB	NA	NA	[11]
FPAE	UV lithography/RIE	1 × 16, 100 GHz	18 dB	15 dB	3 dB	3 dB	[12]
PFCB	UV lithography/RIE	1 × 5, 200 GHz	6 dB	20 dB	0.5 dB	NA	[13]
PFS-co-GMA	UV lithography/RIE	1 × 33, 100 GHz	11 dB	20 dB	NA	NA	[14]
FPE	UV lithography/RIE	1 × 16, 100 GHz	7 dB	27 dB	2.8 dB	1.2 dB	[15]
BCB	Embossing	1 × 5, 100 GHz	NA	NA	NA	NA	[16]

In order to evaluate the fabrication method used in this work, we compared the fabricated device with other AWGs developed by other fabrication techniques. The results are summarized in Table 1. The data presented in Table 1 (Loss, crosstalk, uniformity, PDL) are the most representative parameters for comparing different AWGs. From Table 1, we can see that we have developed a 16-channel AWG with good characteristics using all-wet-etching process. In the case of the 5-channel AWG fabricated by the embossing technique, we did not find any data related to the fabricated device.

Keywords

Photosensitive material; Wet-etching; Optical properties; Arrayed waveguide grating

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