

# United States Patent [19]

[11] **Patent Number:** **5,539,074**

**Herr et al.**

[45] **Date of Patent:** **Jul. 23, 1996**

- [54] **LINEAR AND CYCLIC POLYMERS OR OLIGOMERS HAVING A PHOTOREACTIVE ETHENE GROUP**
- [75] Inventors: **Rolf-Peter Herr**, Freiburg, Germany; **Stephen Kelly**, Möhlin; **Martin Schadt**, Seltisberg, both of Switzerland; **Klaus Schmitt**, Lörrach; **Andreas Schuster**, Freiburg, both of Germany
- [73] Assignee: **Hoffmann-La Roche Inc.**, Nutley, N.J.
- [21] Appl. No.: **191,835**
- [22] Filed: **Feb. 4, 1994**
- [30] **Foreign Application Priority Data**
- |               |      |             |        |
|---------------|------|-------------|--------|
| Feb. 17, 1993 | [CH] | Switzerland | 488/93 |
| Feb. 23, 1993 | [CH] | Switzerland | 553/93 |
- [51] **Int. Cl.<sup>6</sup>** ..... **C08F 20/10**; C08F 20/22; C08F 20/36; C08F 20/42
- [52] **U.S. Cl.** ..... **526/326**; 526/245; 526/258; 526/292.1; 526/293; 526/297; 526/279; 526/304; 526/305; 526/311; 526/328; 526/347
- [58] **Field of Search** ..... 526/326, 328, 526/245, 292.1, 293, 311, 297, 347, 279, 304, 305, 258

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

4,974,941	12/1990	Gibbons et al.	350/349
5,190,687	3/1993	Hachiya et al.	252/299.1

**FOREIGN PATENT DOCUMENTS**

0240276	10/1987	European Pat. Off.	.
445629	11/1991	European Pat. Off.	.
482985	4/1992	European Pat. Off.	.

**OTHER PUBLICATIONS**

Nishikubo et al., *Macromolecules* 18:2131-2135 (1985).  
 Barley et al., *Makomol. Chem.* 192:2801-2810 (1991).  
 Kawanishi et al., *Polymers for Advanced Technologies* 1:311-318 (1990).  
 Derwent Abstract for EP 482 985.  
 Schadt et al., "Surface-induced parallel alignment of liquid crystals by linearly polymerized photopolymers" *Jpn. J. Appl. Phys.* 31:2155-2164 (1992).  
 Ichimura et al. "Reversible change in alignment mode of nematic liquid crystals regulated photochemically by command surfaces, modified with an azobenzene monolayer", *Langmuir* 4:1214-1216 (1988).

Seki et al., "Photochemical alignment regulation of a nematic liquid crystals by Langmuir-Blodgett layers of azobenzene polymers as command surfaces", *Macromolecules* 22:3505-3506 (1989).

Ichimura et al., "Reversible alignment change of liquid crystals induced by photochromic molecular films, reversible alignment of a nematic liquid crystal induced by pendent azobenzene groups-containing polymer thin films", *Makromol. Chem., Rapid Commun.* 10:5-8 (1989).

Ichimura et al. "Photocontrol of in-plane alignment of a nematic liquid crystal by a photochromic spiropyran monolayer absorbing linearly polarized light", *Chemistry Letters*, pp. 1063-1066 (1992).

Abstract 93-037881/05 for EP 525 477 (1993).

Abstract 93-037882/05 for EP 525 478 (1993).

Abstract 93-037877/05 for EP 525 473 (1993).

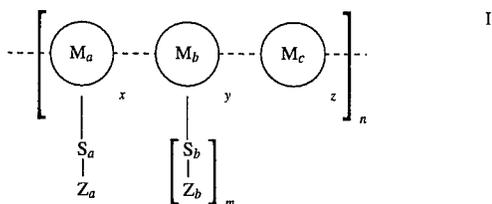
*Primary Examiner*—Joseph I. Schoffer

*Assistant Examiner*—Wu C. Cheng

*Attorney, Agent, or Firm*—George M. Gould; George W. Johnston; Robert A. Silverman

[57] **ABSTRACT**

The invention is concerned with linear and cyclic polymers or oligomers having a photoreactive ethene group. The polymers are of the formula



wherein

$M_a, M_b, M_c$  are monomer units for homo- or copolymers;  $x, y, z$  are mole fractions of the copolymers, whereby in each case  $0 < x \leq 1$ ;  $0 \leq y \leq 1$  and  $0 \leq z < 1$ ;

$S_a, S_b$  are spacer units;

$Z_a, Z_b$  are molecule units which can undergo photochemical isomerization/dimerization;

$n$  is a magnitude of 4-100 000 and

$m$  is 0 or 1,

The compounds are used as an orientating layer for liquid crystals.

**6 Claims, No Drawings**