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Synthesis and formation of anisotropic network from monomers diacrylates derivates of 4-hydroxybenzenethiol

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Abstract

New anisotropic films by photopolymerization of diacrylates compounds with mesomorphic properties have been obtained. The photopolymerization was carried out by irradiation of the monomers at oriented mesophase, in cells with planar alignment.

Bis{4-[6-(acryloyloxy)hexyloxy]benzoyl}-1-thio-4-oxyphenylen (**IIIa**) and Bis{4-[6-(acryloyloxy)undecyloxy]benzoyl}-1-thio-4-oxyphenylen (**IIIb**) monomers present thermotropic properties. The photopolymerization reaction of monomers was studied by photo-DSC. Oriented films, exhibiting highly optical anisotropy and optical transparency. The films were characterized by FT-IR.

Keywords: Anisotropic films; Diacrylates; Mesophase; Photopolymerization

1. Introduction

In the past years the photoinitiated polymerization of direactive liquid crystals has been of great interest in the technological and scientific research area, because these films are suitable for the preparation of thin, oriented solid films as electronic components, especially for applications such as solid state polarizers, interference filters, etc. [1–6].

Oriented films, commonly called anisotropic networks are prepared from liquid crystal molecules which contain at least two reactive groups [7,8]. They are carried out to mesomorphic phase, oriented by mechanical treatment and photoirradiated with ultraviolet light, where the photoinitiator is fragmented homolithically, generating the beginning of polymerization. Then homogeneous macroscopically oriented thin solid films of high mechanical strength, anisotropic thermal and electrical resistivity can be produced [9,10].

The advantage of photoinitiated polymerization over thermal polymerization is that the photopolymerization has become greatly independent from temperature which enables selection of the mesophase [11].

Nematic networks can be produced by polymerization of monomers in nematic state, where these are preferred over smectic monomers for most practical applications due to their lower viscosity [12].

This paper deals with the preparation, characterization of new nematic networks of monomers diacrylates and the studies of the photoinitiated polymerization reactions by photo-DSC.

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2. Experimental section

2.1. Synthesis of polymerizable monomers with acrylate end groups

The monomers were synthesized according to the synthetic routes shown in Schemes 1–3.

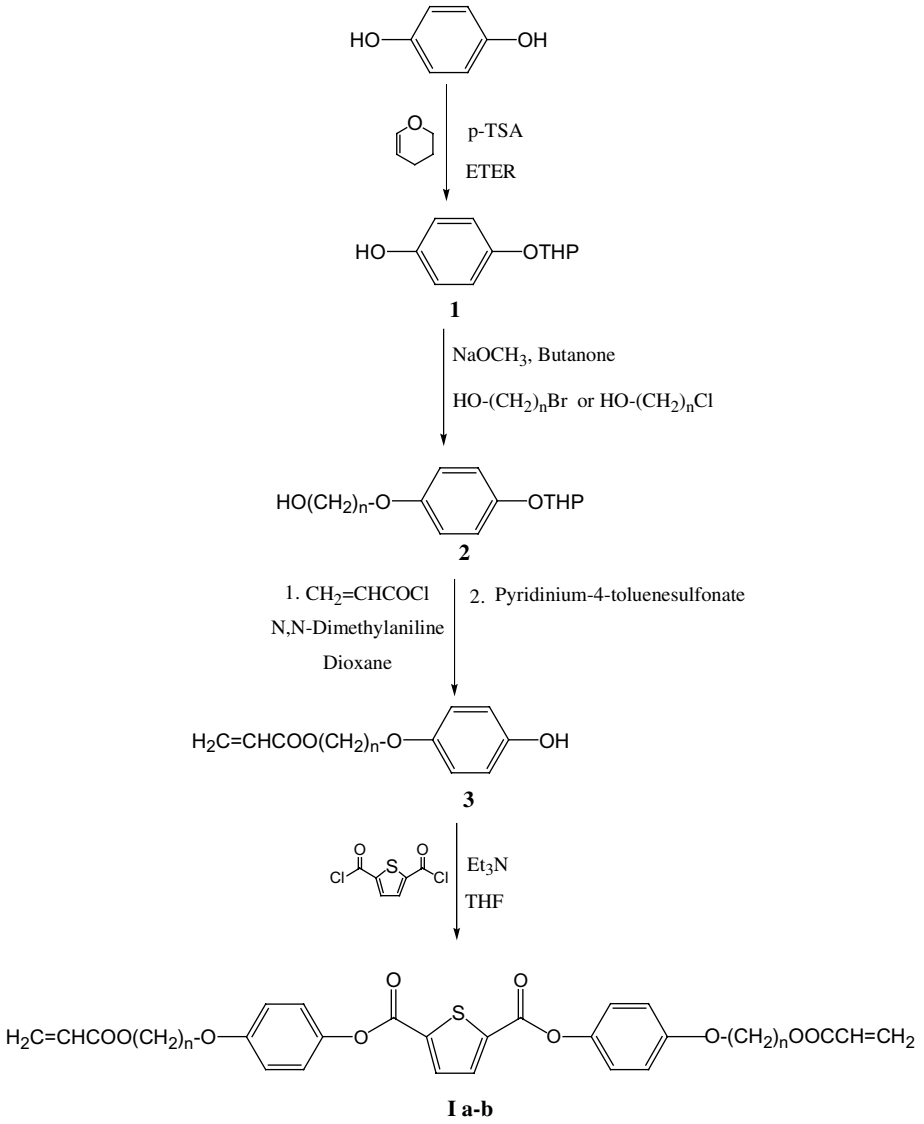
As an example, the synthesis of some monomers are presented below. All the solvents were dried before using them. Organic starting chemicals were purchased from Aldrich and used as delivered.

Optical absorption measurements were taken using an ATI Unicam UV 4 spectrophotometer. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker CA250 spectrometer. The chemical shifts were calibrated from tetramethylsilane (TMS). Infrared measurements were carried out using a Nicolet Magma-IR^{TM} 550-Fourier transforming instrument. A STA 625 differential scanning calorimeter (DSC) was used to determine the thermal transitions. All heating and cooling rates were 10 °C/min under nitrogen.

The in situ photopolymerization was studied by DSC using a Perkin-Elmer DSC-7 suitably modified for the study of photopolymerization.

Mesomorphic properties were studied by optical microscopy using a Leitz Ortholux II Pol-BK, equipped with a hot stage.

Experimental details are not given for all compounds, but can be found in Refs. [13–15].



Scheme 1. Synthetic routes of the different monomers.