Thermotropic Liquid Crystalline Polymers Smectic “C” Phase in a Liquid Side-Chain Poly α Chloroacrylate

G. Decobert¹, F. Soyer¹, J.C. Dubois¹, and P. Davidson²

¹ Laboratoire de Chimie, THOMSON-CSF, Domaine de Corbeville, B.P. 10, F-91400 Orsay Cedex, France
² Laboratoire de Physique des Solides, Bat. 510, Université de Paris Sud, F-91405 Orsay Cedex, France

SUMMARY

Microscopic observations, thermal studies, dielectric relaxation measurements and X-Ray diffraction experiments on magnetically aligned samples of a mesogenic side-chain poly 4-butoxy-phenyl-4(α-chloroacryloyloxyhexyloxy) benzoate are presented.

INTRODUCTION

Many studies in the field of mesogenic side-chain polymers have been carried out during last years. They now allow to find some reports of existence of thermotropic liquid-crystalline (LC) states for such polymeric system (1, 2, 3). In the liquid crystalline states, the motions of the polymer main chain have to be decoupled from those of the anisotropically oriented mesogenic side chains by flexible spacers. The synthesis and identification of nematic, cholesteric and some smectic such as Sₐ, S₈, polymeric liquid crystals have already been reported (4, 5). Some authors claimed formation of Sm tilted smectic phase (6, 7).

In this communication, we report direct information about the structural state of the smectic C phase of a polyαchloroacrylate by means of optical microscopy, differential scanning calorimetry, dielectric relaxation measurements and X-Ray diffraction experiments on magnetically aligned samples.
RESULTS AND DISCUSSION

N and Sc phases were discovered in the polyα-chloroacrylate of general formula (1)

\[
(1) \quad \begin{array}{c}
\text{Cl} \\
\text{O} \\
\text{O} \\
\text{Cl}
\end{array} \quad \begin{array}{c}
\text{CH}_2 - \\
\text{C} - \text{O} - (\text{CH}_2)_6 - \text{O} - \text{R}
\end{array}
\]

with \( R = \)

Experimental Part

The synthesis of polymer (1) has been described earlier (8) (MW = 5.10^3). Preparation of p-n butyloxyphenol was made following the procedure of Klarmon et al. (9). Optical studies with polarized light were performed using a microscope (Leitz Orthoplan) equipped with a heating stage. The DSC curve was obtained with a DSC Perkin-Elmer and the frequency and temperature dependent dielectric measurements were made with an LCR Meter HP 4262A (temperature range: -70°C to 210°C, frequency range 100 Hz - 10 kHz)

Results

The characteristic DSC-curve with two endothermal peaks corresponding to \( S \rightarrow N \) and \( N \rightarrow \) isotropic melt transitions are given in fig. 1. The glass transition temperature was observed on the DSC curve at 30°C.

Both \( N \) and \( S \) phases display a very fine "Schlieren" texture at temperatures below the clearing temperature \( T_{cl} \) (fig. 2). Increasing the temperature up to 388K leads to full disappearance of the anisotropy, i.e. to the transition into the isotropic melt.

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Fig. 1: DSC-curve of polymer 1
scan rate: 20°C/min
weight of the sample: 7 mg