

Liquid Crystal Polymers with Side Chains SCLCP Materials and Techniques an

Abstract

The most recent developments in the chemistry of side chain liquid crystal polymers are the primary focus of this review. It focuses on new, clearly defined structures, supramolecular arrangements, properties, and applications as well as current trends in synthetic methods. Except for some areas that have recently been reviewed, such as dendritic and elastomeric systems, the review covers literature published in this century.

Keywords: Liquid crystals • Side chain polymers • Polymer modification • Polymer synthesis • Self-Assembly

Introduction

Materials that combine the mechanical properties of polymers with the anisotropy of liquid crystalline they were able to synthesize polymers with nematic, smatic, and cholesterol phases through free radical polymerization of methacryloyl type monomer, despite some previous attempts [1]. Their method of decoupling the motions of a polymer main chain from a mesogens allowed side chain moieties to build up long-range ordering. There have also been reports of systems with disco tic-type mesogens that can produce various columnar phases. The decoupling spacer idea made it possible to make a wide range of SCLCP materials using a variety of structural design and synthetic methods, many of which underwent significant changes [2]. Applied research on polymer networks, transistors, PLEDs, memory storage devices, and sensing and memory storage devices was the driving force behind the development of fundamental research over time. The purpose of this paper is to review the most recent findings in novel synthesis. LC side chain polymer chemistry and properties has been the subject of a few prior studies, but these studies were focused on more specific topics [3].

Methods

Polymerization of free radicals

Acrylic monomer polymerization in the presence of free radical initiators is a relatively straightforward procedure that is frequently utilized in the synthesis of novel and useful side chain systems anchored on carbon polymer backbones [4]. This method has recently been used to make azobenzene elastomers for tunable gratings as well as functionalized polymer precursors for liquid crystalline polymer networks with side chain cinematic and chalcone moieties. Polymer LC properties are influenced not only by the structure of the side chain mesogens or the length of the flexible spacer, but also by the flexibility of the polymer skeleton, which is influenced by polydispersity and molecular weight [5]. Recently, copolymers with a poly main chain and analogous copolymers of MMA, terminal, and limonene have been described. Even though they were only vaguely characterized, their properties were compared to those of poly-methacrylate and acrylates with the same phenyl benzoate monogenic group. It has been suggested that the new backbone-containing torpedoed moiety's structure makes it possible for mesophases to be more thermally stable. The materials were, as expected, extremely polydispersity [6]. The initial stage of SCLCP's synthesis was carried out using an intriguing synthetic approach. Tran's esterification resulted in acrylic monomers with methoxybiphenyl monogenic pendants via a very efficient enzymatic procedure.

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Hydrosilylation and LC polysiloxanes with side chains

Additional approaches to the polysiloxanes side chain system will be discussed in this section as well. The technology of siloxane polymers is of great interest. Materials with a much lower T_g than polymethacrylates and liquid crystalline polyacrylates are provided by the highly flexible Si-O bonds. For SCLC polysiloxanes that are capable of generating mesomorphic properties at moderate temperatures, the Hydrosilylation reaction, which is triggered by platinum complexes, has currently been described [7]. The majority of current research focuses on the synthesis of polymers that produce cholesteric and chiral smectic C mesophases. The polydispersity is created during the synthesis of the polysiloxanes substrate, despite the fact that catalysed Hydrosilylation of mesogenic alkenes with polymers results in the almost complete addition of the Si-H moiety across the alkene double bond. The fact that some of the authors used the same "silicone" oligomer substrate allows the reader to directly compare the thermal properties of these materials with different mesomorphic side chains, which is a good coincidence [8]. They can either form random copolymers by grafting various side chains together or by varying the structure of a flexible spacer between the cholesterol group and the siloxane backbone. Liquid crystalline side chain polysiloxanes have the potential to be useful in optical applications like switches, filters, and data storage systems. Copolymers containing dichroic dyes, azobenzene or anthraquinone derivatives, copolymers containing cholesterol and menthol or a mesogens, and non-mesogenic chiral systems are also the focus of current research the polysiloxanes-based hydrogen-bonded SCLCPs have been shown [9]. There were two types of copolymers and polymers made of siloxane, the latter of which can have up to one monomeric unit. The interactions between the imidazole ring and carboxypropyl side groups of polysiloxanes in azobenzene or stilbazole derivatives produced the LC properties in both instances. SCLCPs can be constructed using this method, which allows for additional tuning of liquid crystalline properties by altering the ratio of hydrogen bonded species.

Systems of liquid crystals that can be assembled by themselves

For LC materials to have the best possible properties, it is essential to have an understanding of the structure-properties relationship [10].

The other method, in contrast to SCLCPs, in which the side groups are bonded to the polymer chain by covalent bonding, uses non-covalent interactions like ionic or hydrogen bonding to self-assemble relevant moieties and create LC polymers. The strength of this bonding ranges from to. There are previous studies on this type of assembly of flexible spacer or mesogenic group components. Recently, this strategy has evolved into the architecture of SCLCPs, which can be greatly expanded while simultaneously facilitating simpler synthetic methods. Bent-core side chain polymethacrylates based on the same type of hydrogen bonding have been described. In general, the self-assembly can take place for either a polymer or a monomer, which is then polymerized in a subsequent step. Up until now, some of them have stable smectic phases. The structure of pendant side groups in main-chain/side chain polymers has been reported to involve ionic or hydrogen bonding. The photo refractivity of SCLCPs, which have a hydrogen-bonded moiety, was compared to that of analogues with the same mesogens of nitrobenzylideneaniline but no hydrogen bonding group. Diffraction efficiencies of the hydrogen-bonding polymer were found to be high below the glass transition temperature.

Conclusions

Side chain liquid crystalline polymer research is still a rapidly growing field due to numerous potential and existing applications. Using extensive fundamental studies from the past, more than one hundred new polymeric structures were described between 2000 and 2008. As a result of significant advancements in synthetic methods, a wide range of new systems can now be obtained. Using living and controlled polymerization methods, tailored polymers can be produced with much less difficulty. Bulky monomers containing a variety of mesogenic moieties have been successfully polymerized using the RAFT and ATRP polymerization techniques. Polymeric structures can now be much more clearly defined thanks to new catalysts and significant advancements in research into ring opening polymerization (ROMP) and ring opening metathesis polymerization (ROP). Non-covalent side chain system research is expected to contribute significantly. Ion and hydrogen bonding-driven self-assembly has been the method of choice for obtaining the layered nanomaterials of SCLCP. It provides a simpler and more effective method for synthesizing the

entire range of new polymers.

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