Thesis Title Synthesis, Characterization and Study of Some Physical Properties of Photocrosslinked Liquid Crystalline Elastomers
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ABSTRACT

The photocrosslinkable side chain liquid crystalline polysiloxanes were synthesized and their phase behaviours were studied.

In the first part, low molecular weight liquid crystals containing cinnamate group with different spacer lengths and terminal groups were synthesized and characterized. Phase transitions of all compounds were determined by DSC and optical microscopy. It was found that the intermediate compounds, 4-(alkenyloxy)cinnamic acid, with longer spacer length gave the broader mesophase range and lower melting and clearing points. On the other hand, in the case of low molecular weight liquid crystals, esters of cinnamic acid, the longer flexible spacer gave rise to the shorter mesophase range. Four synthesized mesogens showed nematic phase whereas only one compound containing chiral group showed smectic and cholesteric phases.

In the second part, different side chain liquid crystalline polysiloxanes were synthesized by hydrosilation reaction of polysiloxane with the synthesized mesogens with different spacer lengths and terminal groups obtained in the first part using platinum catalyst. Except the glass transitions, all other phase transitions of polymers could not be seen in the DSC thermograms. For polymers with the same terminal substituent group, Tg of the one containing longer flexible spacer decreased but Tc was increased and therefore the mesophase range became broader. In the case of polymers with equal spacer length, it was found that the higher rigidity and polarizability of the terminal substituent group in the polymer containing a chiral group showed higher Tg and broader mesophase range.

In the third part, photolysis of side chain liquid crystalline polysiloxane films irradiated with mercury lamp were elucidated by IR and UV spectroscopies. The (2+2) cycloaddition and photo-Fries rearrangement products have been found in polymers containing 3 and 6 methylene units with approximately the same rate of crosslinking. However, photocrosslinking of polymer containing three benzene rings and a chiral group was hardly occurred in the mesophase as well as in the isotropic phase.