Thin films systems of multi-functionalities have been developed in terms of optical resolutions and non-linear optics (NLO). Optical isomers such as α-amino acids or pharmaceutical materials are usually very difficult to separate by means of conventional methods such as distillation or recrystallization, because their chemical or physical properties are same. Optical resolutions of these isomers are normally carried out by chromatographic methods, using small differences of absorption-desorption behaviors of these isomers on chromatographic columns. If the optical resolutions could be successfully done through membranes, wide applications are expected in terms of industrial purposes. The optical resolutions through thin membranes require an effective molecular recognition so that only one isomer can permeate through the membrane and the other isomer is rejected to permeate.

Non-linear optical (NLO) materials have been attracting a great interest in opto-electronic applications. Particularly, second harmonic generation (SHG) for frequency doubling and switching has been widely studied. SHG activities require a good orientation of polar groups within thin films when guide waves are designed. Organic materials are much superior to inorganic materials in terms of SHG activities and thin films of polymers are much advantageous for practical applications because of easy processing. Thin films of SHG active polymers having high thermal stabilities are required when a strong laser beam is applied, because of heat accumulations within the films. Therefore, it has been desired for the NLO active polymers to make thin films of high temperature polymers.

This paper deals with thin films systems for optical resolutions and NLO active high temperature polymers.

OPTICAL RESOLUTIONS THROUGH MEMBRANES 1,2)

Effective separations of optical isomers through thin membranes request molecular recognitions by membranes so that only one-side of isomers can permeate through the membranes. Chiral interactions of α-helix of poly(α-amino acids) with optical isomers provide a great possibility to separate through the membranes. In case when water-soluble substrates such as α-amino acids are selected, it would be necessary to arrange hydrophilic domains along through the helix of poly(α-amino acid). On the other hand, hydrophobic domains would be required for self-organizations
of the helix of poly(a-aminoacid) within the membranes. Based on this molecular design of the membranes, following structure was proposed:

This molecular design of the membrane can be achieved by poly(L-glutamate) having following amphiphilic side chains, which can be synthesized by an ester exchange reaction of poly(methyl L-glutamate) with NONIPOL 6 (a commercially available surfactant):

\[
\begin{align*}
\text{HO} \left( \text{CH}_2 \text{CH}_2 \text{O} \right)_m \text{C}_9 \text{H}_{19} \\
\text{COO(CH}_2\text{CH}_2\text{O)}_5 \text{C}_9 \text{H}_{19}
\end{align*}
\]

A 15% solution of poly(methyl L-glutamate) in dichloroethane was heated at 65°C for 60 hr with slightly excess amount of NONIPOL 6 in the presence of p-toluenesulfonic acid as a catalyst, with eliminating methanol out of the solution. Polymer, NON 6 PLG, was obtained by pouring into methanol. FT-IR spectrum of NON 6 PLG is shown in Fig. 1 and NMR spectrum is indicated in Fig. 2.