

## SYNTHESIS AND PROPERTIES OF THERMOTROPIC POLYAMIDES AND POLYURETHANES

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We started to investigate thermotropic polyesters in 1983, when there were not so many researchers studying on thermotropic polymers in the academic world.

To synthesize polyesters with low melting points and low transition temperatures by which the correlation between polymer structure and liquid crystallinity can be examined, flexible spacers were introduced into the polyester backbone. The obtained polyesters gave sharp solid-state CP/MAS NMR spectra, affording the information on conformations of phenyl benzoate moiety and of alkylene spacer. Although both conformations were regular in as-prepared samples, the solid state to a small extent changed with thermal treatment. As many aromatic polyesters are hardly soluble in NMR solvents, measurement of the solid-state  $^{13}\text{C}$  NMR spectrum was found to give much information on primary and secondary structures. In addition, thermotropic polyesters containing flexible spacers gave molded samples with considerably high strength.

An aromatic polyamide with lyotropic liquid crystallinity is represented by DuPont's Kevlar, i.e., poly-p-phenylene terephthalamide, which was commercialized in 1972. We have studied to prepare thermotropic polyamides which show liquid crystallinity on melting. Similarly to the polyester, the introduction of flexible spacer gave copolyesteramides with lowered transition temperatures, which contained p-aminophenol as an amide-forming component. To this structure, p-phenylenediamine, bis(p-aminophenyl)methane, or a substituted 4,4'-biphenylenediamine was added as the second amide-forming component. Correlation between the polyesteramide structure and liquid crystallinity was elucidated.

On the basis of these informations, thermotropic copolyamides and polyamides without ester linkage were synthesized. Mechanical properties of the thermotropic spacer-containing polyamides depend on the molecular weight, and a high molecular weight thermotropic polyamide gave injection-molded specimen with relatively high