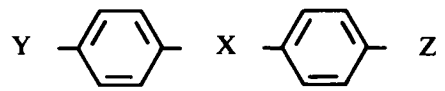
NASA TECH BRIEF

Production of Crystalline Polymers via Liquid Crystal Monomers

A method for producing crystalline polymers through a liquid crystalline phase of monomers has been developed.

The monomers are from a family with the following basic structures:

(1) Aromatics of the type:



where Z is a polymerizable group such as vinyl, X can be any of the central groups such as -CH = CH-, -CH = N-, -N = N-, -N = N(O)-, and Y can be any end group such as $CH_3(CH_2)_nO$, Cl, Br, I, NO_2 (described in a review article by G. H. Brown and W. G. Show in Chemical Reviews 57, 1049 (1957)). Substituents can also be placed at the ortho and meta positions of the aromatic rings.

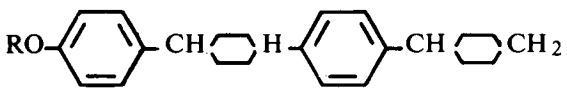
(2) Any other nematic, smectic, cholesteric, or lyotropic liquid crystal containing a polymerizable group.

The monomer is polymerized while held in the liquid crystalline phase either thermally, photolytically, catalytically, or by X- or gamma-ray irridiation.

In addition to the previously described polymerizations, polymerization can be performed in an electric or a magnetic field that influences the orientation of the molecules in the liquid crystalline phase.

The principle of this polymerization is as follows: the liquid crystalline phase is one in which long-range order exists between molecules in a phase having the flow properties of a viscous liquid and the optical properties of an anisotropic solid. Thus, a monomer reacting in this phase should have preferred orientations leading to crystalline polymers. A magnetic or an electric field can increase the ordering in this phase and consequently influence the crystallinity.

As an example of the above reaction, the preparation of new monomers of the following structures can be cited:



where R is CH_3, C_4, H_9, or $C_{18}H_{37}$

These vinyl monomers are solids at room temperature. Polymerization can be conducted in the liquid crystalline phase without catalyst and leads to good yield of polymer in several hours.

Notes:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Headquarters
National Aeronautics
and Space Administration
Washington, D.C. 20546
Reference: B69-10744

Patent status:

No patent action is contemplated by NASA.

Source: C. Palos and M. Labes of
Drexel Institute of Technology
under contract to
NASA Headquarters
(HQN-10235)

Category 03