NASA TECH BRIEF

NASA Headquarters

A Stable Liquid Crystal for Electro-Optical Displays

The problem:

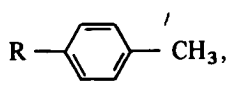
Many electro-optical display devices use liquid crystals to provide an iridescent display. Unfortunately, one of the most versatile liquid crystals used for this purpose (the anil-type) is chemically unstable in the presence of heat or moisture.

The solution:

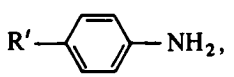
The substitution of a hydroxy (OH) group ortho to the anil linkage makes the anil-type liquid crystal more stable.

How it's done:

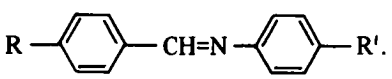
Nematic liquid crystals such as the anil-type are molecularly ordered liquids with many of the optical properties of a crystal. The anil-type molecule consists of a para substituted methyl benzene molecule,



linked to a para substituted aniline molecule,



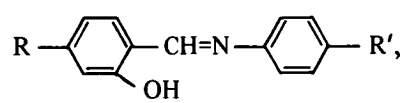
through an "anil" linkage,



It is the anil linkage (C=N) that may be broken by the action of heat or water. Previous efforts to stabilize this molecule involved changing the terminally substituted (R,R′) groups; ortho substituted groups were rarely tried, primarily because they would change the essentially linear shape of the molecule and might be expected to detract from its liquid crystalline properties. However, the ortho hydroxy compounds are not only more stable, but instead of diminishing the crystalline character of the liquid, the hydroxy substitution gives liquids with more homogenous optical scattering characteristics and more reproducible threshold voltages for electro-optical displays.

The preparation of o-hydroxy-N(p-methoxybenzylidene)-p-n-butyaniline(OHMBBA) is illustrative of the general technique used in the synthesis of these compounds. Equimolar quantities of p-methyoxy-o-hydroxybenzaldehyde and p-n-butyaniline are mixed in absolute ethanol and heated at boiling for 30 minutes. The OHMBBA is crystallized by cooling to 0° C.

In addition to OHMBBA, similar compounds with the basic structure,



can be prepared, where R and R′ may be, for instance, the same or different alkyl, alkoxy, aryl or aryloxy groups.

Notes:

1. Additional information may be found in "Properties of Structurally Stabilized Anil-Type Nematic Liquid Crystals", I. Teucher, C. M. Paleos, and M. M. Labes, Molecular Crystals and Liquid Crystals. 1970. Vol II, pp. 187-189.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   NASA Headquarters
   Code KT
   Washington, D. C. 20546
   Reference: B72-10746

(continued overleaf)

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457 (f)] to Temple University, Philadelphia, Pennsylvania 19122.

Source: Mortimer M. Lakes of
Temple University
under contract to
NASA Headquarters
(HQN-10714)