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ANOTHER TYPE OF "DISCOTIC PHASES"

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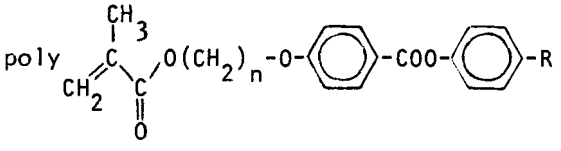
Typical properties of "discotic phases" as a type of mesophase have been reported by Billard,[1] Chandrasekhar[2] and others.[3] Whereas Chandrasekhar does not refer to the optical sign of a uniaxial oriented phase of those disc-like molecules, Billard stated clearly that such a "discotic phase" shows optical negative double refraction, this being a typical feature of this texture. The substance was, as in the case of Chandrasekhar, a monomolecular compound (alkoxy derivatives of triphenylene).[3] We recently found, when inspecting a series of polymeric mesophases of the type



that is some cases an optical negative character of the mesomorphic phases appeared. However, only a few members of this new class of compounds, synthesized by Ringsdorf et al.[4] were of the optical negative type. A typical example is the polymer with n=2 and R=OCH_3. The substance has a relatively sharp transition point at 100°C, a mesophase being formed, which has been designed as "nematic" by Ringsdorf et al. (see table).

Under the heating microscope, between glass slides and with crossed Nicols, this mesophase shows the typical droplets and interference patterns that resemble a nematic phase. Spherulites exhibited an optical positive character under orthoscopic conditions and using a half wavelength plate.

Heating to higher temperatures (>∿130°C) leads to the vanishing of spontaneous double refraction. Within the mesomorphic range and applying pressure, homeotropy with a negative sign could be induced. This state was conserved completely if the sample was cooled down, a pseudomorphosis of the uniaxial mesophase texture being formed.

Substance N°.	n =	R =	Phases, note 1) transitions	ΔH iso [J/g]	Opt.character of droplets (Orthoscopic, obeserv.)	Opt. char. of the homoeotropic phase (Conoscopic observ.)
(1)	6		sm 164 n 184 i	-	-	+
(2)	2	$-OCH_3$	g 1oo n 121 i	2,3	+	-
(3)	6	$-O-CH_3$	g 95 n 1o5 i	2,1	-	+
(4)	Copolymer with (2) and a chiral group: 2	R=	g 18o ch >23o i	to be published by Ringsdorf et. al.	+	-
(5)	6	$-OC_6H_{13}$	g 6o sm 115 i	15,5	-	none
(6)	3	$-C_6H_{13}$	g $\sim$ 1oo sm 12o i	6,8	-	none
(7)	6	$-CH_3$	g $\sim$ 7o n 84 i	1,3	+	-

note 1) phase designations, transition temperatures and enthalpy values for the transition mesophase/isotropic phase as given by Ringsdorf et. al.

g: glassy; n: "nematic"; sm: "smectic"; i: "isotropic"; ch: "cholesteric"

This way, glassy samples of about 10-50 μm thickness are easily prepared, which show a perfect homogeneity of negative uniaxial character (conoscopic conditions, λ/2-plate being used).

The behavior resembles strongly a "discotic" phase but also to the well known transformation phenomenon of an "undisturbed" focal conic cholesteric texture into the Grandjean texture by touching the cover slide. Like the Grandjean texture the new phase formed by applying pressure, shows negative double refraction, but there is no optical activity. In the case of substance (4) an optical active typical Grandjean cholesteric phase texture is formed.

Other "Ringsdorf polymers" being inspected in the same manner showed different behavior which can be summed up as follows:

A negative uniaxial mesophase being conserved in the glassy state and persistent at room temperature could be produced with substance Nos. (2), (4), and (7); Nos. (1) and (3) yielded glasses with positive sign (see table). Nos. (5) and (6) did not give double refracting glasses, but solidified under pressure forming microcrystalline phases.

We shall not speculate about possible relations between constitution and optical behavior. More experimental work is necessary and being done in close cooperation with the Ringsdorf Group.

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