

This article was downloaded by: [Tomsk State University of Control Systems and Radio]

On: 21 February 2013, At: 12:40

Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954

Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/gmcl16>

A pure reentrant cholesteric phase

Nguyen Huu Tinh^a, C. Destrade^a, J. Malthete^b & J. Jacques^b

^a Centre de Recherche Paul Pascal, Domaine Universitaire, 33405, Talence Cedex, France

^b Laboratoire de Chimie des Interactions Moléculaires, Collège de France, 75231, Paris Cedex 05, France

Version of record first published: 28 Mar 2007.

To cite this article: Nguyen Huu Tinh, C. Destrade, J. Malthete & J. Jacques (1982): A pure reentrant cholesteric phase, *Molecular Crystals and Liquid Crystals*, 72:7-8, 195-199

To link to this article: <http://dx.doi.org/10.1080/01406568208084679>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.tandfonline.com/page/terms-and-conditions>

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be

independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

A PURE REENTRANT CHOLESTERIC PHASE

NGUYEN HUU TINH and C. DESTRADE

Centre de Recherche Paul Pascal, Domaine
Universitaire - 33405 Talence Cedex, France.

J. MALTHETE and J. JACQUES

Laboratoire de Chimie des Interactions
Moléculaires, Collège de France -
75231 Paris Cedex 05, France.

(Submitted for Publication November 23, 1981)

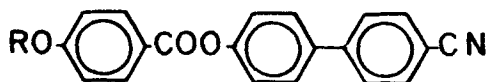
Abstract : An optically active derivative
of p-cyanobiphenyl exhibits a stable reentr-
tant cholesteric phase with the sequence :
 $K N^*_{SA} N^*_I$.

Introduction

The existence of a pure reentrant nematic
phase is known for several years¹⁻⁴. The recent
publication of a reentrant cholesteric mixture⁵
induced us to publish a part of our results in
this field.

Several cores with the cyano group are known
to be suitable for the appearance of the reentrant
phenomenon at atmospheric pressure, among them
p-cyanobiphenyl is one of the more stable and
easily available. As a matter of fact the com-

pounds 1a and 1b exhibit a reentrant nematic phase²



1a R = C₈H₁₇ K 97 N 120 S_A 201 N 240 I

1b R = C₉H₁₉ K 96(N 71) S_A 217 N 232 I

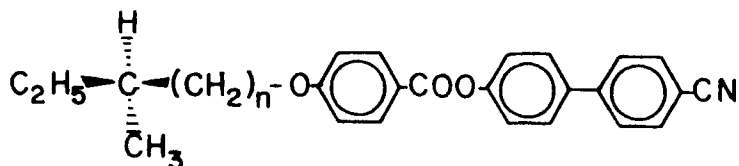
Generally, this phenomenon is only observed with one, two or three chain lengths in the same series, typically from C₈ to C₁₀^{3,4}. On the other hand, the substitution of an hydrogen atom by a methyl group in the normal chain is known to destabilise the nematic phase when it is near the polar rigid core⁶.

According to these observations, in order to prepare a pure p-cyanobiphenyl exhibiting a reentrant cholesteric phase, we have built up the chiral chain with a length nearly equivalent to those of 1 and a lateral methyl at its extremity.

Results

The compounds (S)-(+)-2a and (S)-(+)-2b were prepared by reaction of the corresponding optically active benzoyl chloride (obtained from (S)-(-)-2-methylbutanol) with 4-hydroxy-4'-cyanobiphenyl, and were purified by chromatography on silicagel. The purity was checked by elemental analysis and thin layer chromatography. Transition temperatures were determined by calorimetry using a DSC (Dupont 990). The textures were observed with a

polarizing microscope equipped with an heating and cooling stage (Mettler FP5).



(S)-(+)-2a, $n=3$: K 74 N^{*}99 S_A 178 N^{*}231 I;

$[\alpha]_{578}^{25} = +5.4^\circ$ (CHCl₃, $c \sim 1$).

(S)-(+)-2b, $n=5$: K 72 (S_C^{*}42) S_A 214 N^{*}220 I;

$[\alpha]_{578}^{25} = +3.7^\circ$ (CHCl₃, $c \sim 1$).

A reentrant cholesteric phase could be observed with compound 2a and was entirely miscible with the reentrant nematic phase of 1a (Fig. 1). The presence of "finger prints" in 2a cholesteric phases allowed us to observe an increasing of the pitch only near the N^{*} → S_A transition on heating, a similar behaviour has been described in a binary mixture⁵.

Discussion.

It is rather surprising that only 2a, with the relatively short C₆ branched chain, exhibits the reentrant phenomenon, when 2b with chain length corresponding to this of the reentrant nematogenic 1a is devoid of the expected properties. Furthermore, we must point out that 2b exhibits a metastable S_C^{*} smectic phase: it is the first example of a pure twisted S_C^{*} smectic liquid crystal with a strong longitudinal dipole moment.

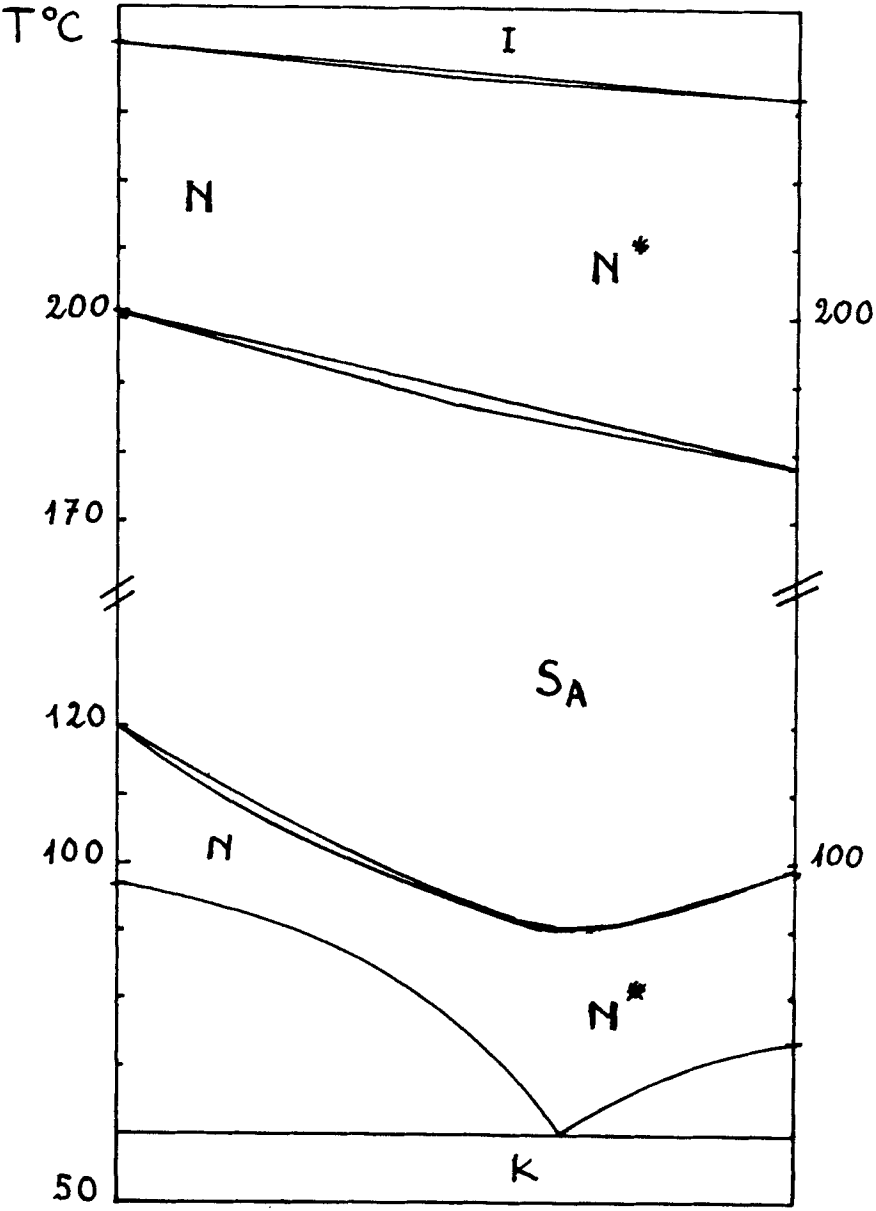


Fig. 1

References

- I F.Hardouin, G.Sigaud, M.F.Achard and H.Gasparoux, Phys.Lett., 71A 347 (1979).
- 2 F.Hardouin, A.M.Levelut, Nguyen Huu Tinh and G.Sigaud, Mol.Cryst.Liq.Cryst., Lett. 56 35 (1979).
- 3 Nguyen Huu Tinh, A.Pourere and C.Destrade; Mol.Cryst.Liq.Cryst., 62 125 (1980).
- 4 Nguyen Huu Tinh and C.Destrade, Nouv.J.Chim., 5 337 (1981).
- 5 J.Billard, C.R.Acad.Sc. Paris, 292 881 (1981).
- 6 G.W.Gray, Liquid Crystals and Plastic Crystals, John Wiley and Sons, New York (1974) vol.1 p. 103.