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Yong-Gang Yang

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Preliminary communication

A novel series of liquid crystalline organomercury complex liquid crystals

by YONG-GANG YANG and JIAN-XUN WEN*

Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences,
354 Fenglin Lu, Shanghai 20032, PR China

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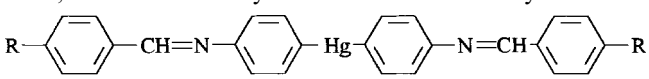
A novel family of bis[(4-alkoxyphenyl)ethynyl]mercury liquid crystals has been synthesized. Their mesomorphism has been studied by DSC and polarizing microscopy and a very broad SmA phase has been found.

The first thermotropic metal-containing liquid crystals were reported by Vorländer in 1910. He discovered that the alkali metal carboxylates, $R(CH_2)nCOONa$, formed classical lamellar phases characteristic of soaps. In 1923 Vorländer also found that the diarylmercurials shown below form smectic phases [1]. Several decades later, there is currently much interest in the synthesis of



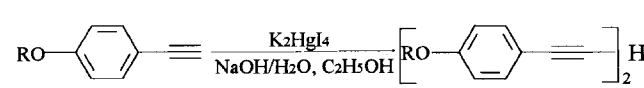
metal-containing liquid crystals owing to the perceived advantages of combining the properties of liquid crystal systems with those of transition metals. The area has been well reviewed recently with excellent new work appearing constantly [2, 3]. Metallomesogens are liquid crystalline materials with potential applications in optical devices. The basis for this prediction is the physical properties which are assumed to follow from the presence of a metallic centre in a mesogenic molecular skeleton. The synthesis of new mesogenic species with different ligands, metals or molecular geometries, is therefore the current subject of research.

Metal-containing compounds which exhibit thermotropic mesomorphism can be either coordination or organometallic complexes. The former are widespread and mesogenic complexes of several transition metals are known; however the only organometallic complexes reported up to now are mercury, palladium or platinum derivatives [2–4]. Few reports of organomercury liquid crystals have been published [1, 5–8], and most of these do not show clear phase behaviour.

We have now found that the derivatives of bis(phenylethynyl) mercury complexes can form liquid crystalline phases. Three compounds were synthesized from 4-alkoxyphenylacetylene, K_2HgI_4 and NaOH in 95%C_2H_5OH (aq) at room temperature, as shown in the scheme, according to a literature method [9]. Yields of 80–90% were achieved and characterization was by MS, elemental analysis, IR and ^1H NMR spectroscopy.

The phase transition temperatures of the target compounds were measured visually by optical microscopy using a polarizing microscope (Olympus PM-6) fitted with a heating stage (Mettler FP-80) and a control unit (FP-82), and by differential scanning calorimetry (DSC, Shimadzu DSC-50 calorimeter with a data system, heating and cooling rate 5 min^{-1}). The transition temperatures reported in this paper were the peak values of the transition from DSC traces, and are summarized in the table.

The three compounds are all liquid crystals, and with the lengthening of the tails the smectic phase is formed more easily. They exhibit clearly not only a classical nematic phase texture (figure 1, schlieren texture), but also a broad SmA smectic mesophase (figure 2). Further work on the phase behaviour of this series of organomercury liquid crystals is planned.



R= $(CH_2)nH$, n=6,7,8.

Scheme.

*Author for correspondence.

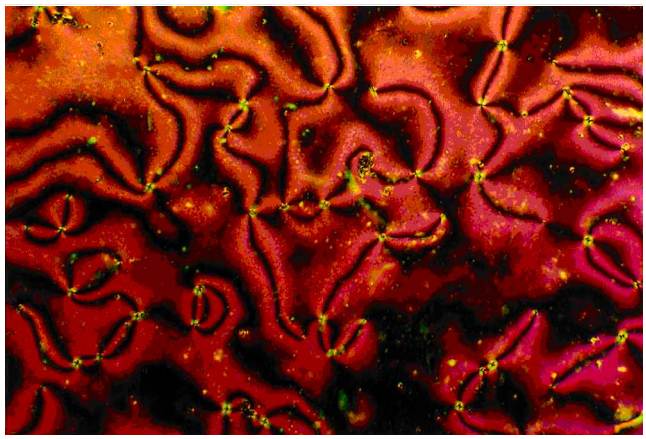


Figure 1. Photomicrograph of the texture of compound **a** in the N phase, at 115.7°C (x40).

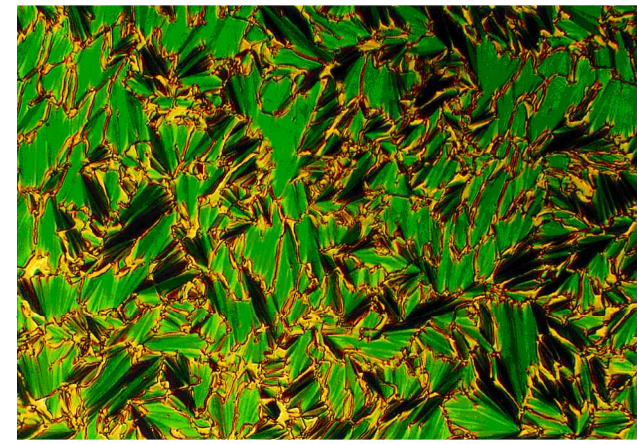


Figure 2. Photomicrograph of the texture of compound **a** in the SmA phase, at 85.5°C (x40).

Table. Transition temperatures of the organomercury complexes. Cr = crystal, N = nematic, S = smectic, I = isotropic.

Compound	*n*	Phase transition temperature/°C
a	6	Cr 94.6 N 127.5 I 125.3 N 90.8 SmA 77.4 Recr
b	7	Cr 81.3 SmA 112.1 N 112.8 I 111.2 N 110.0 SmA 71.7 Recr
c	8	Cr 66.2 Cr_2 69.9 SmA 123.1 I 120.9 SmA 61.5 Recr

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