

NOVEL CHOLESTERIC GLASSY LIQUID CRYSTALS OF 1,1'-DISUBSTITUTED FERROCENE: SYNTHESIS AND SELECTIVE REFLECTION PROPERTIES OF AN UNSYMMETRIC DIMESOGEN

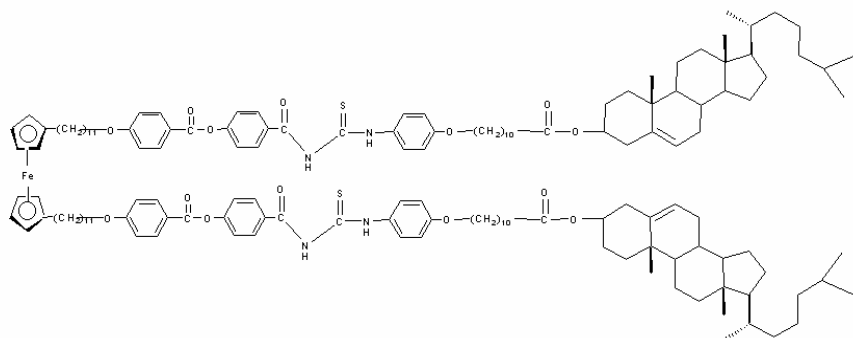
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There is a growing interest among chemists around the synthesis of liquid crystalline compounds containing transitional metals with the expectation that these can bring about additional properties like optical, electrical and magnetic behaviour in contrast to their organic counter parts.¹ Further, introduction of a ferrocene unit as a component of liquid crystalline materials can have an added advantage, given its ability to undergo reversible one - electron transfer processes.² The number of 1,1'-disubstituted ferrocene derivatives prepared to date are found to exhibit mesomorphic behaviour², some of them purely nematic, some SmC or both SmC and SmA. No glassy cholesteric mesophase of ferrocene has been reported until now.

The number of low molecular weight liquid crystals suitable for the fixation of the cholesteric molecular ordering by sudden cooling is limited compared to the polymeric systems. Tamaoki et al. have reported several studies on symmetric dimesogens containing two cholesteryl groups linked with diyne and alkyl chain which can be reversibly solidified maintaining the reflected colors and a rewritable full color recording was achieved from these materials³. Recently there has been an upsurge of interest on unsymmetric dimesogens which contain two non-identical mesogenic cores namely a cholesteryl ester unit attached to different moieties^{4,5}. Some of them show rich mesomorphic properties including an incommensurate smecticA (SmAic) phase.

From the application point of view, synthesis of non-symmetric ferrocene-dimesogens in which two structurally different mesogenic groups inter-linked by a flexible spacer exhibiting fixed cholesteric colors with glass transition (T_g) could be of great interest in the development of rewritable memory or recoding media. In continuation of our ongoing studies on the ferrocene compounds⁶⁻⁸ we report here on the synthesis and characterization of a dimesogen (see Fig. below) containing a versatile bidentate ligand namely N-Benzoyl-N-arylthiourea (BATU) and cholesterol. For comparative purposes, we also prepared several monomesogens without cholesterol.



Incorporation of BATU in the system could serve as a building block for preparing heterometallic liquid crystal systems.

The dimesogen exhibits an enantiotropic cholesteric phase with selective reflection in the visible region with iridescent colors. To our knowledge, this is the first ferrocene-based steroid system exhibiting such optical property. When this compound between two glass plates showing iridescent colors was quickly cooled down to 0°C by dropping in ice – water, glassy materials retaining the cholesteric colors were obtained. The Grandjean texture observed at the cholesteric temperature range was retained in the glassy state depicting helical orientation in the glassy solid.

The X - ray crystal structure determination of one of the representative example provided evidence in general for the involvement of structure determining intra- and intermolecular interactions in all the liquid crystalline compounds embracing BATU units.

Further, we report here the results of our studies on the evaluation of this compound as a rewritable memory or recording media.

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