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研究论文

氢键稳定的苯并菲盘状液晶的合成及介晶性

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摘要 盘状液晶分子能自组装成高度有序的六方柱状介晶相.
其各向异性的载流子高速迁移率使其成为较理想的有机光电子材料. 采用分子间氢键锚定柱状相,
获得介晶相温度范围宽、有序度高的苯并菲盘状液晶是本研究的目的. 本文通过分子设计, 合成了3个系列, 共18个有两种不同软链的苯并菲盘状液晶化合物$C_{18}H_6(OR)_5(OCH_2COOEt)$, $C_{18}H_6(OR)_5(OCH_2COOBu)$和$C_{18}H_6(OR)_5(OCH_2CONHBu)$, 其中R＝$C_nH_{2n+1}$, n＝4～9. 化合物的纯度和结构通过^{1}H NMR和元素分析确证.
化合物热稳定性通过热重分析(TGA)测定, 并显示出较高的热稳定性. 通过偏光显微镜(POM)和差示扫描量热法(DSC)对这些化合物的热致液晶性进行了研究. 结果显示对于分子中含有酰胺基的苯并菲液晶化合物$C_{18}H_6(OR)_5(OCH_2CONHBu)$, 与具有同样软链长度的分子中不含酰胺键的化合物系列$C_{18}H_6(OR)_5(OCH_2COOBu)$相比较, 前者由于柱内分子间氢键的形成, 具有更高的熔点和清亮点.

关键词 苯并菲 盘状液晶 柱状相 分子间氢键 柱状相锚定

分类号

Synthesis and Mesomorphism of Hydrogen-bonding Stabilized Triphenylene Discotic Liquid Crystals

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Abstract Discotic liquid crystals self-assemble to highly ordered hexagonal columnar mesophase (Col_{ho}) and exhibit anisotropic high charge carrier mobility, and can be used as organic opto-electronic materials. Hydrogen bonding stabilized triphenylene discotic liquid crystals with ordered Col_{ho} phases and wider mesophase ranges are the goals of present research. In this paper, three series with total of eighteen triphenylene discotic liquid crystalline compounds possessing two different kinds of peripheral chains, which are abbreviated as $C_{18}H_6(OR)_5(OCH_2COOEt)$, $C_{18}H_6(OR)_5(OCH_2COOBu)$ and $C_{18}H_6(OR)_5$- $(OCH_2CONHBu)$, R＝C_nH_{2n+1}, n＝4～9, were synthesized. The structural characterization of these compounds was carried out with ^{1}H NMR and elemental analysis. The thermal gravimetry analysis showed that all these compounds had good thermal stability up to 300 ℃. Their thermotropic liquid crystal properties were studied through polarized optical microscopy and differential scanning calorimetry. The results showed that, for compounds $C_{18}H_6(OR)_5(OCH_2CONHBu)$ and $C_{18}H_6(OR)_5(OCH_2COOBu)$, the former has higher melting and clearing points than the latter due to the intra-columnar intermolecular hydrogen bonding.

Key words triphenylene discotic liquid crystal columnar mesophase intermolecular hydrogen bonding anchorage of columnar mesophase

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