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Full Paper

混和柔链苯并菲盘状液晶的合成：分子对称性及氧原子效应对柱状介晶相稳定性的影响

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摘要
盘状液晶分子结构细微的变化可能会导致其介晶性显著改变。苯并菲盘状化合物烷氧链被含氧酯链取代，可能会出现全新的介晶性。本文合成了系列含三条丙氧乙酰氧基(PrOCH$_2$COO-)和三条烷氧基(RO-)混和柔链苯并菲盘状液晶化合物，结构简式为$C_{18}H_6(OC_nH_{2n+1})_3(OCOCH_2OC_3H_7)_3$,$n$=4 - 8, 和 2,3,6,7,10,11-六(丙氧乙酰氧基)苯并菲，结构简式为$C_{18}H_6(OCOCH_2OPr)_6$. 所合成的苯并菲化合物通过热失重分析(TGA), 显示在N_2气氛中350^{o}C以下稳定. 初步的X-射线研究显示, 化合物呈有序的六方柱状相(Col_{ho}).差示扫描量热法(DSC) 和带热台的偏光显微镜(POM)研究结果显示，这些混和柔链的苯并菲盘状化合物与同样链长的全醚链化合物$C_{18}H_6(OR)_6$和全酯链化合物$C_{18}H_6(OCOR')_6$相比，有更稳定的柱状介晶相和更宽的柱状相温度范围. 不对称化合物*asym*-$C_{18}H_6(OC_nH_{2n+1})_3(OCOCH_2COPr)_3$, n=5-8与其对称化合物*sym*-$C_{18}H_6(OC_nH_{2n+1)3}(OCOCH_2COPr)_3$相比，有更高的清亮点和更宽的介晶相温度范围. 而$C_{18}H_6(OCOCH_2OC_3H_7)_6$有最高的清亮点温度.

关键词 苯并菲,盘状液晶,柱状相,*β*-氧原子效应,分子对称性
分类号

Synthesis of Mixed Tail Triphenylene Discotic Liquid Crystals: Molecular Symmetry and Oxygen-Atom Effect on the Stabilization of Columnar Mesophases

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Abstract Small change in chemical structure of discotic liquid crystals can cause big difference in their mesomorphism. Replacing of the alkoxy peripheral chains of triphenylene by oxygen-atom containing ester chains would result in novel mesomorphism. A series of mixed tail triphenylenes containing propoxyacetyloxy and alkoxy, abbreviated as $C_{18}H_6(OC_nH_{2n+1})_3(OCOCH_2OC_3H_7)_3$, n=4—8, and hexa(propyloxyacetyloxy)triphenylene, $C_{18}H_6(OCOCH_2$- $OC_3H_7)_6$ were synthesized. Thermal gravimetry analysis (TGA) of three discogens showed that they had good thermal stability till 350 ℃. The mesomorphism was investigated through differential scanning calorimetry (DSC) and polarized optical microscopy (POM). The preliminary X-ray diffraction (XRD) results of one compound showed that it exhibited ordered hexagonal columnar (Col_{ho}) mesophase. These mixed tail triphenylene derivatives possessed much stable Col_{ho} mesophase and wider mesophase ranges than their hexaalkoxytriphenylene $C_{18}H_6(OR)_6$ and hexaalkanoyloxytriphenylene $C_{18}H_6(OCOR')_6$ analogues. The asymmetrical compounds 2,6,11-trialkoxy-3,7,10-tri(2-propyloxyacetyloxy)triphenylenes with n=5—8 displayed higher clearing points and wider temperature ranges than their symmetrical isomers 2,6,10-trialkoxy-3,7,11-tri(2-propyloxyacetyloxy)- triphenylenes, while $C_{18}H_6(OCOCH_2OC_3H_7)_6$ had the highest clearing point due to the *β*-oxygen-atom effect.

Key words triphenylene discotic liquid crystal columnar phase *β*-oxygen-atom effect molecular symmetry

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