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铁电液晶摩擦-自组装非对称取向

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摘 要: 采用分子自组装单层(SAM)技术对铁电液晶(FLC)进行取向,结合传统的摩擦取向技术,制备了非对称取向的FLC器件。实验结果表明,在FLC相变过程中,无需施加电场,即可获得单畴取向。基于分子模拟和取向原理分析,得出在 P_s 作用下,FLC分子与SAM终端基团取向一致。通过分子在表面-体相过渡区内的相互作用,FLC器件能够实现无缺陷的单畴取向。

关 键 词: 铁电液晶; 自组装单层; 摩擦取向; 非对称取向
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Self-Assembled-Rubbing Hybrid Alignment for Ferroelectric Liquid Crystal

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Abstract: Molecular self-assembled monolayer (SAM) technique is used for ferroelectric liquid crystal (FLC) alignment, and with using conventional rubbing technique, hybrid-aligned FLC cell is fabricated. Without applying electric field during phase transition of FLC, mono-domain alignment of FLC device is obtained. Experimental results show that contrast ratio increases with the polarity of SAM terminal group. Based on molecular simulation and analysis of alignment principle, it is concluded the directions of P_s near the SAM and the rubbed substrates are consistent under P_s action between FLC molecules and SAM terminal groups. Via molecular interaction within surface-bulk transition region, the molecules in FLC cell could form mono-domain alignment with no defect.

Key words: ferroelectric liquid crystal; self-assembled monolayer; hybrid; mono-domain

1. 引言
铁电液晶(FLC)具有快速响应、高对比度、低功耗等优点,在显示领域具有广泛的应用前景。然而,传统的摩擦取向技术存在取向不均匀、易产生缺陷等问题。近年来,分子自组装单层(SAM)技术在液晶取向领域得到了广泛应用。将SAM技术与摩擦取向技术相结合,可以实现非对称取向,从而提高器件的对比度和稳定性。本文研究了在摩擦-自组装非对称取向技术下,铁电液晶(FLC)的取向特性。通过分子模拟和实验分析,探讨了在 P_s 作用下,FLC分子与SAM终端基团的取向一致性,并验证了该技术在实现无缺陷单畴取向方面的有效性。

S_C^* , S_A S_C^* ,
Zigzag , $N^*-S_C^*$
“V” ,
2 , S_A
1
 , $N^*-S_C^*$
[1] , N^*-
 S_C^*
 ;
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 。
 ,
 ;
 [2] 。
 ,
 ,
 [3] ;
 [4-5] ; [6]
 ; M. Okabe
 , [7] 。
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 “V” ,
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2
RN-1199 (Nissan
chem); R-2301 (AZ electric materials)
;isotropic 86 °C- N^* 64.7 °C- SmC^* -4 °C ;
 $P_s=3.5\text{ nc/cm}^2$ 。 ITO
 , SiO_2 ITO ,
 ,
 [8] 。
1 。

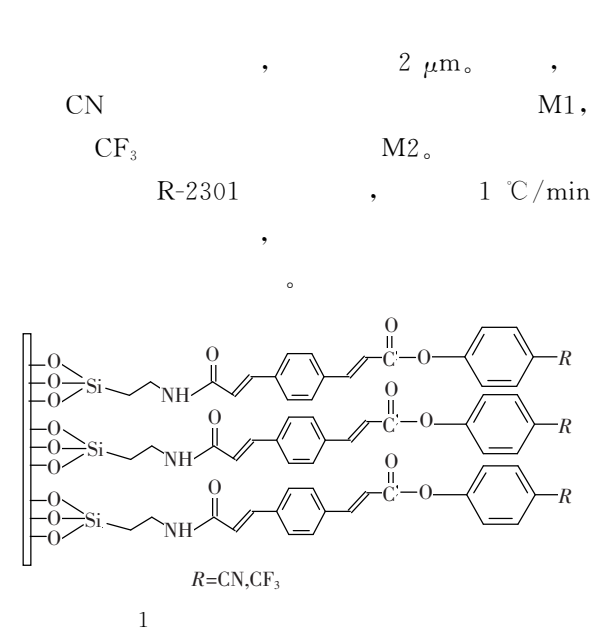


Fig.1 Schematic molecular structure for self-assembled layer

3
M1/M2
 ,
 。 LCT-5016C
 : CF_3 500:1;
CN 700:1。 M1/M2
 ,
 CF_3 CN , CN ;
 ,
 M1/M2
 ,
 M1/M2
 、 2 M2
 。 2 ,
 , 2(b)
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 ,
 M1、M2
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 [8] 。
1 。

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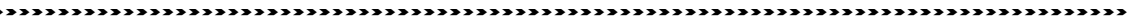
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