液晶与显示
中文核心期刊
Chinese Journal of Liquid Crystals and Displays
主管：中国科学院
主办：中国科学院长春光学精密机械与物理研究所
中国物理学会液晶分会
中国光学光电子行业协会液晶分会
主编：郭海成

液晶与显示 2013, 28(2) 199-203 ISSN: CN:

器件物理及器件制备技术

动态掩膜光刻在液晶取向中的应用

胡华超, 魏冰妍, 胡伟, 陆延青

南京大学 现代工程与应用科学学院,江苏 南京 210093

摘要： 利用基于数控微镜阵芯片的微投影光刻系统将任意设定的图形投影到SD1取向涂层上,约束SD1分子的排列方向,进而控制液晶的区域取向。该动态掩膜光刻系统可用于液晶取向的任意图形制备和偏振控制,实际分辨率达到了5 μm。基于SD1材料的可擦写特性,实现了不同一/二维码间的光控转换,并实现了任意灰度的分区控制。上述器件均可在外场作用下实现开关或调谐。该动态掩膜光刻技术可方便地实现实时、复杂的液晶图形取向控制,在信息显示与识别及可调光子学器件等方面有着广阔的应用前景。

关键词： DMD 液晶 光取向 二维码 灰度

Applications of Dynamic Mask Based Photolithography in Liquid Crystal Alignment

HU Hua-chao, WEI Bing-yan, HU Wei, LU Yan-qing

College of Engineering and Applied Sciences, Nanjing University, Nanjing 210093, China

Abstract: A micro-lithography system based on digital micro-mirror device is utilized in liquid crystal (LC) alignments. The projected images on SD1 guide the SDI molecular orientations of the command layer, and further determine the directors of LC. Both complex pattern fabrication and arbitrary polarization control could be accomplished on this system with resolution up to 5 μm. Pattern transforming among different bar codes and subarea controlling of random gray scale have been demonstrated by means of the optical rewritability of SD1. These LC devices are switchable and tunable under applied fields. The dynamic LC photo-patterning technique may be widely used in information display and identification, tunable photonic devices, etc.

Keywords: DMD liquid crystal photoalignment 2D barcode gray scale

收稿日期 2013-01-15 修回日期 2013-01-26 网络版发布日期

基金项目:

教育部博士点专项科研基金(No.20120091120020)

通讯作者: 胡伟,E-mail:huwei@nju.edu.cn

作者简介: 胡华超(1986-),男,河南沈丘人,硕士研究生,主要从事液晶光控取向技术方面的研究。

作者Email: huwei@nju.edu.cn

参考文献：

[1] Gibbons W M, Sun S T. Optically generated liquid crystal gratings [J]. *Appl. Phys. Lett.,* 1994, 65(20):2542-2544. [2] 郭海成.纳米结构液晶取向膜 [J].液晶与显示2012,27(1):1-7. [3] 郭春桔,夏森林,孙振,等. 侧链含稠环的新型聚酰亚胺液晶垂直取向剂的制备及表征[J]. 液晶与显示,2012,27(1):8-13. [4] 姜莹, 孙振, 房玉庆,等. 聚酰亚胺液晶垂直取向膜的表面取向分析 [J].液晶与显示2011,26(1):9-12. [5] Berreman D W. Solid surface shape and alignment of an adjacent nematic liquid-crystal [J]. *Phys. Rew. Lett.,* 1972, 28(26):1683-1686. [6] Janning J. Thin-film surface orientation for liquid crystals [J]. *Appl. Phys. Lett.*, 1972, 21(4):173-174. [7] Chaudhari P, Lacey J, Len S C, *et al.* Atomic beam alignment of liquid crystals [J]. *J. Appl. Phys.,* 1998, 37(1A/B):L55-L56. [8] Ichimura K, Suzuki Y, Seki T, *et al.* Reversible change in alignment mode of nematic liquid-crystal regulated photochemically by command surfaces modified with an azobenzene monolayer [J]. *Langmuir,* 1988, 4(5):1214-1216. [9] Presnyakov V, Asatryan K, Galstian T, *et al.* Optical polarization grating induced liquid crystal mocro-structure using azo-dye command layer [J]. *Opt. Express,* 2006, 14 (22):10558-10564. [10] Kapoustine V, Kazakevitch A, So V, *et al.* Simple method of formation of switchable liquid crystal gratings by introducing periodic photoalignment pattern into liquid crystal cell [J]. *Opt. Commun.,* 2006, 266(1):1-5. [11] Hu W, Srivastava A, Xu F, *et al.* Liquid crystal gratings based on alternate TN and PA photoalignment [J]. *Opt. Express,* 2012, 20(5): 5384-5391. [12] Hu W, Srivastava A K, Lin X W, *et al.* Polarization independent liquid crystal gratings based on orthogonal photoalignments [J]. *Appl. Phys. Lett.,* 2012, 100(11):111116(1-4). [13] Wu H, Hu W, Hu H.C, *et al.* Arbitrary photo-patterning in liquid crystal alignments using DMD based lithography system [J]. *Opt. Express,* 2012, 20(15):16687-16689. [14] Wu W Y, Fuh A Y G. Rewritable liquid crystal gratings fabricated using photoalignment effect in dye-doped poly(vinyl alcohol) film [J]. *Jpn. J. Appl. Phys.,* 2007, Part1,46(10A):6761-6766. [15] Zhao X, Bermak A, Boussaid F, *et al.* High-resolution photoaligned liquid-crystal micropolarizer array for polarization imaging in visible spectrum [J]. *Opt. Lett.,* 2009, 34(23):3619-3621. [16] 盛秋康. 二维码解码技术的研究与应用 [D]. 南京:南京理工大学,2011. [17] Fan F, Du T, Abhishek K. S, *et al.* Axially symmetric polarization converter made of patterned liquid crystal quarter wave plate [J]. *Opt. Express,* 2012, 20(21): 23036-23043.

本刊中的类似文章

1. 齐鹏, 施园, 刘子源.TFT-LCD Touch Mura不良的研究和改善[J]. 液晶与显示, 2013,28(2): 204-209

2. 陈瑞改, 陶宇虹, 谢佳, 张永栋, 李曙新.基于头部追踪的宽视角裸眼3D显示系统[J]. 液晶与显示, 2013,28(2): 233-237

3．刘亮, 王向楠, 赵德友, 王永茂, 杨国波.TFT-LCD移动显示窄边框技术进展[J]. 液晶与显示, 2013,28(2): 228-232

4．徐正平, 王德江, 黄厚田, 姚园, 李军.数字微镜器件视频显示性能分析[J]. 液晶与显示, 2013,28(2): 255-260

5．原小涛, 弓爱君, 杨槐.手征性向列相液晶复合体系的研究[J]. 液晶与显示, 2013,28(2): 155-161

6．姚丽双, 彭增辉, 刘永刚, 宣丽.铁电液晶摩擦-自组装非对称取向[J]. 液晶与显示, 2013,28(2): 162-165

7．崔文静, 邢红玉, 叶文江, 张志东.液晶可调电容器的研究[J]. 液晶与显示, 2013,28(2): 173-178