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特邀报告

纳米结构液晶取向膜

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摘要：介绍了一种新型纳米结构液晶取向膜技术,详述该取向膜的机理和最新进展。该取向膜本身是不均匀的,但不均匀性在亚微米以下,可以为液晶分子提供均匀的取向,并且产生任何在 $0\sim 90^\circ$ 范围内的预倾角,具有良好的可靠性和可控性。分析了获得这样均匀取向性能的条件,提出3种产生纳米结构液晶取向膜的方法。

关键词：取向膜 液晶排列 纳米技术 纳米印刷

Nanostructured Alignment Layers for Liquid Crystals—A Review

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Abstract: This paper reviews recent results on nanostructured alignment surfaces for liquid crystals. These surfaces are heterogeneous and yet can give uniform alignment of the liquid crystal and are able to give any pretilt angles in the range of $0\sim 90^\circ$ reliably and controllably. The conditions for having such uniform alignment properties are studied. Three techniques for the generation of such nanostructured surfaces are reviewed.

Keywords: alignment layer liquid crystal alignment nanotechnology nanoimprint

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参考文献:

- [1] Wan J T K, Tsui O K C, Kwok H S, et al. Liquid crystal pretilt control by inhomogeneous surfaces [J]. *Phys. Rev. E*, 2005, 72(2): 021711(1-4).
- [2] Yeung F S, Ho J Y, Li Y W, et al. Variable liquid crystal pretilt angles by nanostructured surfaces [J]. *Appl. Phys. Lett.*, 2006, 88(5): 051910(1-3).
- [3] Yeung F S Y, Xie F C, Wan J T K, et al. Liquid crystal pretilt angle control using nanotextured surfaces[J]. *J. Appl. Phys.*, 2006, 99(12): 124506(1-4).
- [4] Ho J Y L, Chigrinov V G, Kwok H S. Variable liquid crystal pretilt angles generated by photoalignment of a mixed polyimide alignment layer [J]. *Appl. Phys. Lett.*, 2007, 90(24): 243506(1-3).
- [5] Kwok H S, Yeung F S Y. Nano-structured liquid-crystal alignment layers [J]. *J. Soc. for Information Display*, 2008, 16(9): 911-918.
- [6] Vaughn K E, Sousa M, Kang D, et al. Continuous control of liquid crystal pretilt angle from homeotropic to planar[J]. *Appl. Phys. Lett.*, 2007, 90(19): 194102(1-3).
- [7] Komitov L, Barbero G, Dahl I, et al. Controllable alignment of nematics by nanostructured polymeric layers[J]. *Liquid Crystals*, 2009, 36: 747-753.
- [8] Seo J H, Jang H J, Lee S R, et al. Wide pretilt angle control of liquid crystal display device by ion beam exposure on the vertical aligning layer[J]. *Jpn. J. Appl. Phys.*, 2007, 46(11): L1074-L1076.
- [9] Kim K H, Baek J I, Cheong B H, et al. Pretilt angle control and multidomain alignment of liquid crystals by using polyimide mixed with liquid crystalline prepolymer[J]. *Appl. Phys. Lett.*, 2010, 96(21): 213507(1-3).
- [10] Yeung F S Y, Kwok H S. Fast-response no-bias-bend liquid crystal displays using nanostructured surfaces[J]. *Appl. Phys. Lett.*, 2006, 88(6): 063505(1-3).
- [11] Li Y W, Tan L, Kwok H S. Passive-matrix-driven field-sequential-color displays[J]. *J. Society for Information Display*, 2008, 16(3): 429-434.
- [12] Li Y W, Lee C Y, Kwok H S. Liquid crystal dynamic flow control by bidirectional alignment surface[J]. *Appl. Phys. Lett.*, 2009, 94(6): 061111(1-3).
- [13] Yu X J, Kwok H S. Bistable bend-splay liquid crystal display[J]. *Appl. Phys. Lett.*, 2004, 85(17): 3711(1-3).
- [14] Li Y W, Kwok H S. Bistable twisted-bend and twisted-nematic liquid crystal display [J]. *Appl. Phys. Lett.*, 2009, 95: 181107(1-3).
- [15] Li Y W, Lee C Y, Kwok H S. Permanent bistable twisted nematic displays using Bi-directional alignment surface // *39th Society for Information Display International Symposium*, Los Angeles, CA: SID, 2008: 1026-1029.
- [16] Yeh P, Gu C. *Optics of Liquid Crystal Displays* [M]. New York: Wiley, 1999.
- [17] Uchida T, Ohgawara M, Wada M. Liquid crystal orientation on the surface of obliquely-evaporated silicon monoxide with homeotropic surface treatment [J]. *Japn. J. Appl. Phys.*, 1980, 19(11): 2127-2136.
- [18] Schadt M, Seiberle H, Schuster A. Optical patterning of multi-domain liquid-crystal displays with wide viewing angles[J]. *Nature*, 1996, 381(6579): 212-214.
- [19] Nishikawa M, Taheri B, West J L. Polyimide films designed to produce high pretilt angles with a single linearly polarized UV exposure[J]. *SID Symposium Digest of Technical Papers*, 1998, 29(1): 131-134.
- [20] Filas R W, Patel J S. Chemically induced high-tilt surfaces for liquid crystals [J]. *Appl. Phys. Lett.*, 1987, 50(20): 1426-1428.
- [21] Sugimori S, Katoh T. Polyimide: US patent 5,693,379. 1997-12-02.
- [22] Nishikawa M, Yasuda K, Kawamura S, et al. Liquid crystal alignment agent: US patent 5,969,055. 1999-10-19.
- [23] Park J, Kim H, Lee J, et al. Polymer blend for preparing liquid crystal alignment layer: US patent 6,731,362. 2004-05-04.
- [24] Kim J, Yoneya M, Yokoyama H. Tristable nematic liquid-crystal device using micropatterned surface alignment[J]. *Nature*, 2002, 420(6912): 159-161.
- [25] Zhang B S, Lee F K, Tsui O K C, et al. Liquid Crystal Orientation Transition on Microtextured Substrates [J]. *Phys. Rev. Lett.*, 2003, 91

(21):215501(1-4). [26] Li Y W. Fast liquid crystal technology and its application . Hongkong: Hong Kong University of Science and Technology, 2010. [27] Kwok H S, Li Y W, Yeung F S. Nanostructured alignment layers for liquid crystal displays [J]. *Molecular Crystals and Liquid Crystals*,2009, 507:26-40. [28] Lee C Y, Li Y W, Kwok H S. Variable liquid crystal pretilt and azimuth angle using stacked alignment layers // *40th Society for Information Display International Symposium*, San Antonio, TX:SID, 2009: 1619-1622. [29] Zhang K, Liu N, Twieg R J, *et al.* Pretilt study of double-layer alignment film,[J]. *Liquid Crystals*, 2008,35: 1191-1917. [30] Lee Y J, Gwag J S, Kim Y K, *et al.* Control of liquid crystal pretilt angle by anchoring competition of the stacked alignment layers [J]. *Appl. Phys. Lett.*, 2009,94(4):041113(1-3). [31] Chigrinov V G, Blinov L M. *Electrooptic Effects in Liquid Crystal Materials*[M]. New York: Springer-Verlag, 1994. [32] Tseng M C, Fan F, Lee C Y, *et al.* Tunable lens by spatially varying liquid crystal pretilt angles[J]. *J. Appl. Phys.*, 2011,109(8):083109(1-5). [33] Wu G M, Chien H W, Huang J W, *et al.* Intermediate pre-tilt angle control by a composite alignment thin film structure for liquid crystal displays [J]. *Nanotechnology*, 2010,21(3):134022 (1-5).

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1. 于涛, 陈晟, 储培鸣, 郑永亮, 申剑锋. IPS液晶取向膜表面光学各向异性 DA 的研究[J]. 液晶与显示, 2012,(3): 292-296
2. 姜莹, 孙振, 房玉庆, 汪映寒. 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

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