Lab on a Chip

Electronic Supplementary Information (ESI) for Lab on a Chip

Microfludic Sensing Devices Employing *In-Situ*-Formed Liquid Crystal Thin Film for Detection of Biochemical Interactions

Ye Liu,[a] Daming Cheng,[b] I-Hsin Lin,[c] Nicholas L. Abbott [b,c] and Hongrui Jiang*[a,b,d]

[a] *Department of Electrical and Computer Engineering, University of Wisconsin-Madison, USA.*
[b] *Materials Science Program, University of Wisconsin-Madison, USA.*
[c] *Department of Chemical and Biological Engineering, University of Wisconsin-Madison, USA.*
[d] *Department of Biomedical Engineering, University of Wisconsin-Madison, USA.*

Supplementary Methods

Materials

Liquid crystal, 5CB and 1-decanethiol [$CH_3(C_9H_{18})SH$], 96%, L-α-dilauroyl phosphatidylcholine (L-DLPC), N,N-dimethyl-N-octadecyl-3-amino-propyltrimethoxysilyl chloride (DMOAP) and phospholipase A_2 (PLA_2) from Naja mossambica mossambica were purchased from Sigma-Aldrich (St. Louis, MO, USA). N- hexadecyl mercaptan [$CH_3(C_{15}H_{30})SH$], 92% was purchased from Acros Organics (Geel, Belgium). Glass slides were purchased from Fisher Scientific (Pittsburgh, PA, USA). Microfab NI 100 make-up solution and Microfab NI 100 wetting agent were purchased from Enthone-OMI (West Haven, CT, USA). High purity Ni gauze, #39704, was purchased from Alfa Aesar (Ward Hill, MA, USA). Positive photoresist (PR), AZ P4620, was purchased from Clariant Corporation (Somerville, NJ, USA). Double adhesive spacer (250-μm thick) was acquired from 3M Co. (St. Paul, MN, USA). Ethyl vinyl acetate microbore tubings were purchased from Cole Parmer Co. (Vernon Hills, IL, USA).

Acquisition and analysis of microscopic images

All schematics [Fig. 1(a) (c), Fig. 2, Fig. 8(d) (e), Fig. 9(b), Fig. 10(d)] are created by Microsoft Visio®. All simulation result plots [Fig. 3, Fig. 4, Fig. 5] are exported from ANSYS Fluent® 12.1. Fig. 1(b) is taken by a digital optical camera: Konica Minolta model 13655. Other figures [Fig. 6, Fig. 7, Fig. 8(a) (b) (c), Fig. 9(a), Fig. 10(a) (b) (c), Fig. 11] are taken by a polarized optical microscopy (POM), which consists of a stereoscope (Nikon, SMZ1500) and two crossed polarizers. The Gamma values of these images are increased by 22% uniformly for better visualization, by an image processing tool (ACDSee Pro2®).

Repeatability test

Fig. S1 depicts the process of the repeatability test. Fig. S1(a) shows the initial state that the channel is pre-filled with the LC. Next, the LC is "cut" by the DTAB solutions [Fig. S1(b)]. Then the sensing channel was purged using ethanol so that DTAB solution as well as the LC thin film was removed from the channel [Fig. S2(c)]. N_2 stream was then applied to dry the channel for 30 min. LC was again introduced into the channel and filled the hexagonal Ni container at the bottom [Fig. S1(d)]. DTAB solution was introduced again into the channel and for the second time formed the LC thin film [Fig. S1(e)]. Comparing Fig. S1(b) and Fig. S1(e), the quality of the LC thin film is almost uniform.

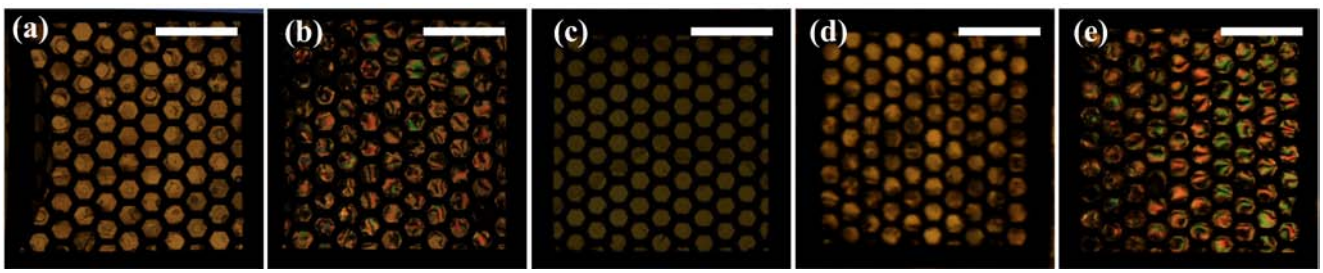

Figure. S1. Repeatability test of the LC thin film device.