Supplementary Material (ESI) for Soft Matter

SUPPLEMENTARY INFORMATION

Dynamic Charge Separation in a Liquid Crystalline Meniscus

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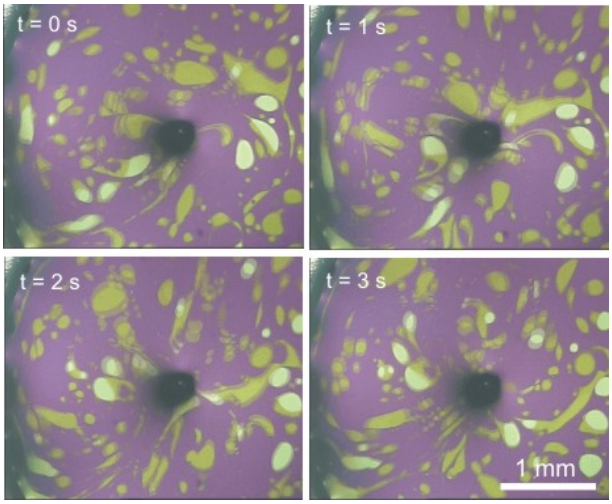

Fig. S1 Consecutive micrographs depicting the electroconvection in the plane of the film of the 8CB liquid crystal. The dark spot in the middle is the tip of the needle that pierces the LC film.

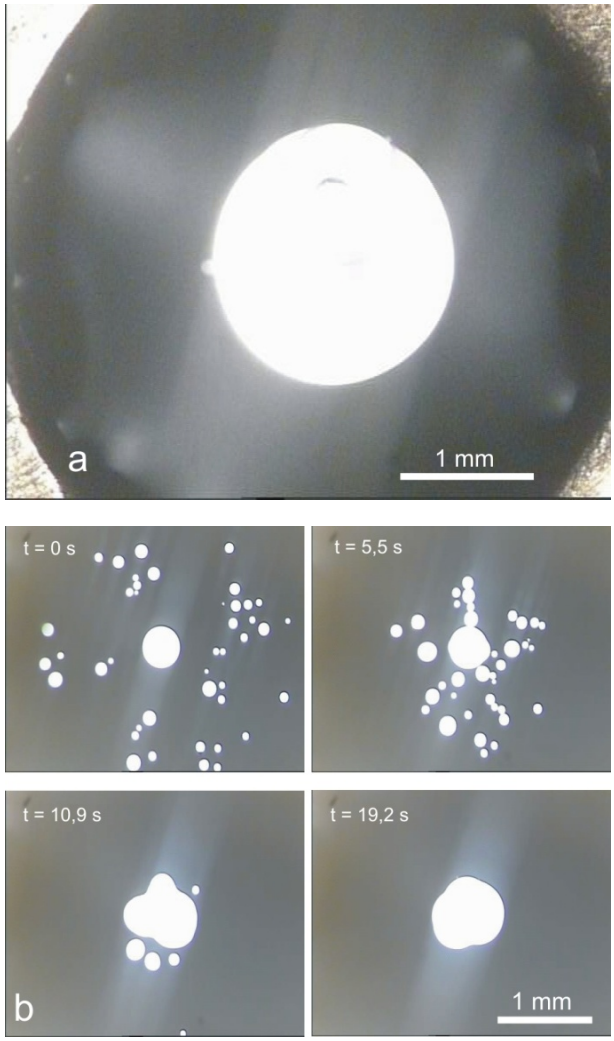

Fig. S2 Freely suspended LC film (MHPPHBC in SmA phase) on the circular metal rim (portions of the rim are visible in the corners of the micrograph). a) a single LC island in the center of the metal rim, b) consecutive micrographs depicting the procedure of merging numerous small islands into a single one with the use of dielectrophoretic forces (100 Hz, 300 V).

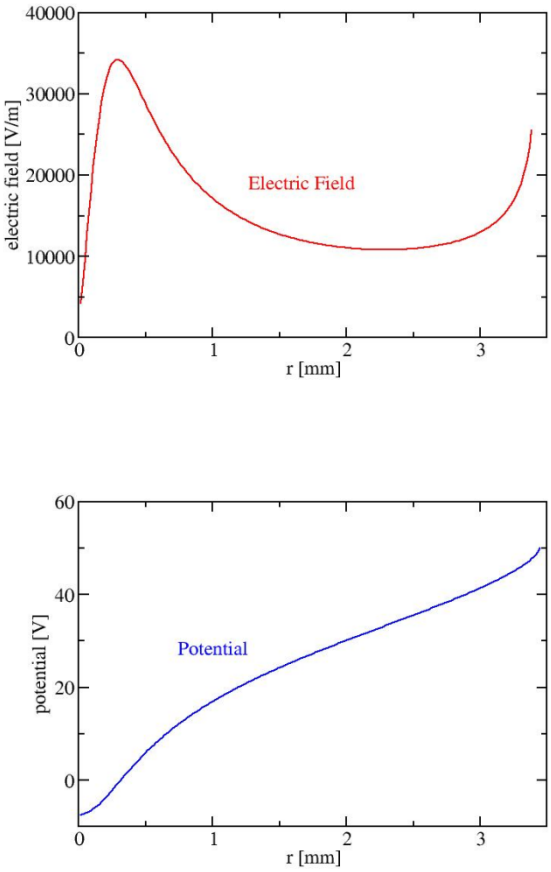

Fig. S3 Results of the numerical calculations of the electric field (top) and the electrostatic potential (bottom) as a function of the radial position (r=0 corresponds to the position of the needle). Calculation performed for the tip of the needle positioned 250 μm below the plane of the rim.

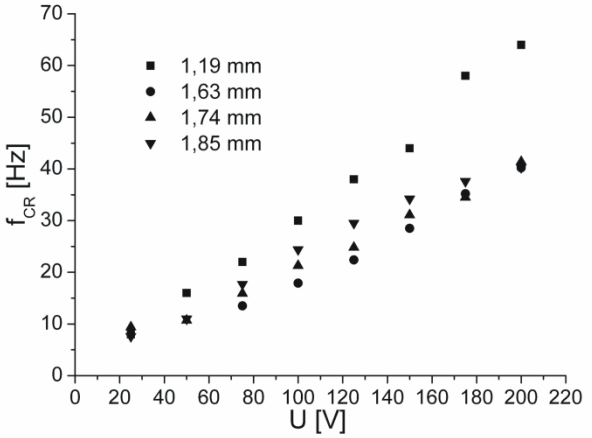

Fig. S4 Critical frequency as a function of applied voltage for 8CB (SmA phase) liquid crystal. Series were performed for several LC island (island diameter from 1,19 mm to 1,74 mm) for the needle in contact with the film.

Table S1. Phase transition of the liquid crystals used in our experiments (where C, SmA, SmC, N and I stand for Crystalline, Smectic A, Smectic C, Nematic and Isotropic phase respectively).

Compound	Phase	T_{TR}	Phase	T_{TR}	Phase	T_{TR}	Phase
8CB	C	21.25°C	SmA	33.85°C	N	40.85°C	I
NPOB	C	50°C	SmA	61.2°C	N	67.9°C	I
MBOBC	C	39°C	SmC*	41.5°C	SmA*	59.5°C	I
MHPPHBC	C	54.1°C	SmC*	74.4°C	SmA*	95.8°C	I

Table S2. Estimated electrophoretic mobility and distance traveled by the ions within half the period of the oscillations of the electric field at the critical frequency for different types of liquid crystals used in our experiments. Number of Figure below the liquid crystal name indicate Figure where we found linear coefficients for calculation.

Liquid Crystal	μ ($m^2 \cdot V^{-1} \cdot s^{-1}$)	d_{ion} [μm]
8CB – SmA	$3{,}29 \cdot 10^{-10}$	0,32
Fig. 3j	$1{,}32 \cdot 10^{-10}$	0,13
	$0{,}98 \cdot 10^{-10}$	0,096
MHPPHBC – SmA*	$3{,}29 \cdot 10^{-10}$	1,56
Fig. 4b	$1{,}32 \cdot 10^{-10}$	0,63
	$0{,}98 \cdot 10^{-10}$	0,46
8CB – SmA	$3{,}29 \cdot 10^{-10}$	0,204
Fig. 6	$1{,}32 \cdot 10^{-10}$	0,082
	$0{,}98 \cdot 10^{-10}$	0,061
NPOB – SmA	$3{,}29 \cdot 10^{-10}$	0,17
Fig. 6	$1{,}32 \cdot 10^{-10}$	0,068
	$0{,}98 \cdot 10^{-10}$	0,051
MBOBC – SmA*	$3{,}29 \cdot 10^{-10}$	0,57
Fig. 6	$1{,}32 \cdot 10^{-10}$	0,23
	$0{,}98 \cdot 10^{-10}$	0,17
MBOBC – SmC*	$3{,}29 \cdot 10^{-10}$	0,57
Fig. 6	$1{,}32 \cdot 10^{-10}$	0,23
	$0{,}98 \cdot 10^{-10}$	0,17
MHPPHBC – SmA*	$3{,}29 \cdot 10^{-10}$	0,64
Fig. 6	$1{,}32 \cdot 10^{-10}$	0,26
	$0{,}98 \cdot 10^{-10}$	0,2
MHPPHBC – SmC*	$3{,}29 \cdot 10^{-10}$	0,52
Fig. 6	$1{,}32 \cdot 10^{-10}$	0,21
	$0{,}98 \cdot 10^{-10}$	0,15

Table S3. The table below depicts the estimated values of the distance d_{ion} traveled by the ions within the critical interval $\tau_0=1/2f_{CR}$. Within the approximations adopted in the estimate (please consult main text for details) we do not find a significant dependence of d_{ion} on the diameter of the LC island.

Island diameter	μ ($m^2 \cdot V^{-1} \cdot s^{-1}$)	d_{ion} [μm]
d = 1,19 mm	$3{,}29 \cdot 10^{-10}$	0,204
	$1{,}32 \cdot 10^{-10}$	0,082
	$0{,}98 \cdot 10^{-10}$	0,061
d = 1,63 mm	$3{,}29 \cdot 10^{-10}$	0,3
	$1{,}32 \cdot 10^{-10}$	0,12
	$0{,}98 \cdot 10^{-10}$	0,089
d = 1,74 mm	$3{,}29 \cdot 10^{-10}$	0,35
	$1{,}32 \cdot 10^{-10}$	0,14
	$0{,}98 \cdot 10^{-10}$	0,1
d = 1,85 mm	$3{,}29 \cdot 10^{-10}$	0,33
	$1{,}32 \cdot 10^{-10}$	0,13
	$0{,}98 \cdot 10^{-10}$	0,1