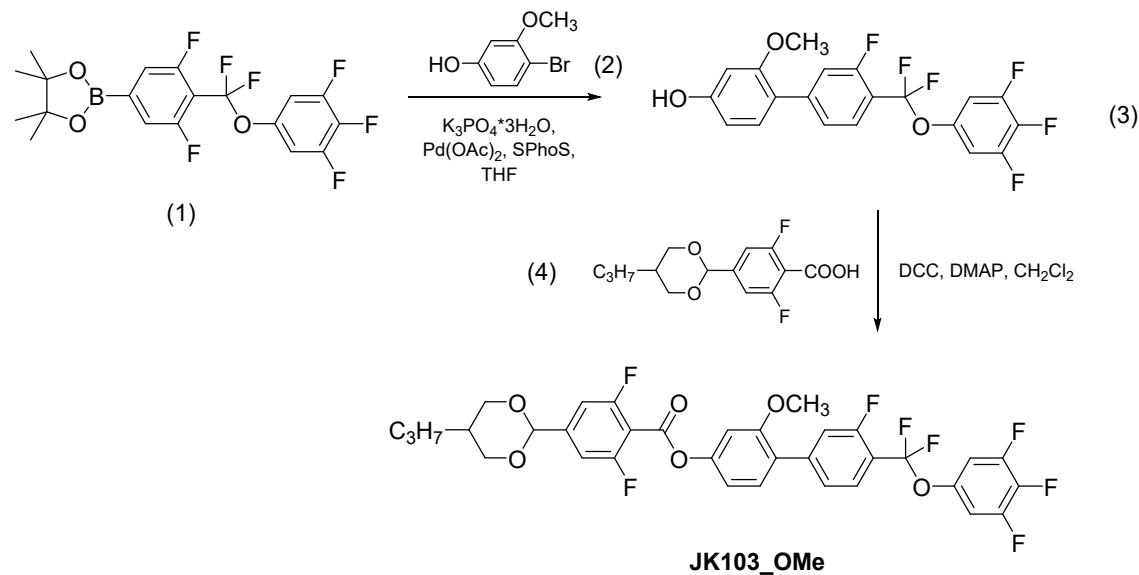


Supporting information for

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Synthesis of JK103_OMe



4'-(difluoro(3,4,5-trifluorophenoxy)methyl)-3'-fluoro-2-methoxy-[1,1'-biphenyl]-4-ol (3)

The mixture of 2-(4-(difluoro(3,4,5-trifluorophenoxy)methyl)-3,5-difluorophenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (1) (7.00 g; 0.0163 mol), 4-bromo-3-methoxyphenol (3.00 g; 0.0148 mol), potassium phosphate trihydrate (13.80 g; 0.0417 mol) in anhydrous THF (150 ml) was refluxed for 1 h under N_2 atmosphere. Then $Pd(OAc)_2$ and SPhos were added and the mixture was stirred at reflux for 2 h. Later, it was cooled down, acidified using 10% HCl solution and extracted with DCM. The organic layer was then dried over $MgSO_4$, and concentrated under vacuum. The crude product was used in next reaction without purification.

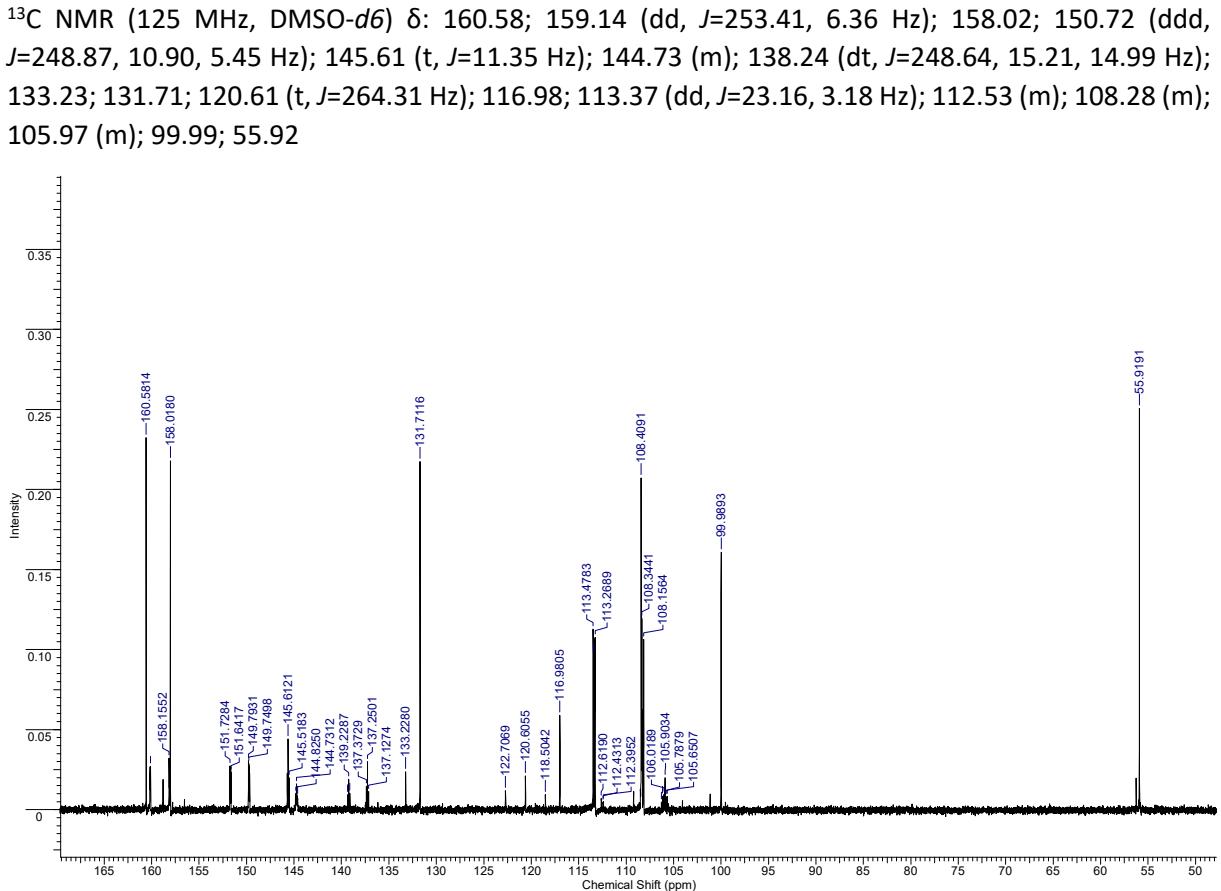
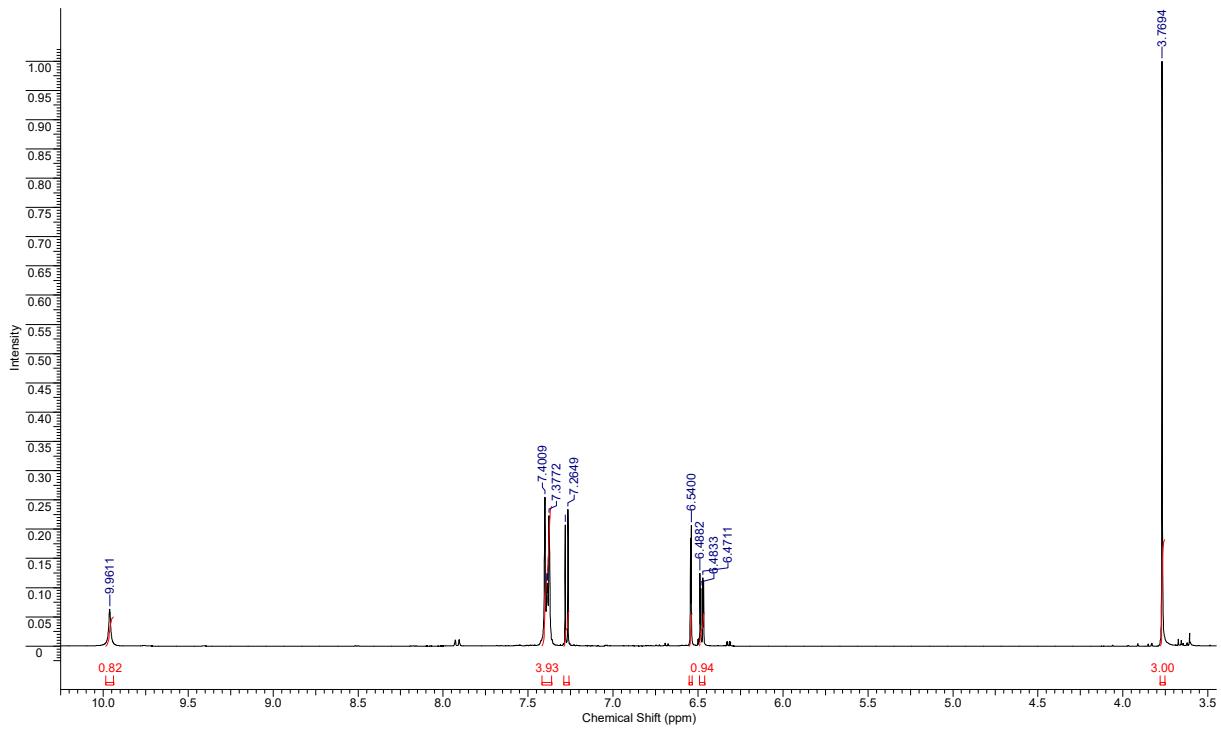
Yield 5.80g (90.6%)

Purity (GC-MS) 93.0%

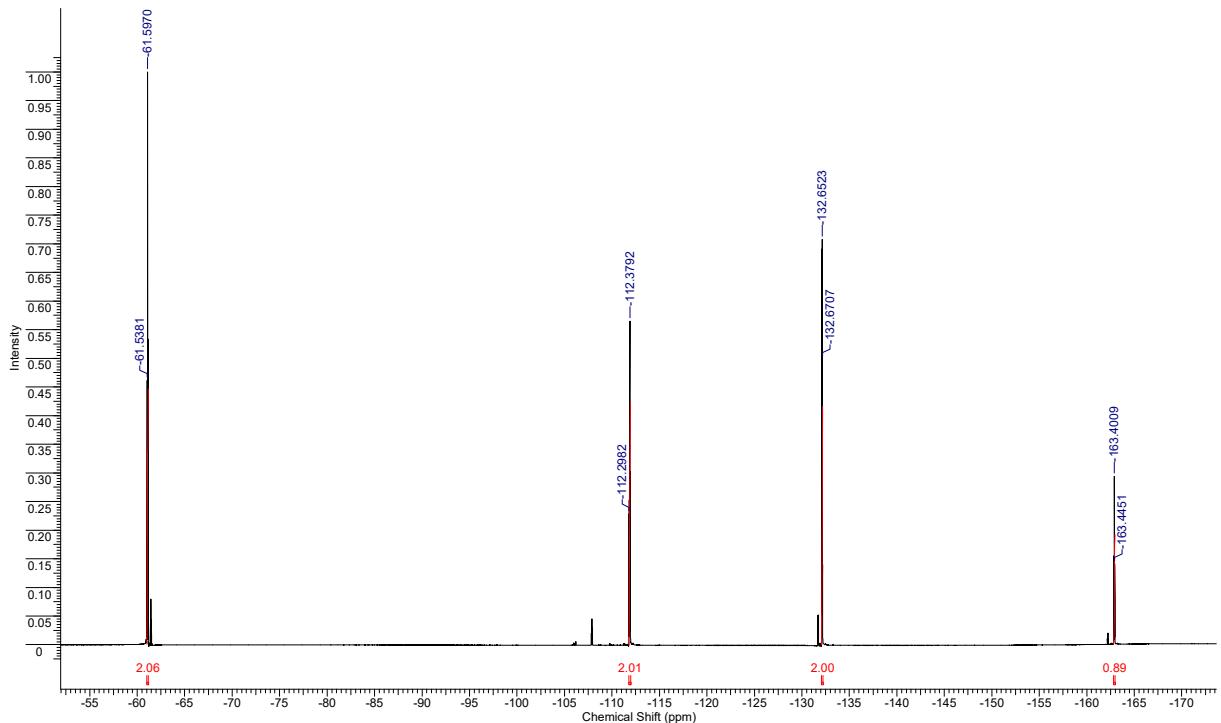
m.p. = 102°C

MS(EI) m/z: 432, 413, 285, 251, 233, 213, 187, 164, 142, 129

1H NMR (500 MHz, DMSO-*d*6) δ : 9.96 (s, 1 H, Ar-OH); 7.39 (m, 4 H, Ar-H); 7.27 (d, $J=8.24$ Hz, 1 H, Ar-H); 6.54 (d, $J=2.14$ Hz, 1 H, Ar-H); 6.48 (dd, $J=8.39$, 2.29 Hz, 1 H, Ar-H); 3.77 (s, 3 H, Ar-OCH₃)



19F NMR (471 MHz, CDCl₃) δ: -61.60 (t, *J*=26.00 Hz, 2 F); -112.37 (td, *J*=26.45, 10.41 Hz, 2 F); -132.64 (dd, *J*=20.81, 8.67 Hz, 2 F); -163.40 (tt, *J*=20.80, 5.20 Hz, 1 F)



4'-(difluoro(3,4,5-trifluorophenoxy)methyl)-3'-fluoro-2-methoxy-[1,1'-biphenyl]-4-yl 2,6-difluoro-4-(5-propyl-1,3-dioxan-2-yl)benzoate (JK103_OMe)

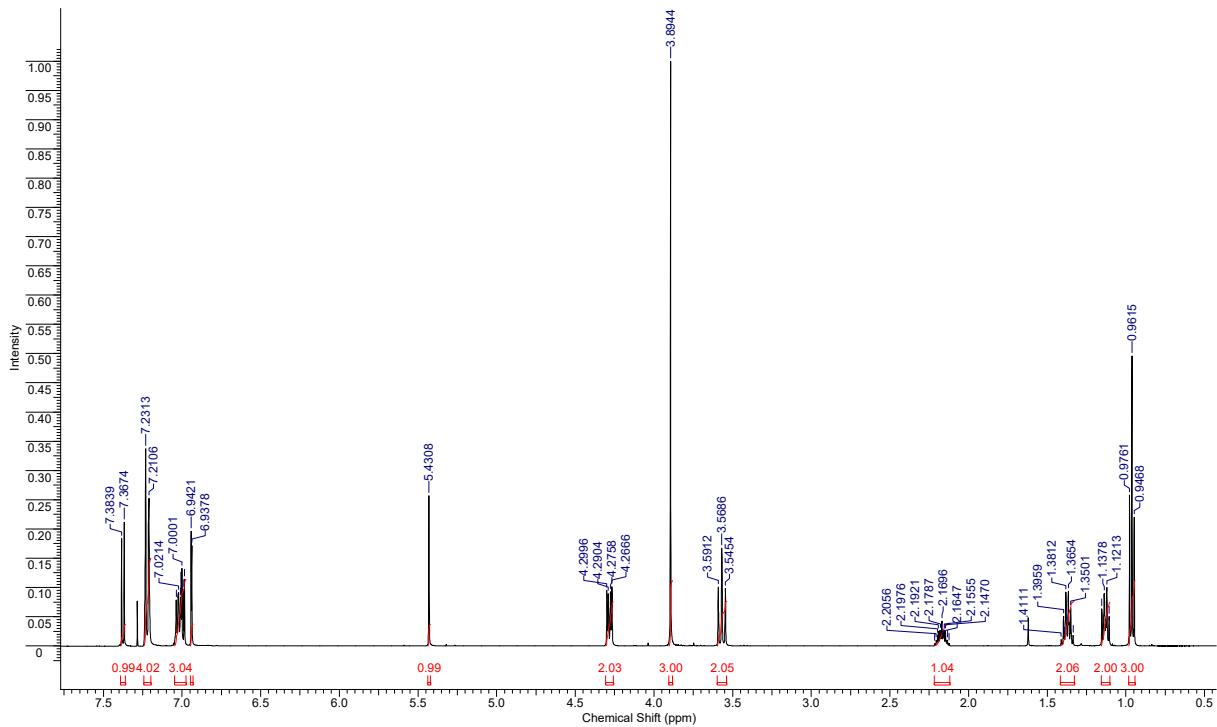
To a stirred solution of 2,6-difluoro-4-(5-propyl-1,3-dioxan-2-yl)benzoic acid (**4**) (1.00 g; 0.0035 mol), 4'-(difluoro(3,4,5-trifluorophenoxy)methyl)-3'-fluoro-2-methoxy-[1,1'-biphenyl]-4-ol (**3**) (1.70 g; 0.00385 mol) and DCC (0.80 g; 0.00385 mol) in DCM (50ml), DMAP (0.1g) was added and the solution was stirred overnight at room temperature. The reaction mixture was filtered through silica pad and the filtrate was concentrated under vacuum. The residue was then recrystallized from ethanol/acetone mixture to give white solid.

Yield 1.1g (44.9%)

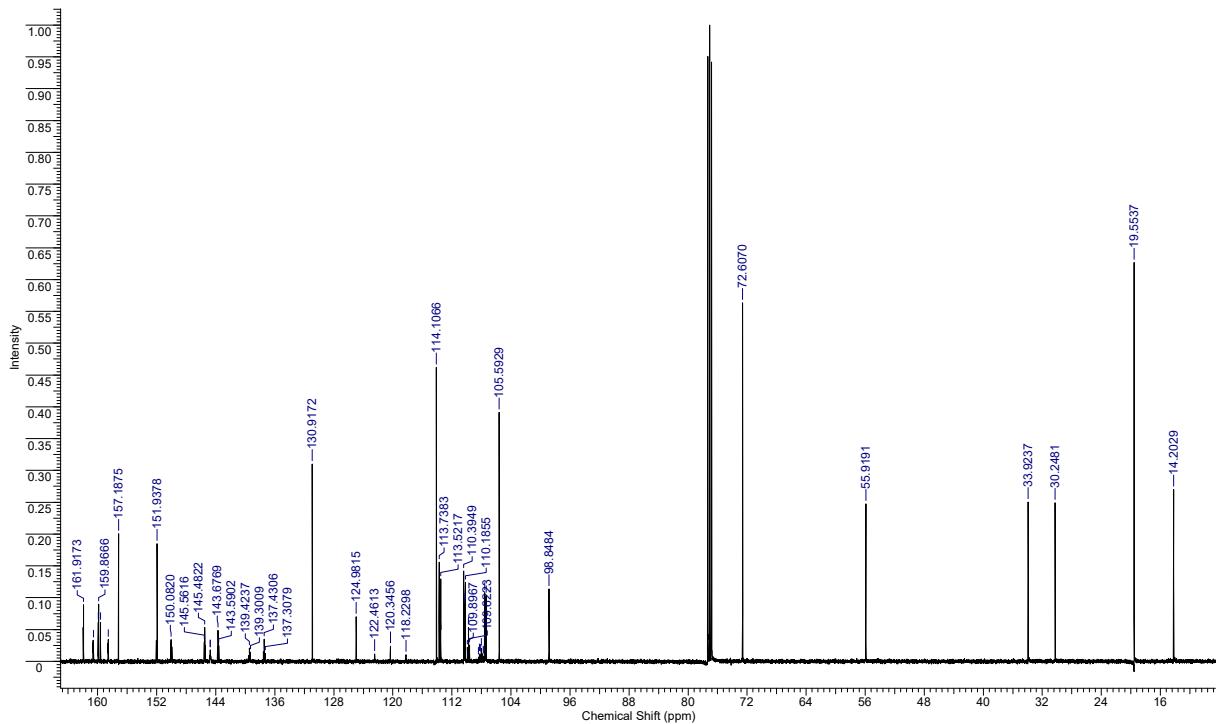
Purity (GC-MS) 99.5% (>99.9% trans isomer)

MS(EI) m/z: 700, 581, 553, 453, 431, 269, 241, 207, 169, 141, 113

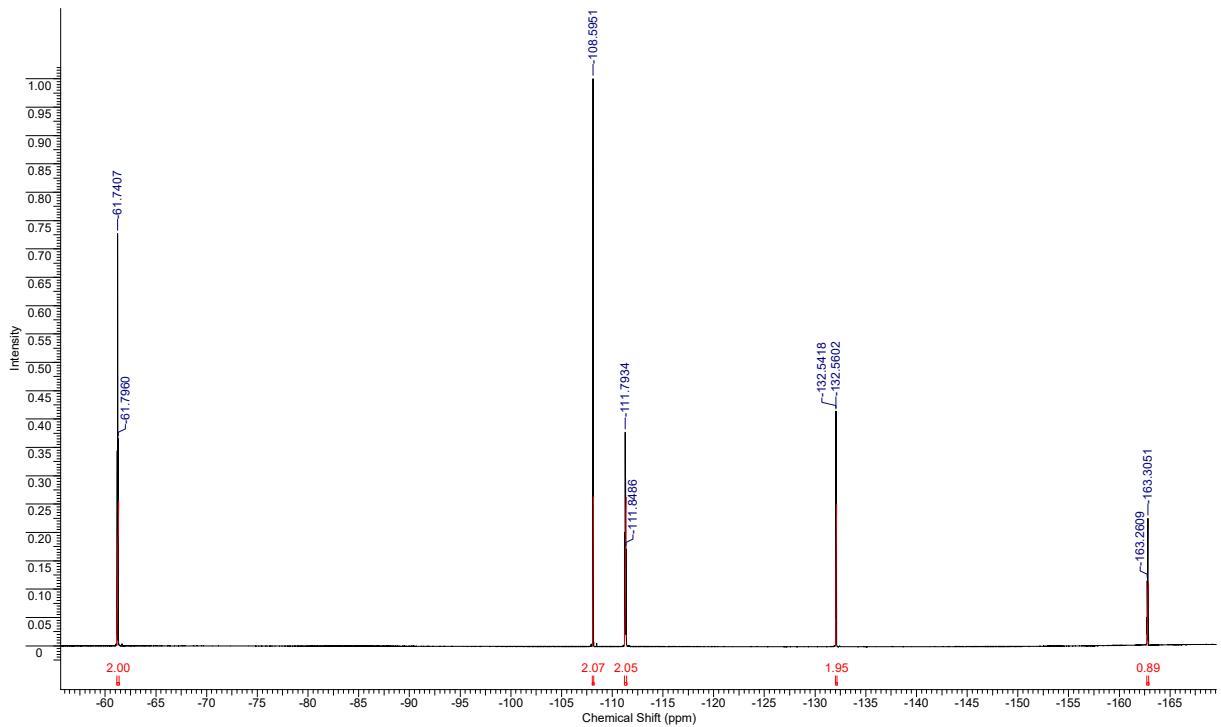
¹H NMR (500 MHz, CDCl₃) δ: 7.38 (d, *J*=8.24 Hz, 1 H, Ar-H); 7.22 (d, *J*=10.38 Hz, 4 H, Ar-H); 7.01 (m, 3 H, Ar-H); 6.94 (d, *J*=2.14 Hz, 1 H, Ar-H); 5.43 (s, 1 H, Ar-CH); 4.28 (dd, *J*=11.90, 4.58 Hz, 2 H, O-CH₂-CH); 3.89 (s, 3 H, Ar-OCH₃); 3.57 (t, *J*=11.44 Hz, 2 H, O-CH₂-CH); 2.17 (m, 1 H, (OCH₂)-CH-CH₂); 1.38 (m, 2 H, CH-CH₂-CH₂); 1.13 (m, 2 H, CH₂-CH₂-CH₃); 0.96 (t, *J*=7.32 Hz, 3 H, -CH₃)



¹³C NMR (125 MHz, CDCl₃) δ: 161.94 (d, *J*=5.45 Hz); 160.61 (d, *J*=6.36 Hz); 159.89 (d, *J*=5.45 Hz); 159.63; 158.58 (d, *J*=6.36 Hz); 157.19; 152.01 (m); 150.02 (dd, *J*=10.45, 4.99 Hz); 145.48 (t, *J*=9.54 Hz); 144.76 (m); 143.68 (t, *J*=10.90 Hz); 138.43 (dt, *J*=250.46, 15.21, 14.99 Hz); 130.92; 124.98; 120.35 (t, *J*=266.13 Hz); 114.11; 113.63 (m), 110.29 (m); 109.76 (t, *J*=17.26 Hz); 108.02 (m); 107.47 (m); 105.59; 98.85 (m); 72.61; 55.92; 33.92; 30.25; 19.55; 14.20



¹⁹F NMR (471 MHz, CDCl₃) δ: -61.74 (t, *J*=26.01 Hz, 2 F); -108.60 (d, *J*=8.67 Hz, 2 F); -111.81 (td, *J*=26.45, 10.41 Hz, 2 F); -132.57 (dd, *J*=20.81, 8.67 Hz, 2 F); -163.30 (tt, *J*=20.80, 5.20 Hz, 1 F)



Development of twisted domains in N_F phase in antiparallelly rubbed cell:

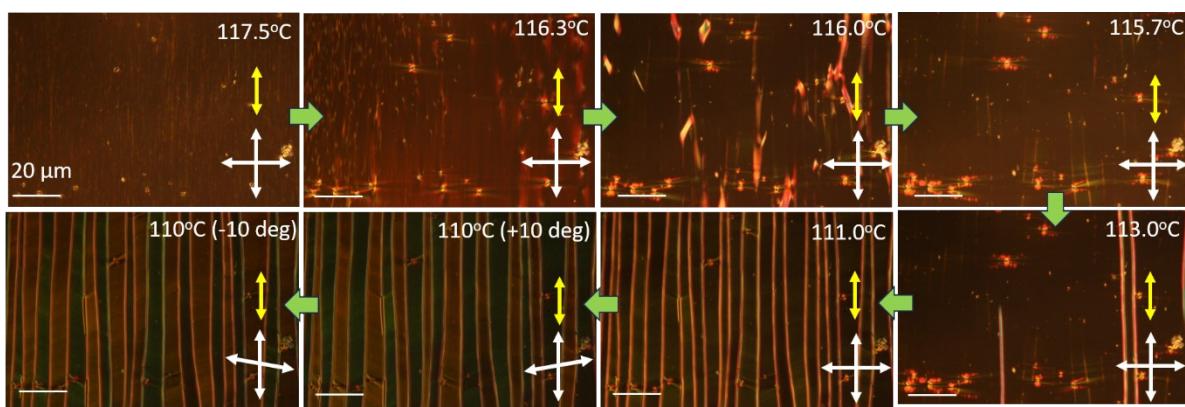


Figure S1: Development of twisted domains when the sample is slowly cooled ($1^{\circ}\text{C}/\text{min}$) in an antiparallelly rubbed cell. Twisted domains only appear at around 111°C . Rotation of the analyser by 10 degrees in opposite direction reveals the twisted domains. Yellow double headed arrow indicates rubbing direction.

Dielectric properties in N_E phase:

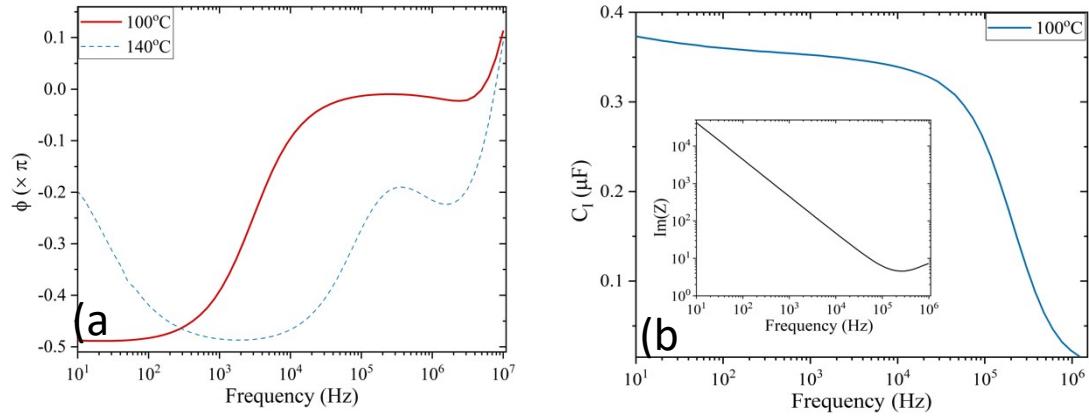


Figure S2 (a) Phase(ϕ) versus Frequency at 140°C (dashed) and 100°C (solid red). Unlike nematic phase (140°C), in the ferroenematic phase (110°C) low frequency (<100 Hz) phase $\phi \approx -\pi/2$, which indicates a capacitive response with very small resistance of the measuring cell in ferroenematic phase as suggested by Clark et.al.[1] (b) Interfacial capacitance calculated from imaginary part of measured complex impedance (inset) on the basis of PCG model[1].

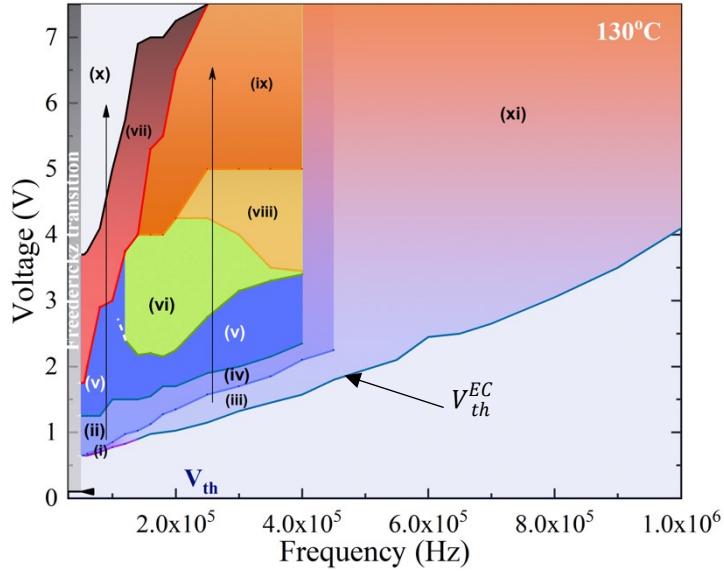


Figure S3 Phase diagram for electroconvective patterns at 130°C showing an approximately linear dependence between threshold voltage (V_{th}^{EC}) and frequency. Such linear dependence can be expected in the inertia mode of EC (wide domains) [2]

References

- [1] N. A. Clark, X. Chen, J. E. MacLennan and M. A. Glaser, *Phys. Rev. Res.*, 2024, **6**, 013195.
- [2] L. Blinov and V. Chigrinov, *Partially Ordered Systems-Electrooptic Effects in Liquid Crystals*, 1984, 235–307