Electronic Supplementary Material (ESI) for Lab on a Chip.

Supporting Information

Droplet immobilization within a polymeric organogel improves lipid bilayer durability and portability

RHEOLOGY MEASUREMENT

Rheometric measurements were performed by using a parallel plate rheometer (TA Discovery Hybrid Rheometer). Experiments were run from 25°C to 55°C with 5°C steps from angular frequencies 0.25 rad/s to 100 rad/s.

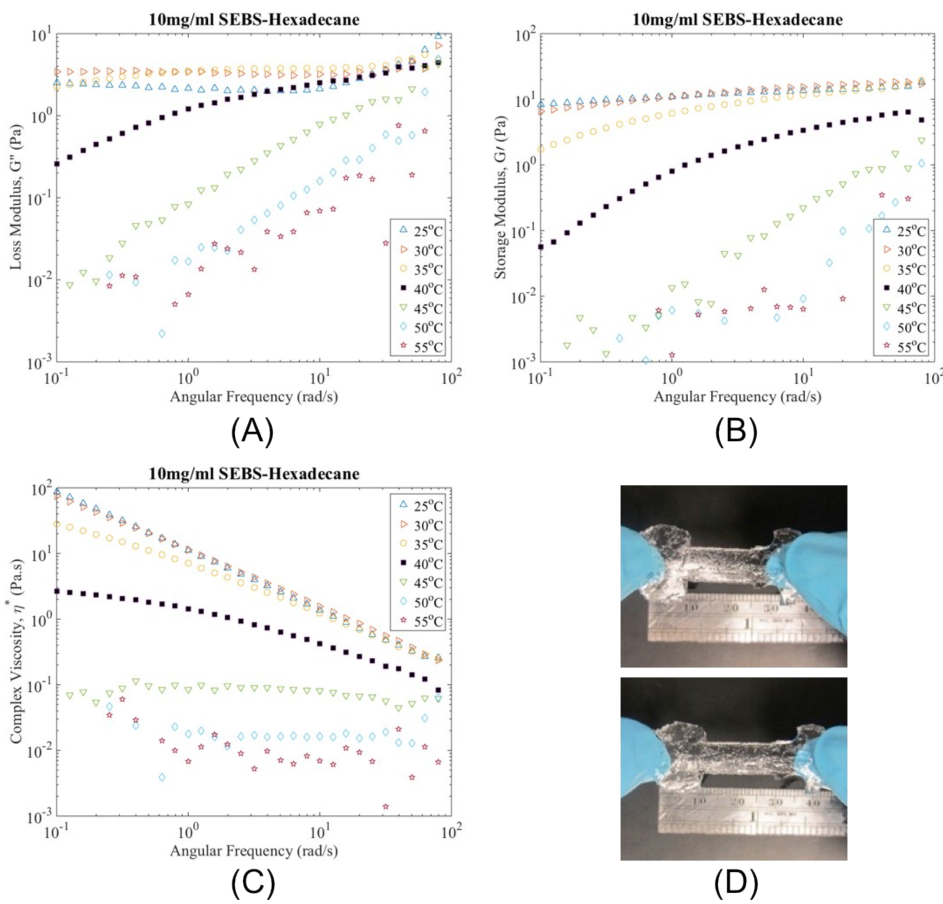

Figure S1: Loss modulus (A), storage modulus (B), and complex viscosity (C) of 10mg/ml SEBS/hexadecane mixture plotted with respect to angular frequencies at various temperatures (25-55°C). A dog-bone shaped specimen made from 50mg/ml SEBS/hexadecane shows flexibility and shape retaining property of the organogel (D).

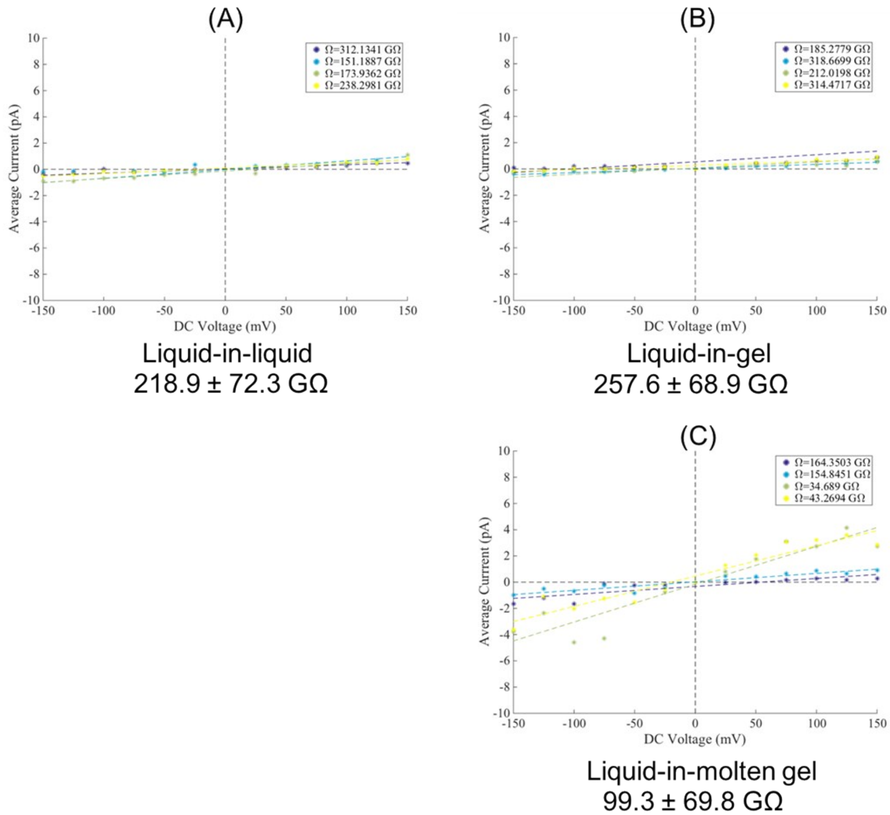

Figure S2: Electrical resistances of A) liquid-in-liquid, B) Liquid-in-gel (20°C), and C) Liquid-in-molten gel (50°C) are calculated by finding the slope of the current versus voltage plot.

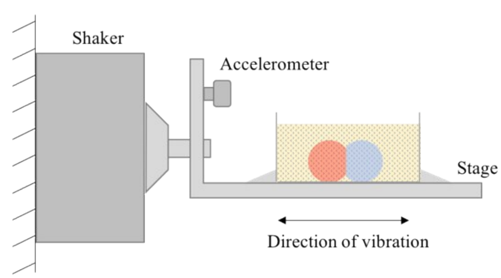

Figure S3: Schematic of experimental setup for durability test.

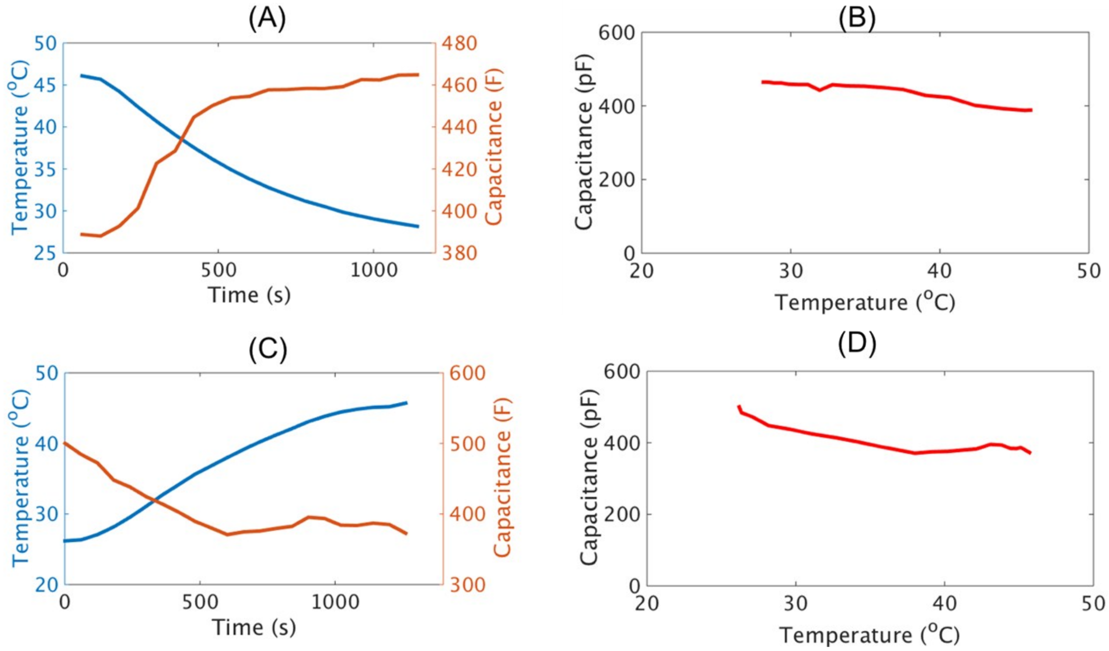

Figure S4: Change in nominal bilayer capacitance and temperature with time as a DIB formed in SEBS-gel is cooled (A) and heated (C). Change in capacitance of the same bilayers plotted w.r.t. temperature as the system is cooled (B) and heated (D).

ELECTROWETTING MEASUREMENT CONSIDERATION

It is well known that aqueous droplets placed under hexadecane are known to shrink over time due to the evaporation of water molecules. As a result of this effect, bilayer buckling was observed when femtoliter droplets are used to form DIBs using DOPC lipid in soybean oil.[1] Figure S5 shows a phase contrast images of a bilayer taken at t=0min and 60min. Image taken after 60min shows a clear ~24µm gap between the aqueous volume and the SEBS-gel that is not present initially (at t=0 min). This gap, which grows at a rate proportional to that of droplet shrinkage, is presumed to be filled with liquid hexadecane as macrophase separation of hexadecane from a SEBS-gel matrix is expected.[2] Careful analysis of phase contrast images have shown that the SEBS-gel boundary does not change even after longer periods of time. The increasing gap between the SEBS-gel boundary and the aqueous droplets is expected to exhibit a higher electro-wetting constant than that is seen during first few minutes. Therefore, all the electro-wetting measurements conducted at room temperature are done immediately after the gel is cooled to room temperature.

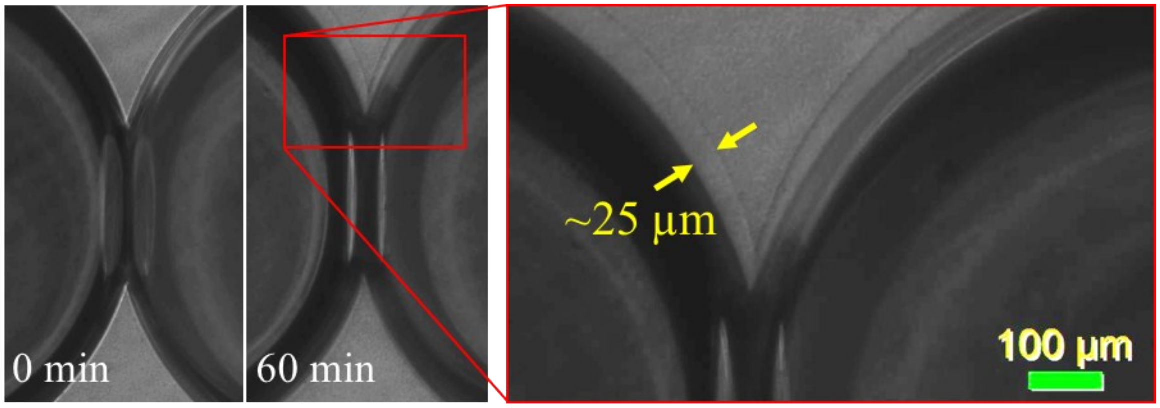

Figure S5: Appearance of hexadecane-filled gap between the droplet phase and SEBS-gel phase due to the evaporation of droplet phase.

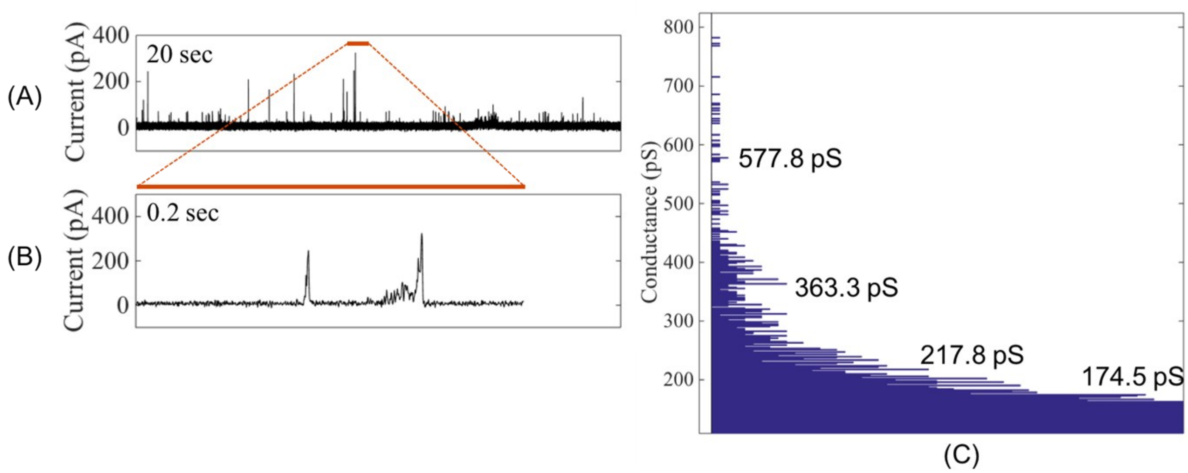

Figure S6: Alamethicin activity at +175mV applied voltage at 50°C (A) & (B). C) The histogram of conductance levels corresponding to the trace shown in (A).

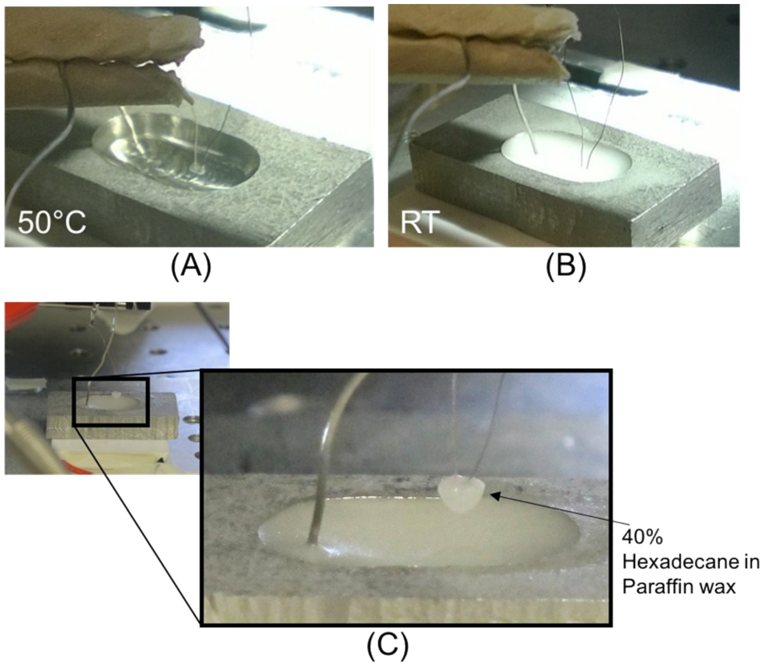

Figure S7: DIB formed in 40% hexadecane-paraffin wax at 50°C (A) and cooled to room temperature (B). A wax-encapsulated DIB formed at the tip of two hanging electrodes held in air (C). Shrinkage of paraffin upon solidification causes bilayer size reduction or rupture.

Movie S1:
A simple drop test being performed on a SEBS-gel encapsulated DIB contained in a PDMS substrate. The bilayer rupture at the end of the fourth drop.

Movie S2:
Demonstrating force transmission through the gel by applying force externally to a flexible substrate that contains the DIB.

Reference

1. P. Mruetusatorn, J. B. Boreyko, G. A. Venkatesan, S. A. Sarles, D. G. Hayes and C. P. Collier, *Soft Matter*, 2014, **10**, 2530-2538.
2. T. L. Chantawansri, A. J. Duncan, J. Ilavsky, K. K. Stokes, M. C. Berg, R. A. Mrozek, J. L. Lenhart, F. L. Beyer and J. W. Andzelm, *Journal of Polymer Science Part B: Polymer Physics*, 2011, **49**, 1479-1491.