# Supplemental Information 1

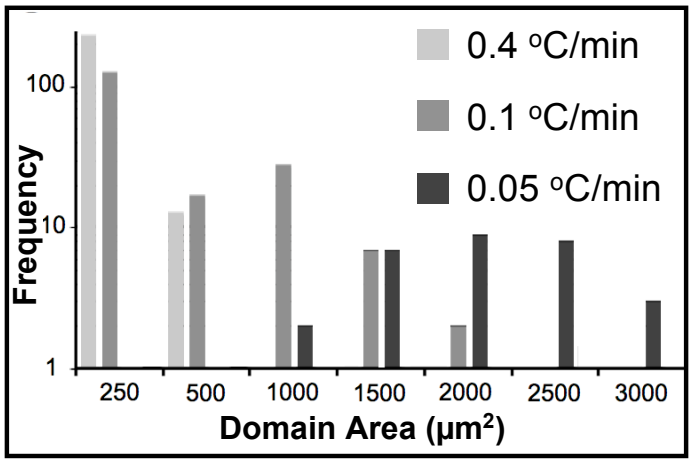



Fig. SI-1: Domain Area Distribution: Histogram of domain areas in Figs. 1F, 1L, and 2A. With increasing cooling rate, both average domain size and dispersion decrease.

# Supplemental Information 2: GalCer:DLPC 10:90 and 20:80

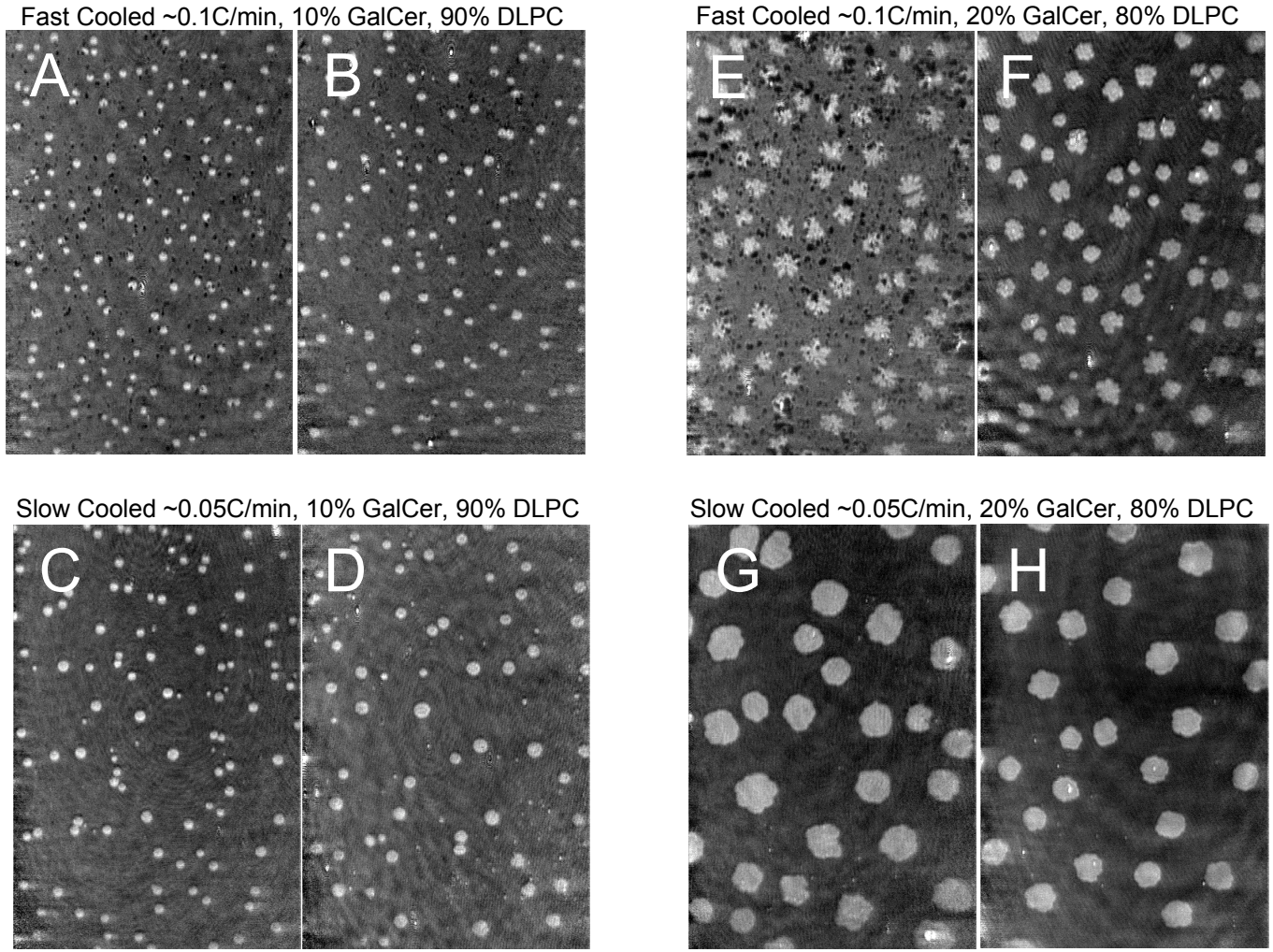
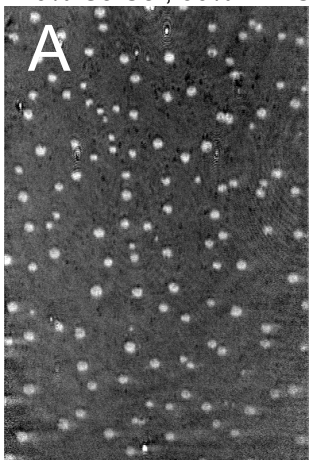



Figure SI-2: Ellipsomertric contrast images (430x645μm) of two lipid mixtures (10% GalCer / 90% DLPC and 20% GalCer 80% DLPC) at two cooling rates (0.1 ºC/min and 0.05 ºC/min). Each concentration and cooling rate shows two representative images.

# Supplemental Information 3: Mixture Comparisons

Fast Cooled ~0.1C/min
10% GalCer, 90% DLPC



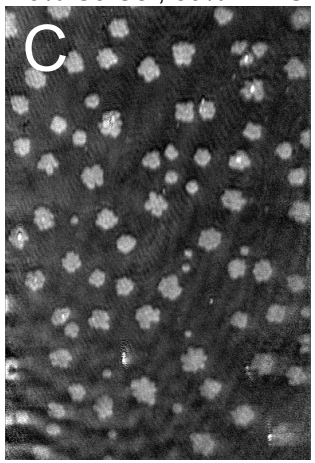

Total Area:
14200 um$^2$

Area %:
6%

Ave Dom
118±47 um$^2$

109 spots

Fast Cooled ~0.1C/min
20% GalCer, 80% DLPC



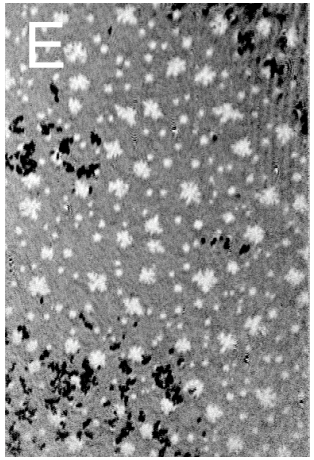

Total Area:
33400 um$^2$

Area %:
14%

Ave Dom
427±223 um$^2$

77 spots

Fast Cooled ~0.1C/min
35% GalCer, 65% DLPC



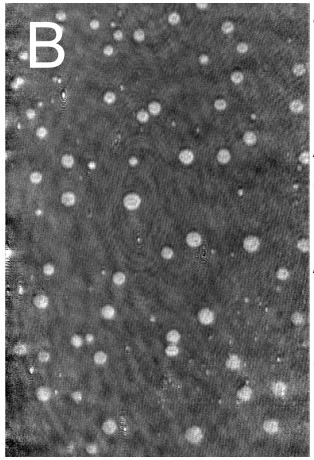

Total Area:
49900 um$^2$

Area %:
23%

Ave Dom
277±338
um$^2$

180 Spots

Slow Cooled ~0.05C/min
10% GalCer, 90% DLPC



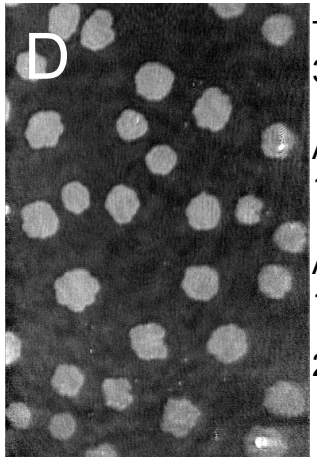

Total Area:
13300 um$^2$

Area %:
6%

Ave Dom
170±118 um$^2$

65 Spots

Slow Cooled ~0.05C/min
20% GalCer, 80% DLPC




Total Area:
36600 um$^2$

Area %:
15%

Ave Dom
1590±385 um$^2$

22 Spots

Slow Cooled ~0.05C/min
35% GalCer, 65% DLPC


Total Area:
52400 um$^2$

Area %:
24%

Ave Dom
1690±648 um$^2$

31 Spots

Figure SI-3: Ellipsomertric contrast images (430x645μm) of three lipid mixtures (10% GalCer / 90% DLPC, 20% GalCer 80% DLPC, and 35% GalCer / 65% DLPC) at two cooling rates (0.1 °C/min and 0.05 °C/min. A comparison of the images illustrates four trends: 1) Domain area increases with GalCer concentration. 2) Domain area increases with longer cooling rates for a given mixture. 3) Number of domains increases as cooling rate increase for all mixtures. 4) Total domain area increases with increasing GalCer concentration.

# Supplemental Information 4: GalCer:DLPC 20:80 Heating/Cooling

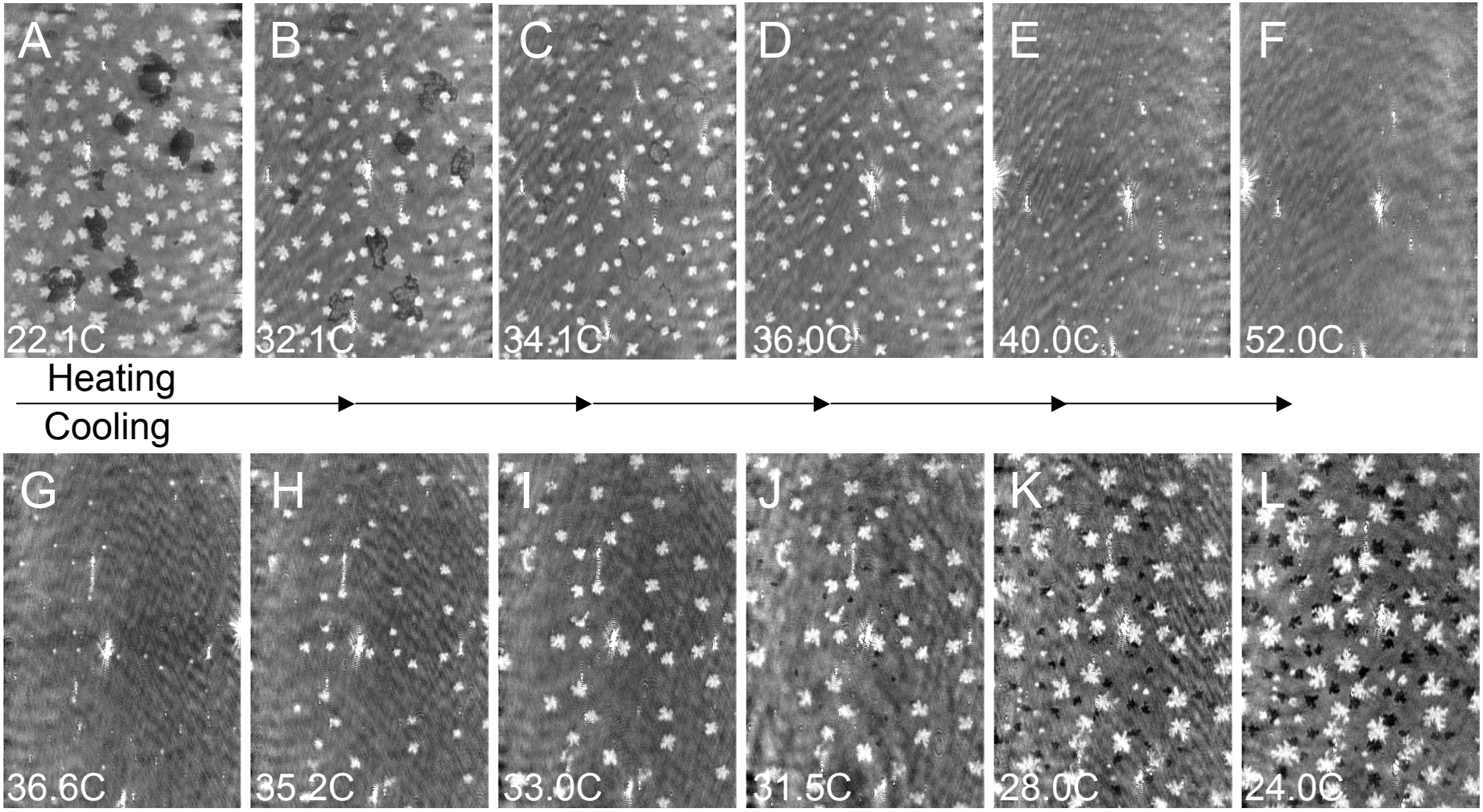



Figure SI-4: Ellipsomertric image snapshots from a series of images captured during a sample heating (A-F) followed by a (0.07°C/min) cooling (G-L) cycle of a 20% GalCer / 80% DLPC lipid mixture. The contrast images are 430x645μm. As the sample is heated, defects heal over (A-C) and domains melt becoming continuous with the fluid membrane (A-F). Upon a second cooling at 0.07°C/min, domains and defects in the membrane are first observable at 36.6 °C and 31.5 °C respectively. Both continue to grow after initial formation to form fractal-like morphologies. A movie of this process can be seen in Supplemental Information (SI).

# Supplemental Information 5: Calorimetry

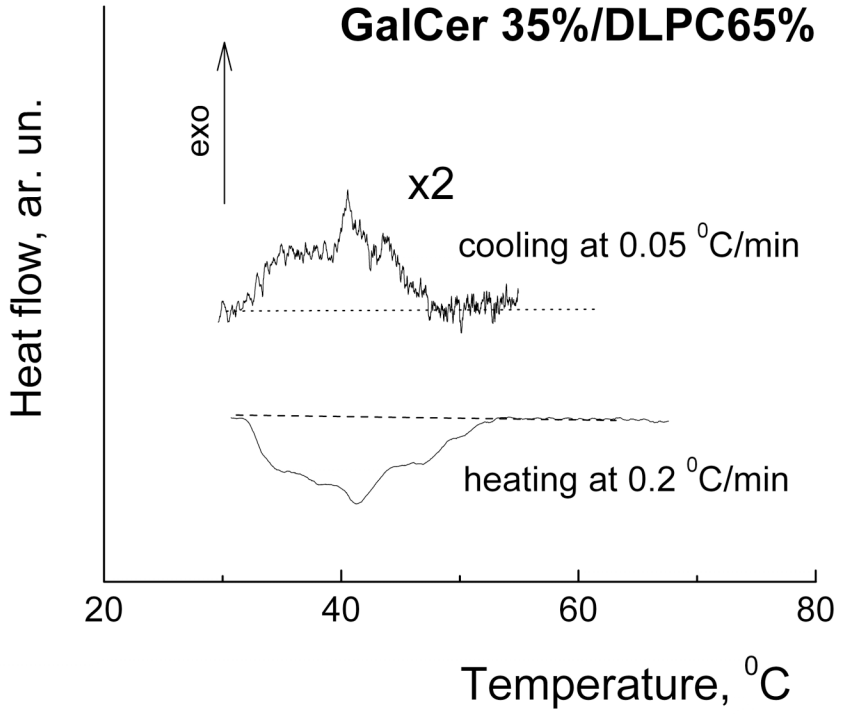



**Figure SI-5.** The differential scanning calorimetry (DSC) results using a Setaram C 80 calorimeter. The linear baseline is subtracted from both heating and cooling scans. Heating and cooling rates are given in the Figure.

The differential scanning calorimetry (DSC) results using a Setaram C 80 calorimeter are consistent with the ellipsometry data. The DSC melting peak at 38-39 ºC is very broad and of complex shape, indicating a complex transition that begins above 32 ºC and is fully complete above 54 ºC. The onset temperature of 43 ± 2 ºC in a cooling cycle indicates the beginning of crystallization with its maximum rate at 38-39 ºC, in agreement with the formation of pin-hole defects, seen in the ellipsometric experiment starting at 39 ºC. The total enthalpy of transition is 25 ± 2 kJ per mole of GalCer.