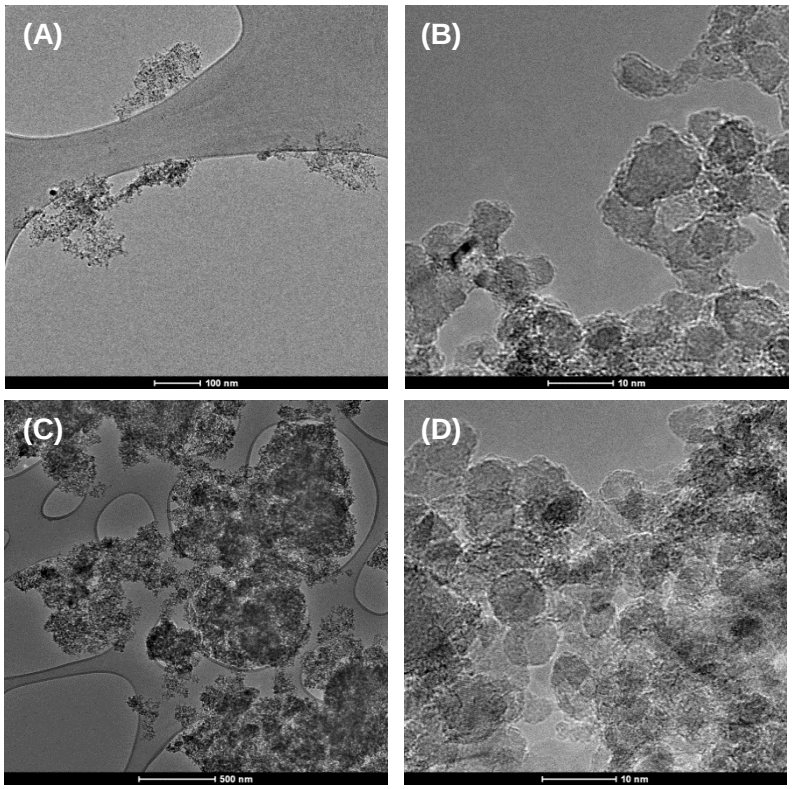

Figure S1: TEM images of the ECNs originally suspended in water (A and B) and organic solvent (C and D) show that the ECNs have a tendency to aggregate into sub micron particle size in media, even though they are about 5-10 nm in the dry powder state. The aggregates show these individual particles in higher resolution images (B and D). Scale: A: 100 nm, B, D: 10 nm, C: 500 nm.

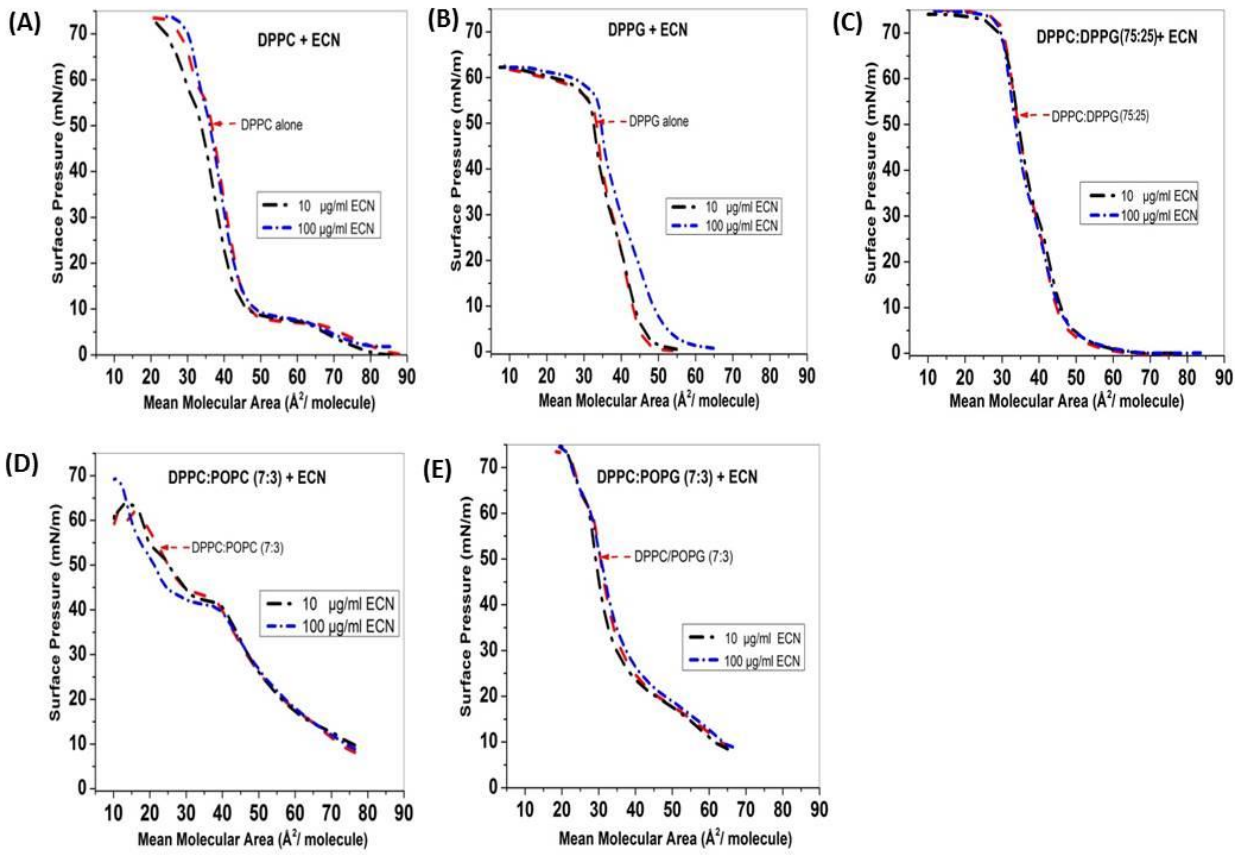

Figure S2: Surface Pressure vs. area per molecule isotherms of (A) DPPC (B) DPPG (C) DPPC: DPPG (75:25) (D) DPPC:POPC (7:3) (E) DPPC:POPG (7:3) monolayers obtained after one hour of incubation with 1 wt % (10 µg/ml) and 10 wt% (100µg/ml) ECN.

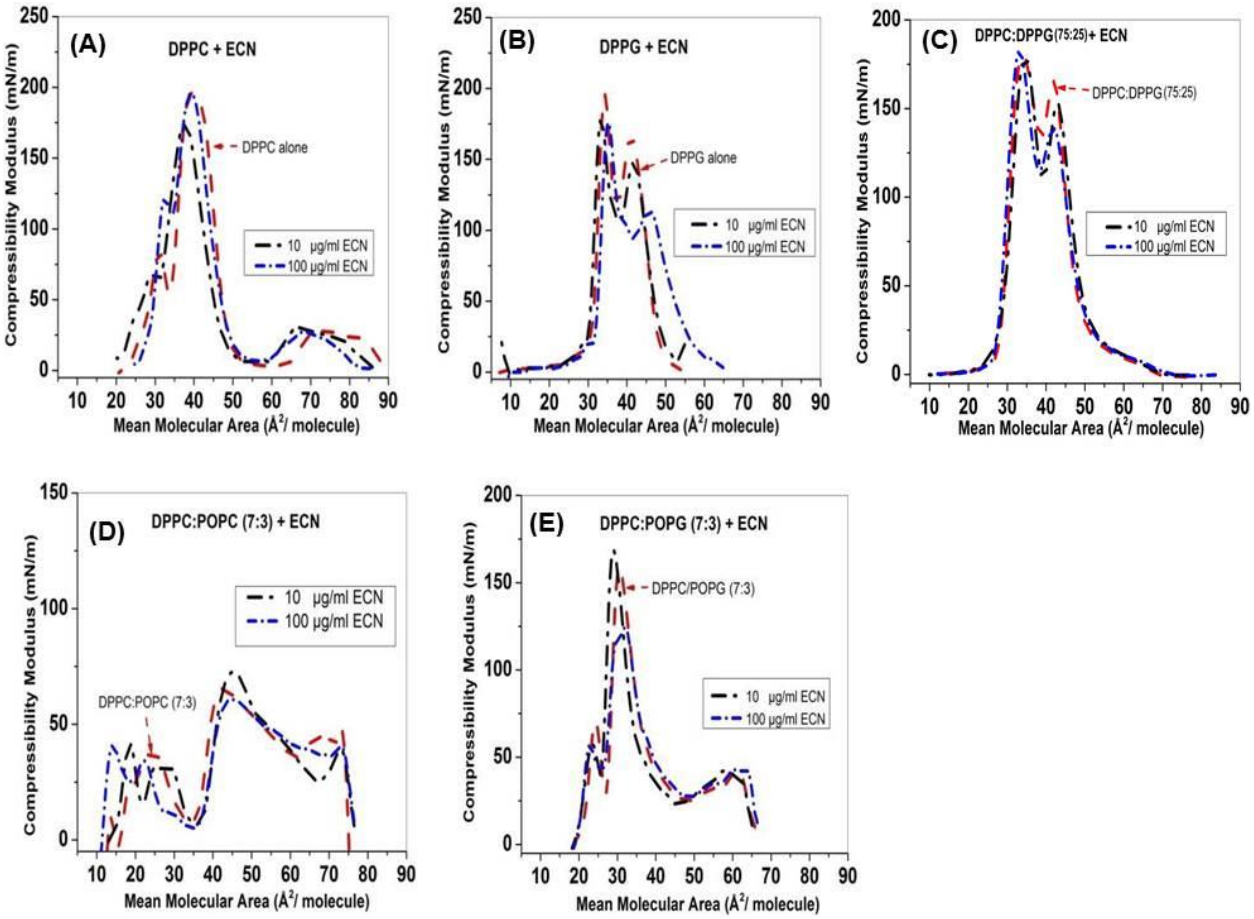

Figure S3: Compressibility Modulus vs. area per molecule isotherms for (A) DPPC (B) DPPG (C) DPPC: DPPG (75:25) (D) DPPC:POPC (7:3) (E) DPPC:POPG (7:3) monolayers obtained after one hour of incubation with 1 wt % (10 mg/ml) and 10 wt% (100µg/ml) ECN.

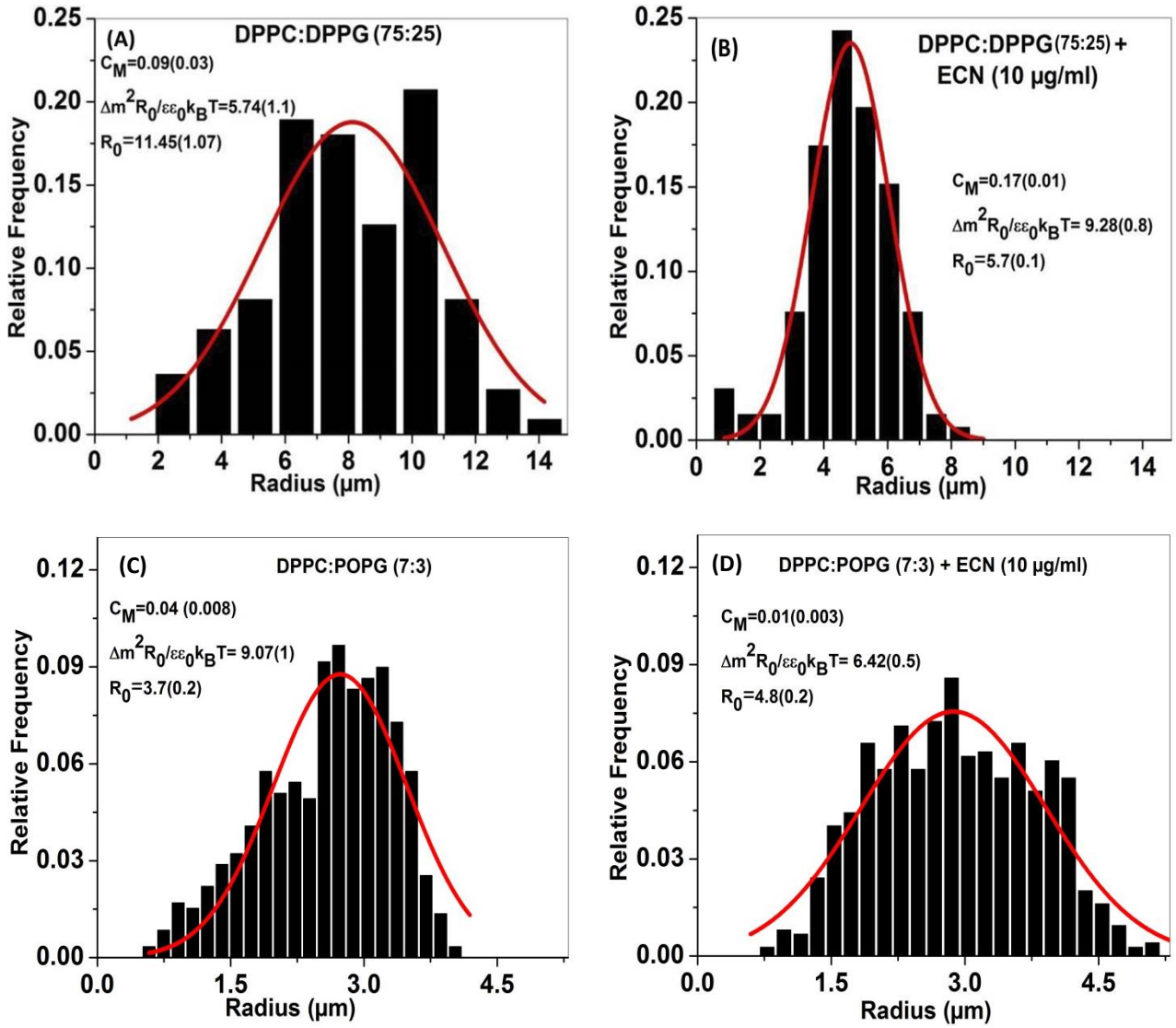

Figure S4: Analysis of domain size distribution of DPPC:DPPG and DPPC:POPG monolayers in the absence (A,C) and presence (B,D) of ECNs. The red curve shows the fit to Equation 4 in the main text. The curve fitting yielded an average adjusted R-Squared value of 0.87, indicating the good quality of the fit. The fitting parameters are also shown.

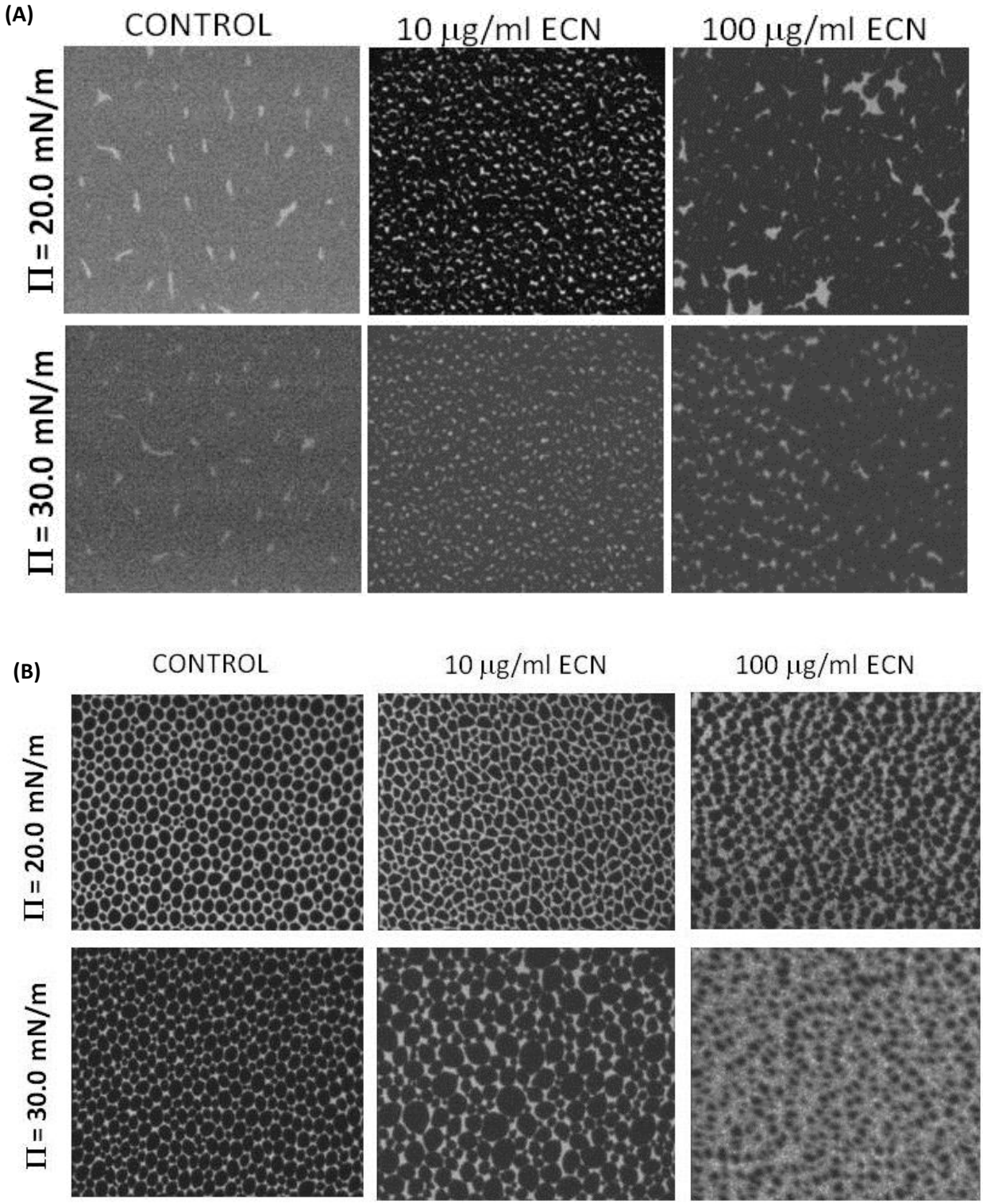

Figure S5: Comparison of ECN induced alterations in lipid domains as a result of exposure to different concentrations of ECN (A) DPPG (B) DPPC:POPG mixture.

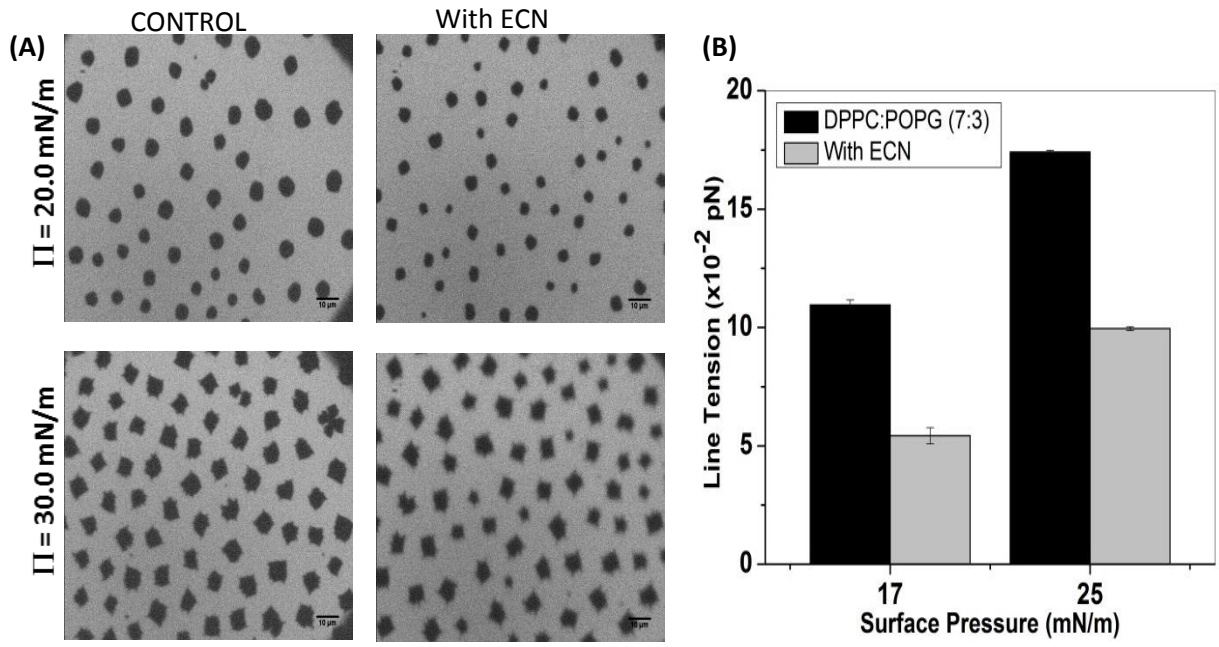

Figure S6: (A) Fluorescence images of DPPC:POPG films without and with ECN spread on a PBS buffer sub-phase at two representative surface pressures. (B) Line tension analysis from the domain size distributions in (A) show a significant decrease in the line tension in the presence of ECNs.

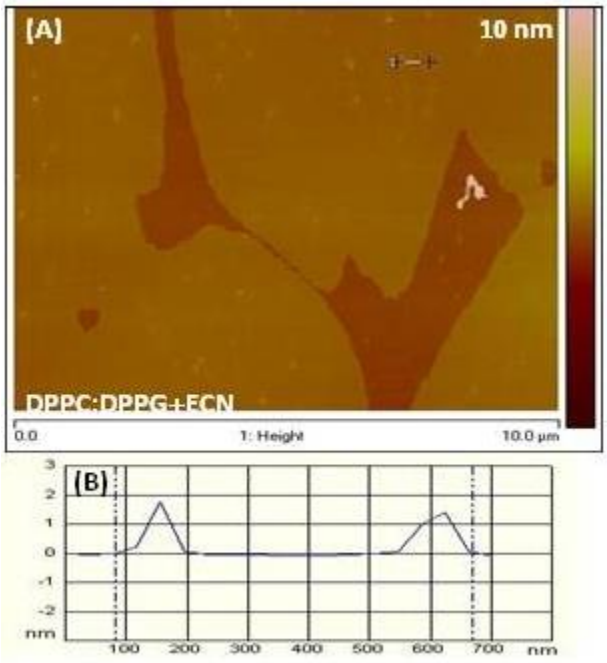

Fig S7: Detailed height analysis within a condensed domain shows that unlike the significant height change in the LE phase, the raised features within the LC domain do not correspond to ECN aggregates of size ~ 250 nm, since the height of these features is significantly lower than that expected for ECN aggregates that contain carbon nanodiamonds of diameter 5-10 nm.

Tables:

Sample	Saturated	Net charge
DPPC	Yes	Neutral
DPPG	Yes	Anionic
DPPC:DPPG (75:25)	Yes	Anionic
DPPC:POPC (7:3)	No	Neutral
DPPC:POPG (7:3)	No	Anionic

Table S1: List of phospholipid combinations studied along with their overall charge and saturation.

ECN in	Particle Size (nm)	Poly-dispersity
Water	219	0.19
Chloroform/ methanol mixture	240	0.35
Lipid/organic mixture	130	0.41

Table S2: Particle size analysis of the ECNs in different media relevant to the experimental conditions.