Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

On the Stability and Chemorheology of Urea Choline Chloride Deep-Eutectic Solvent as an Internal Phase for Acrylic High Internal Phase Emulsions.

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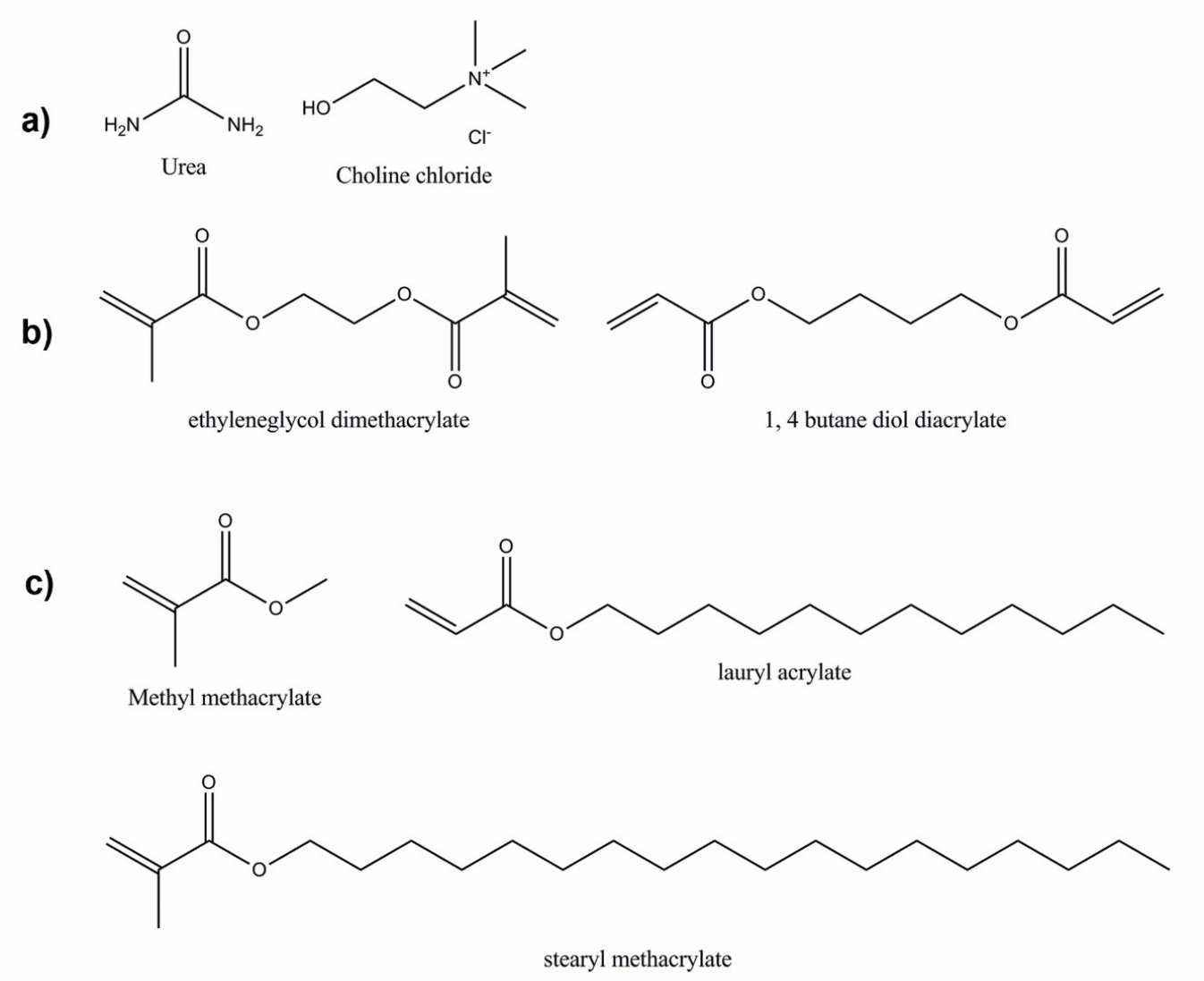

Figure S1. Structures of reagents: a) DES components b) cross-linkers and c) monomers used

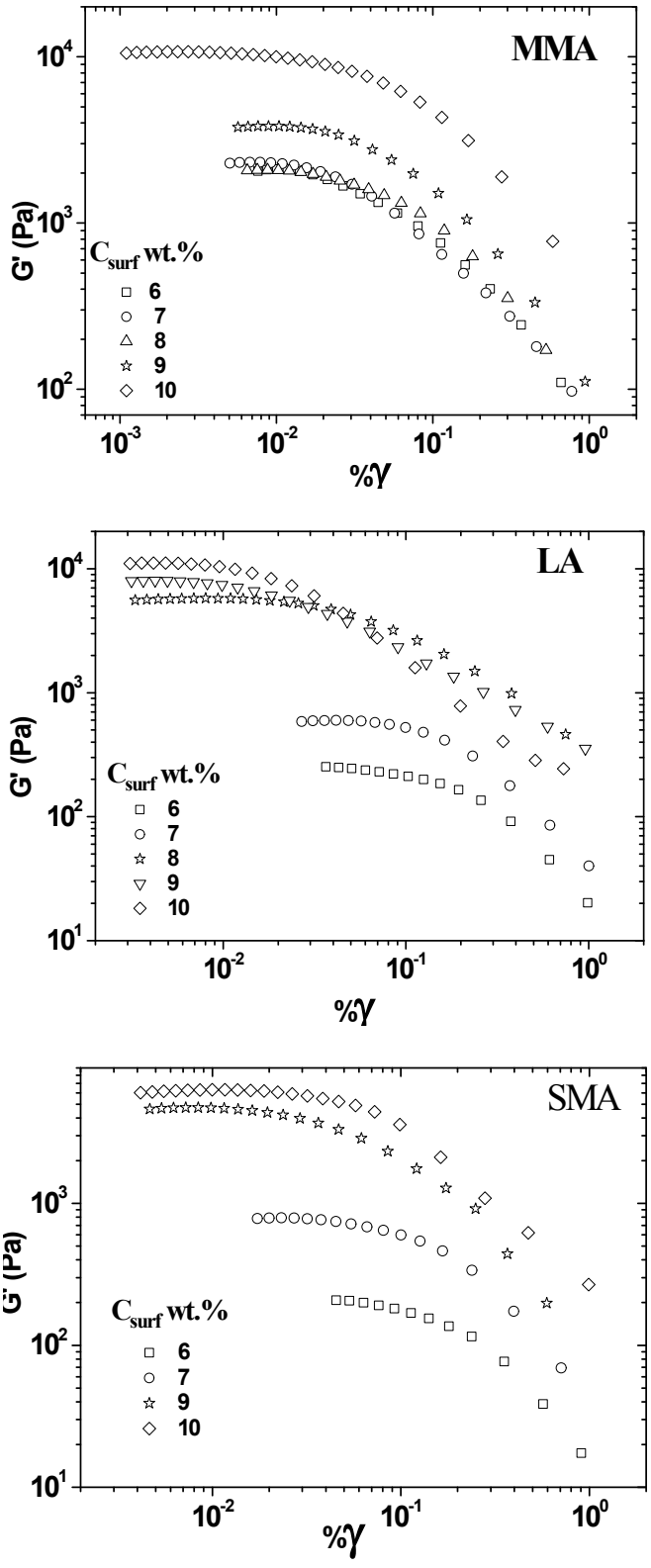

Figure S2. Storage Modulus vs. %Strain a) methyl methacrylate b) lauryl acrylate and c) stearyl methacrylate.

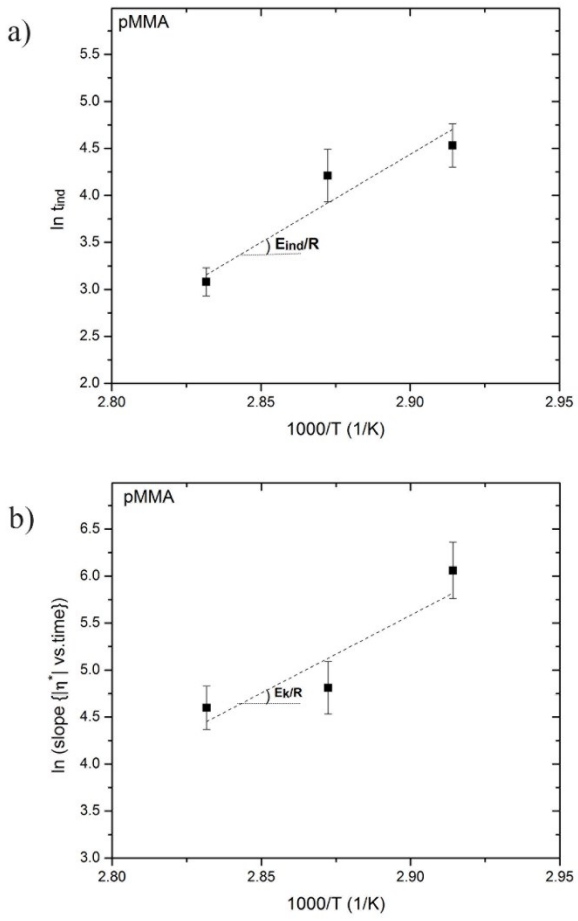

Figure S3. (a) Temperature effects on induction time, t_{ind}, for pMMA where the slope can be used to estimate the induction activation energy, E_{ind}. (b) Using an Arrhenius relationship, the reaction activation energy, E_k, for pMMA can be estimated from the slope of complex viscosity versus time and its temperature dependence.

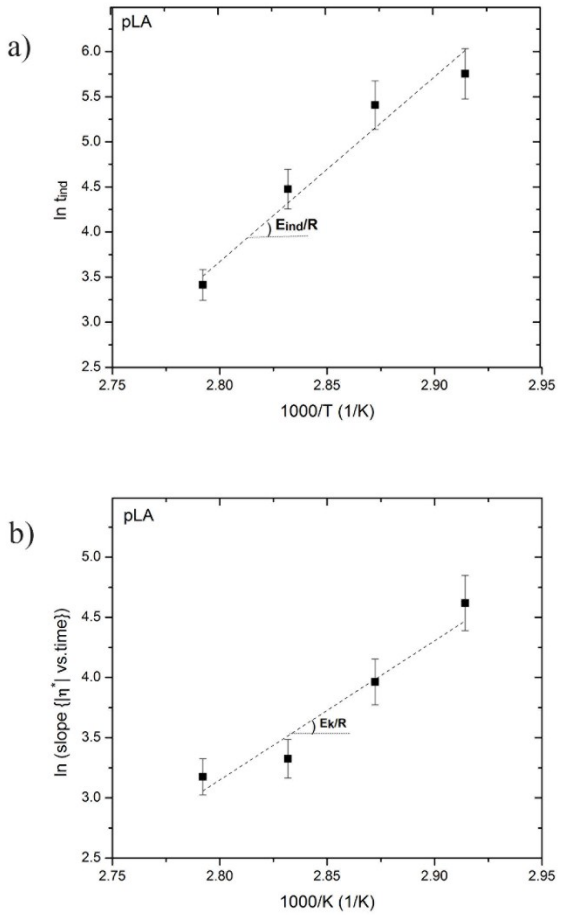

Figure S4. (a) Temperature effects on induction time, t_{ind}, for pLA where the slope can be used to estimate the induction activation energy, E_{ind}. (b) Using an Arrhenius relationship, the reaction activation energy, E_k, for pLA can be estimated from the slope of complex viscosity versus time and its temperature dependence.

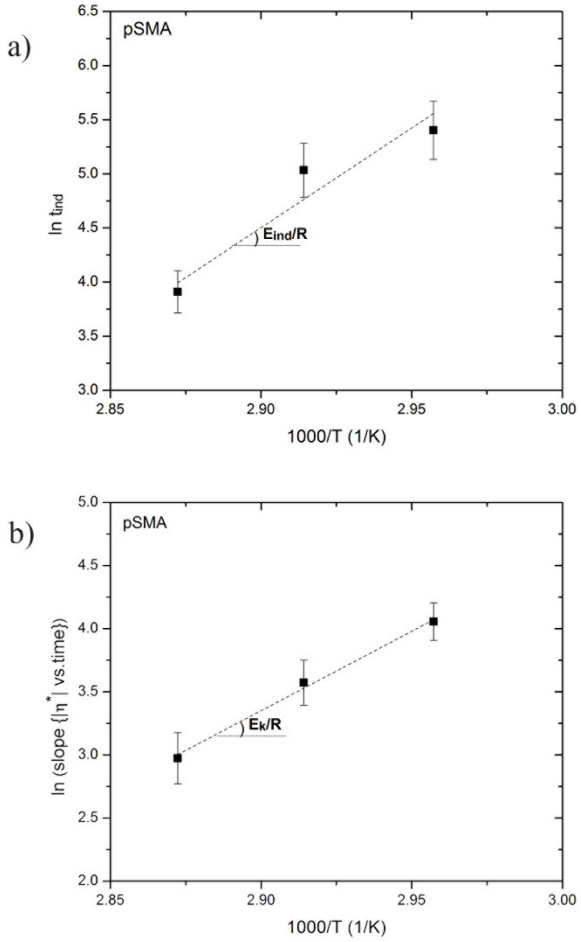

Figure S5. (a) Temperature effects on induction time, t_{ind}, for pSMA where the slope can be used to estimate the induction activation energy, E_{ind}. (b) Using an Arrhenius relationship, the reaction activation energy, E_k, for pSMA can be estimated from the slope of complex viscosity versus time and its temperature dependence.

Scheme S1. Critical extent of reaction for theoretical gel point determination.

$$(1)\ r = \frac{N_m f_m}{N_c f_c}$$

$$f_{w,m} = \frac{\sum f_{m_i}^2 N_{m_i}}{\sum f_m N_{m_i}} \quad \textbf{(2)}$$

$$f_{w,c} = \frac{\sum f_{c_j}^2 N_{c_j}}{\sum f_{c_j} N_{c_j}} \quad \textbf{(3)}$$

$$P_c = \frac{1}{\left[r(f_{w,m}-1)(f_{w,c}-1)\right]^{1/2}} \quad \textbf{(4)}$$

Where:

r = ratio of monomer groups to cross-linker groups

N_m = number of monomer moles

N_c = number of cross-linker moles

f_m= monomer functionality

f_c= cross-linker functionality

$f_{w,m}$ = monomer weight-average functionalities

$f_{w,c}$ = cross-linker weight-average functionalities

P_c = the extent of reaction at gel point

Table S1 Poly(HIPE) summary of equivalent weight, functionality, and extent of reaction at gel point.

Poly(HIPE)	Monomer M_W (g mol^{-1})	Monomer f_{avg}	Cross-linker M_W ($gmol^{-1}$)	Cross-linker f_{avg}	Equivalent Weight	r	$f_{w,m}$	$f_{w,c}$	P_C
pMMA	100.1	1	198.2	2	99.4	0.99	1	2	0.71
pLA	240.4	1	198.2	2	146.2	1.0	1	2	0.71
pSMA	338.6	1	198.2	2	178.9	1.0	1	2	0.71

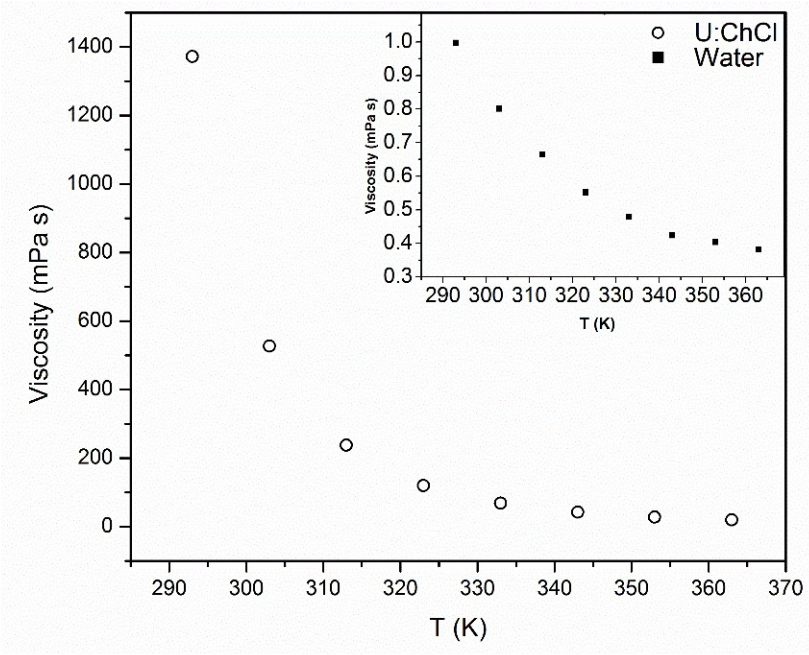

Figure S6 Change in viscosity as a function temperature for urea choline chloride (U:CHCl) DES and water (inset).

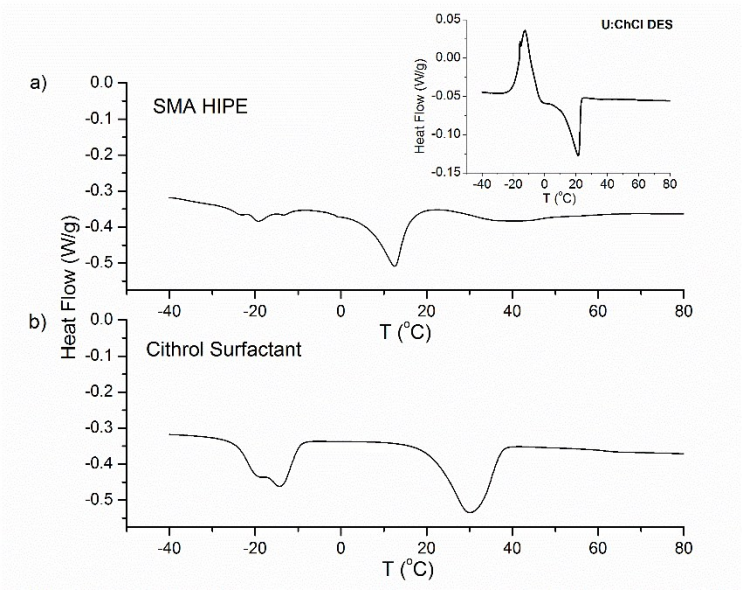

Figure S7 a) Characteristic HIPE DSC curve, (b) Cithrol Surfactant, and urea choline chloride DES (inset).

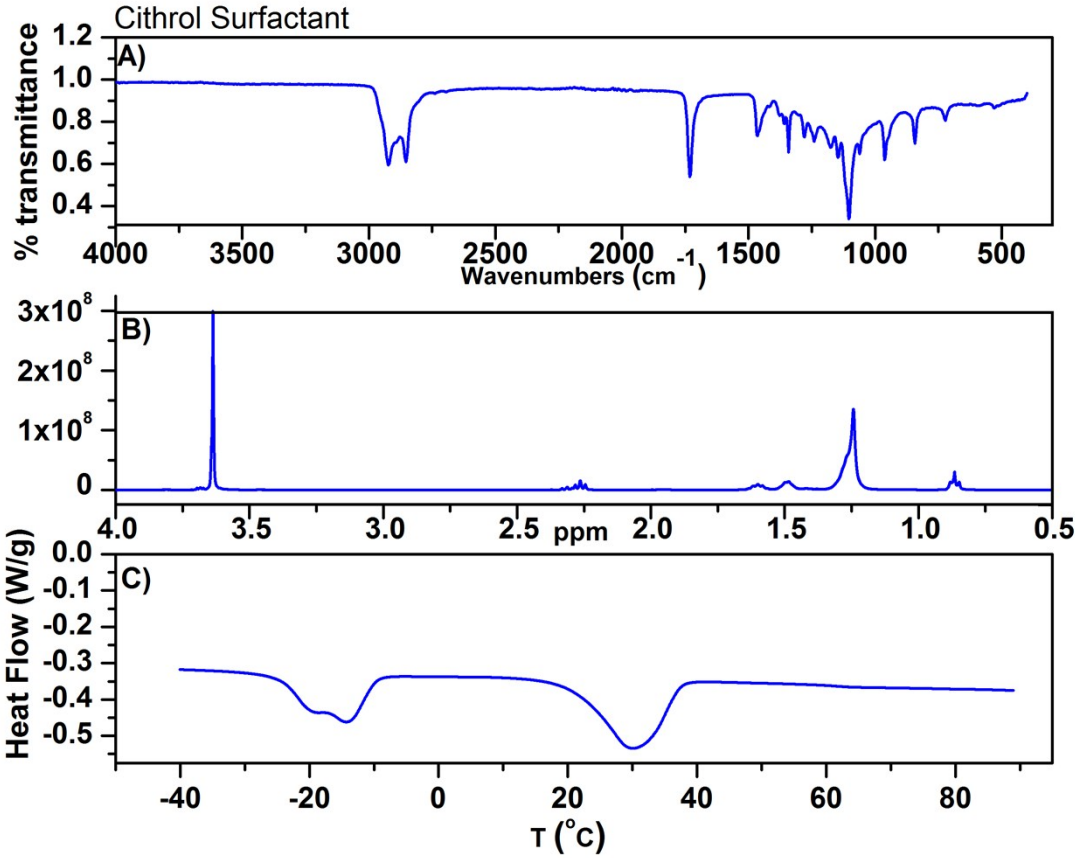

Figure S8. Cithrol Surfactant characterization by A) FTIR, B) NMR, and C) DSC

Table S2. Average drop dispersity, pore size distribution, and pore window size distribution for MMA, SMA, and LA based HIPEs and poly(HIPEs)

Sample	Drop Dispersity	Pore Size Distribution	Pore Window Size Distribution
MMA	0.36	0.38	0.38
SMA	0.25	0.20	0.33
LA	0.49	0.33	0.43

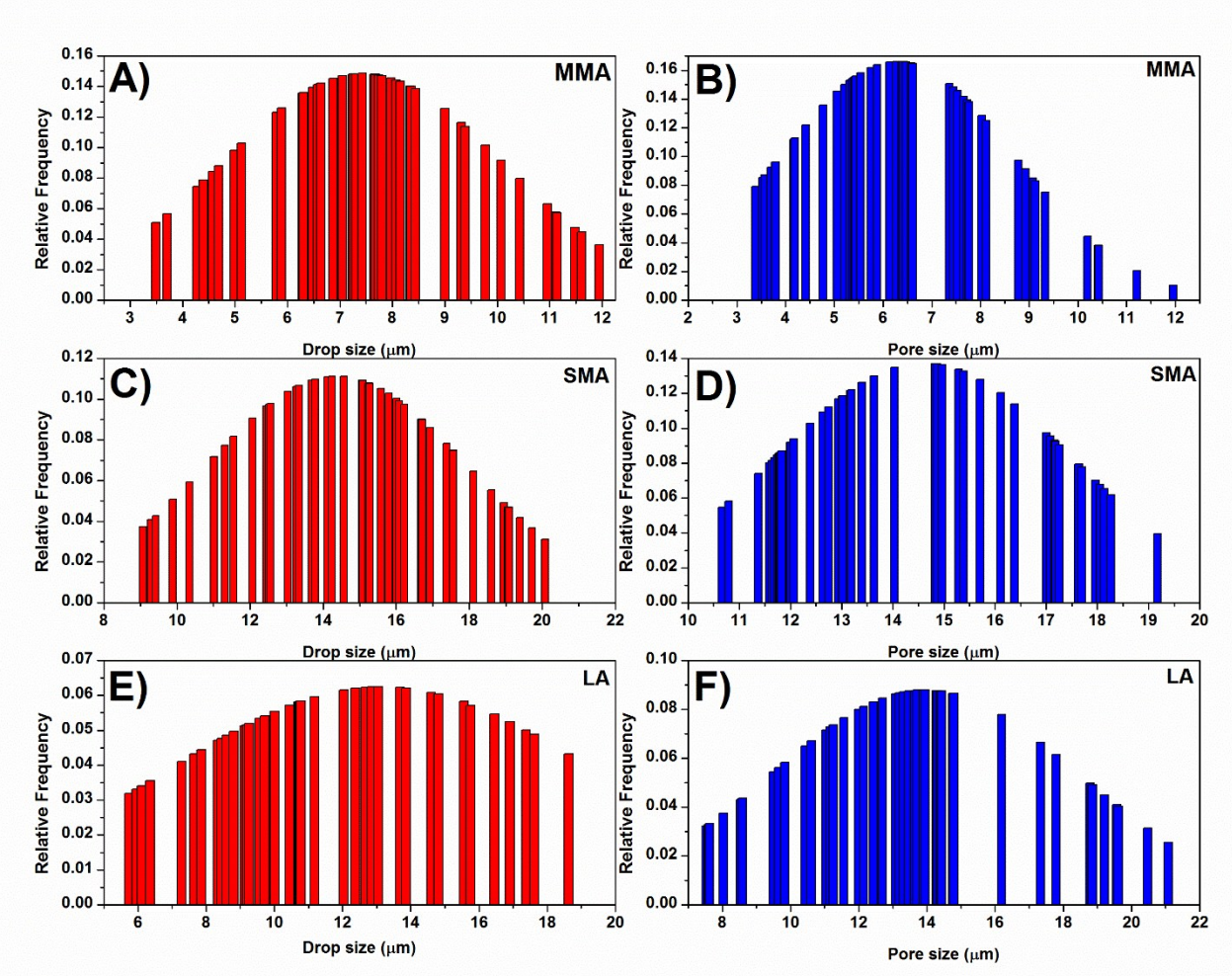

Figure S9. HiPE and poly(HIPE) drop size distribution for A) MMA, C) SMA, and E) LA and pore size distribution for B) MMA, D) SMA, and F) LA.

Table S3. Structural morphology of HIPEs and Poly(HIPEs)

PolyHIPE Sample	Specific Surface Area [m2 g-1]	Drop Radius [μm]	Pore Radius [μm]	Pore Window [μm]	Deg. of Openness [%]
pMMA10	nd[a)]	17.2±6.5	16.4±5.0	2.4±0.9	3.2
pMMA7	1.7	7.4±2.7	6.3±2.4	1.8±0.6	23.2
pLA10	nd[a)]	10.5±3.5	55.3±30	7.0±2.6	0.8
pLA7	1.0	13.1±6.4	14±4.6	2.8±1.2	10.1
pSMA10	4.3	6.9±2.5[b)]	5.8±2.0	1.4±0.6	2.8
pSMA7	nd[a)]	14.4±3.6	14.6±2.9	0.9±0.3	7.1

[a)] not determined. [b)] pSMA10 droplet measurement is representative of pSMA10v.

Figure S10. poly(HIPE) pore window size distribution for A) MMA, B) SMA, and C) LA.