Supplementary Information

Binary Hairy Nanoparticles for highly conductive non-flammable electrolytes

Akanksha Agrawal[Ψ], Snehashis Choudhury[Ψ], Lynden A. Archer*

School of Chemical and Biomolecular Engineering, Cornell University, Ithaca, NY 14853

Ψ- These authors contributed equally to this paper

**Email: laa25@cornell.edu*

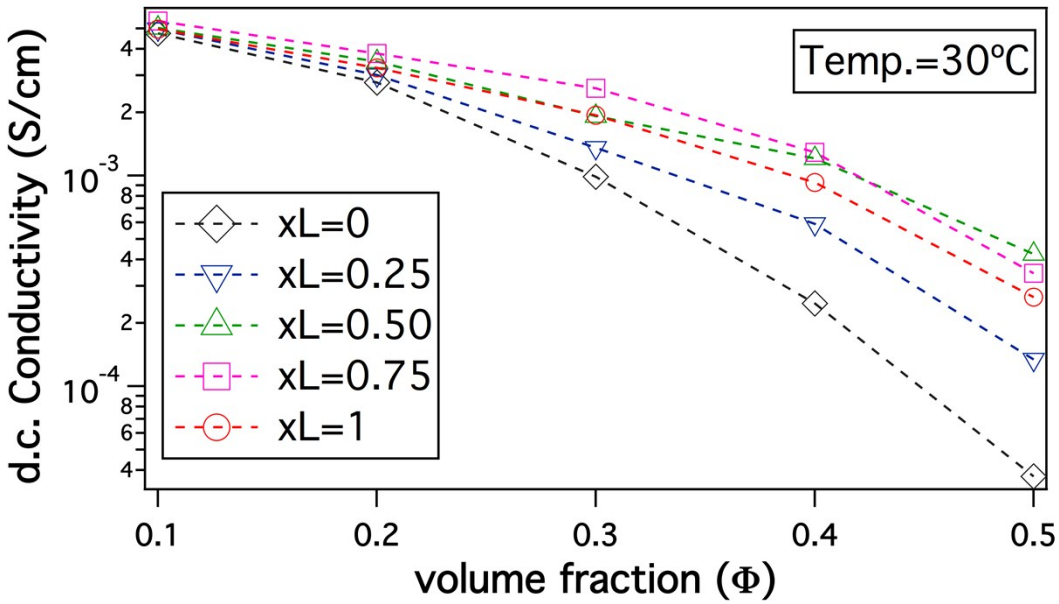

Figure S1: Conductivity as a function of volume fraction for different binary ratios, while the conductivity for pure samples decrease significantly, that of binary mixtures are not as low at particle loading

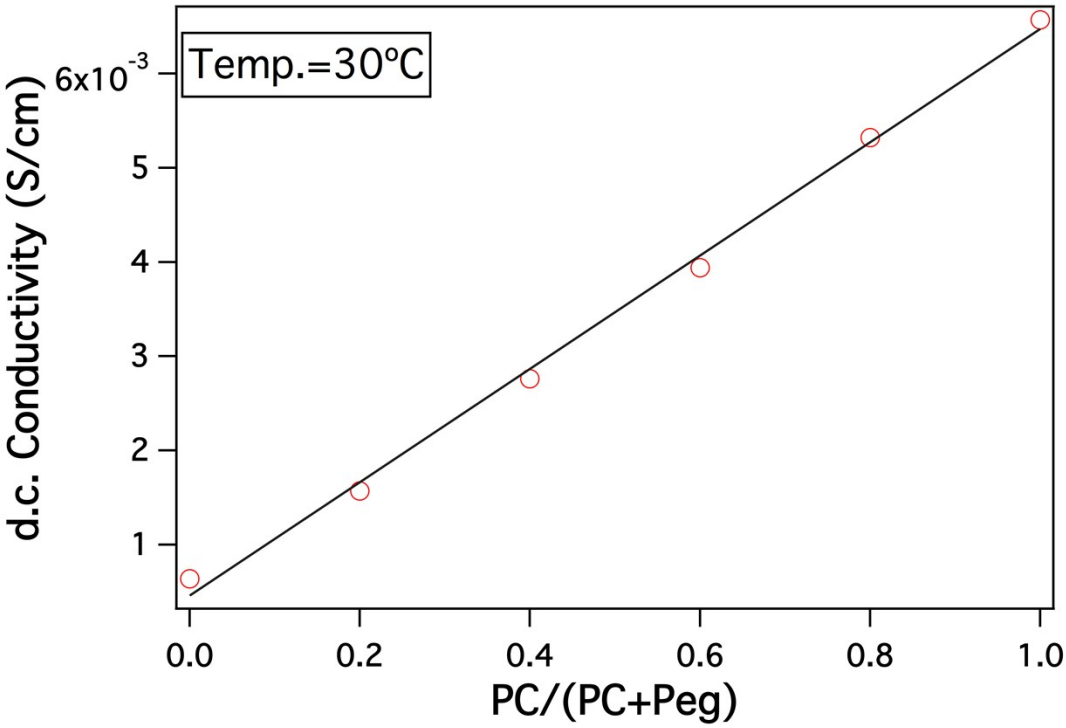

Figure S2: Conductivity as a function of volume fraction of PC in a mixture of PC and Peg. It is fitted to a linear regression. The conductivity values obtained from this line at different organic content are used to normalize the actual conductivity for the respective hybrid samples.

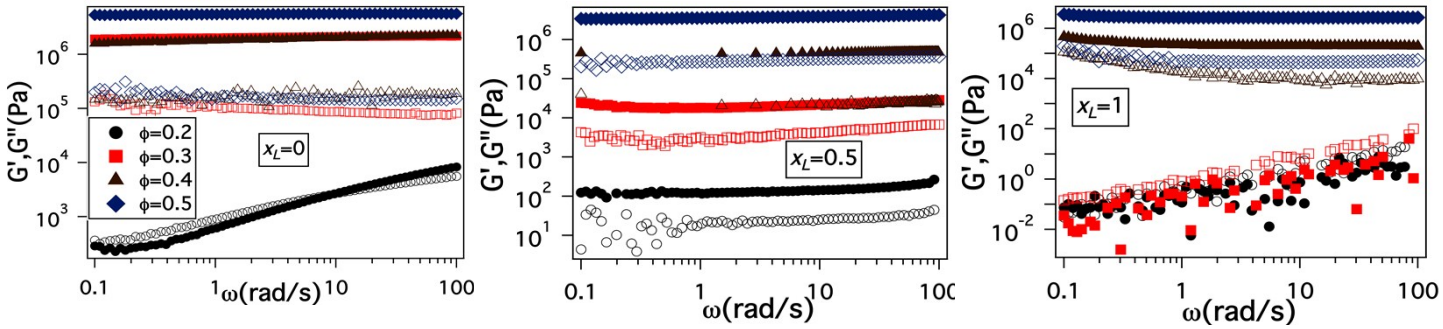

Figure S3: Variation of storage modulus, G′ (closed symbols) and loss modulus, G″(open symbols) with angular frequency, ω(rad/s) at different particle volume fraction, Φ for varying x_L values.

Table ST1. VFT parameters: Pseudo-activation energy, E_a (kJ/mol), pre-factor A(S/cm), reference temperature, T_0(K) and the error in fitting r^2 at different values of Φ with variation in x_L.

x_L	E_a (kJ/mol)	A (S/cm)	T_0 (K)	r^2 (goodness of fit)
Φ=0.2				
0	4.83	0.143	155.30	8.63E-10
0.25	3.23	0.056	172.42	8.62E-08
0.50	2.95	0.092	197.19	2.51E-07
0.75	3.20	0.105	186.58	6.51E-09
1.0	3.32	0.113	190.10	1.32E-09
Φ=0.3				
0	6.04	0.069	137.96	1.19E-07
0.25	5.07	0.088	159.78	6.48E-08
0.50	3.25	0.082	200.13	3.32E-07
0.75	4.17	0.109	168.55	1.98E-08
1.0	4.87	0.210	175.44	2.31E-07
Φ=0.4				
0	7.0	0.025	117.18	1.45E-09
0.25	6.37	0.106	158.37	8.24E-09
0.50	3.75	0.077	192.22	4.43E-08
0.75	4.61	0.087	171.488	2.44E-08
1.0	6.73	0.136	143.58	3.52E-08
Φ=0.5				
0	7.33	0.041	173	1.58E-08
0.25	7.11	0.042	159.85	5.06E-09
0.50	4.18	0.023	178.91	1.01E-09
0.75	5.51	0.025	147.45	2.78E-09
1.0	7.93	0.068	136.45	7.92E-09

Table ST2. Relative volume fraction of PC with respect to PEG, storage modulus in the limit of zero stain, $G'_{\gamma\to 0}$; DC ionic conductivity at 30°C, σ_{DC}; normalized ionic conductivity with neat blend of PC-PEG, $S/S_{0;}$ and pseudo-activation energy, E_a at different values of Φ with variation in x_L.

x_L	Volume fraction of PC/(PC+PEG)	$G'_{\gamma\to 0}$(Pa)	σ_{DC}(S/cm)	S/S_0(S/cm)
Φ=0.2				
0	0.77	2170	2.77E-03	5.41E-01
0.25	0.78	43.4	3.01E-03	5.74E-01
0.50	0.83	187.14	3.49E-03	6.36E-01
0.75	0.87	1160.83	3.81E-03	6.64E-01
1.0	0.91	0.44	3.25E-03	5.43E-01
Φ=0.3				
0	0.61	2.3E+06	6.81E-04	2.38E-01
0.25	0.63	2.7E+04	1.06E-03	3.18E-01
0.50	0.69	6.7E+04	1.72E-03	4.12E-01
0.75	0.75	2.88E+04	2.60E-03	5.17E-01
1.0	0.85	0.65	1.94E-03	3.45E-01
Φ=0.4				
0	0.33	2.6E+06	1.57E-04	9.89E-02
0.25	0.44	8.5E+05	5.31E-04	1.87E-01
0.50	0.55	4.3E+05	1.11E-03	3.16E-01
0.75	0.66	1.4E+05	1.49E-03	2.89E-01
1.0	0.77	8.3E+04	9.29E-04	1.81E-01
Φ=0.5				
0	0.10	6.1E+06	2.93E-05	3.32E-02
0.25	0.14	1.2E+06	1.34E-04	1.01E-02
0.50	0.28	4.5E+06	4.24E-04	1.92E-01
0.75	0.43	1.6E+06	3.44E-04	1.12E-01
1.0	0.65	2.8E+06	2.65E-04	5.97E-02