

Supporting Information

Developing a Nitrile-based Lithium-conducting Electrolyte for Low Temperature Operation

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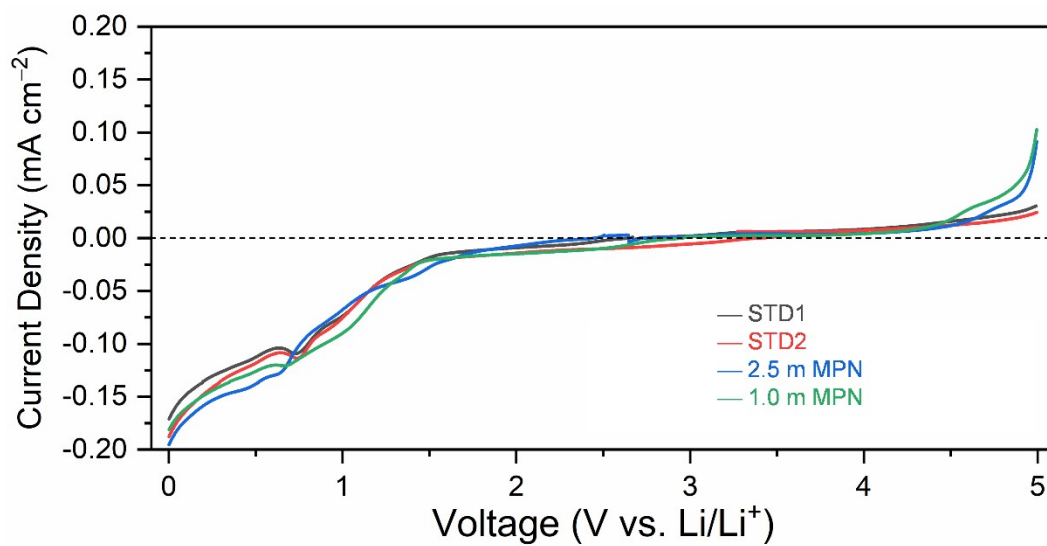


Figure S1. Linear sweep voltammograms scanned at 5 mV s^{-1} to assess the electrochemical stability window of STD1, STD2, 2.5 m MPN, and 1.0 m MPN.

Electrolyte	σ at RT (mS cm ⁻¹)	σ at 0°C (mS cm ⁻¹)	σ at -20°C (mS cm ⁻¹)	σ at -40°C (mS cm ⁻¹)
STD1	5.79	3.60	0.94	fr
STD2	3.30	1.64	0.66	0.15
2.5 m MPN	4.21	2.12	0.85	0.19

Table S1. Summary of total conductivity values for STD1, STD2, and 2.5 m MPN electrolytes.

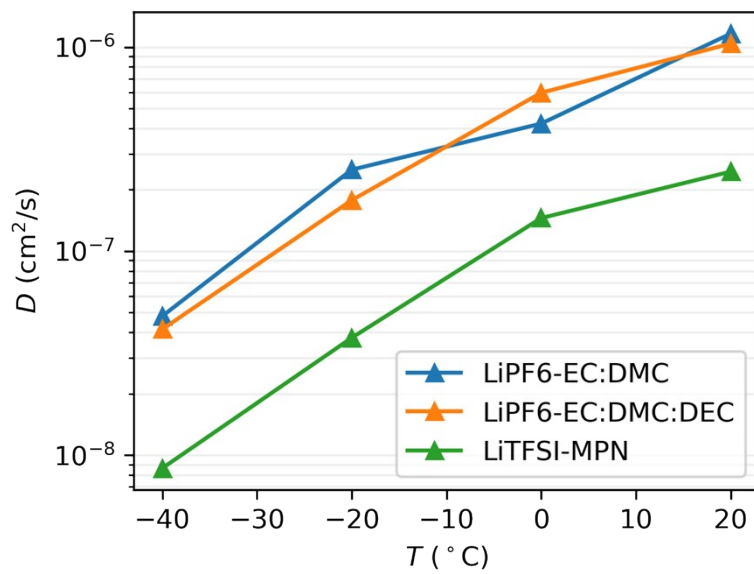


Figure S2. Diffusivities D estimated using MD simulations for the same three systems.

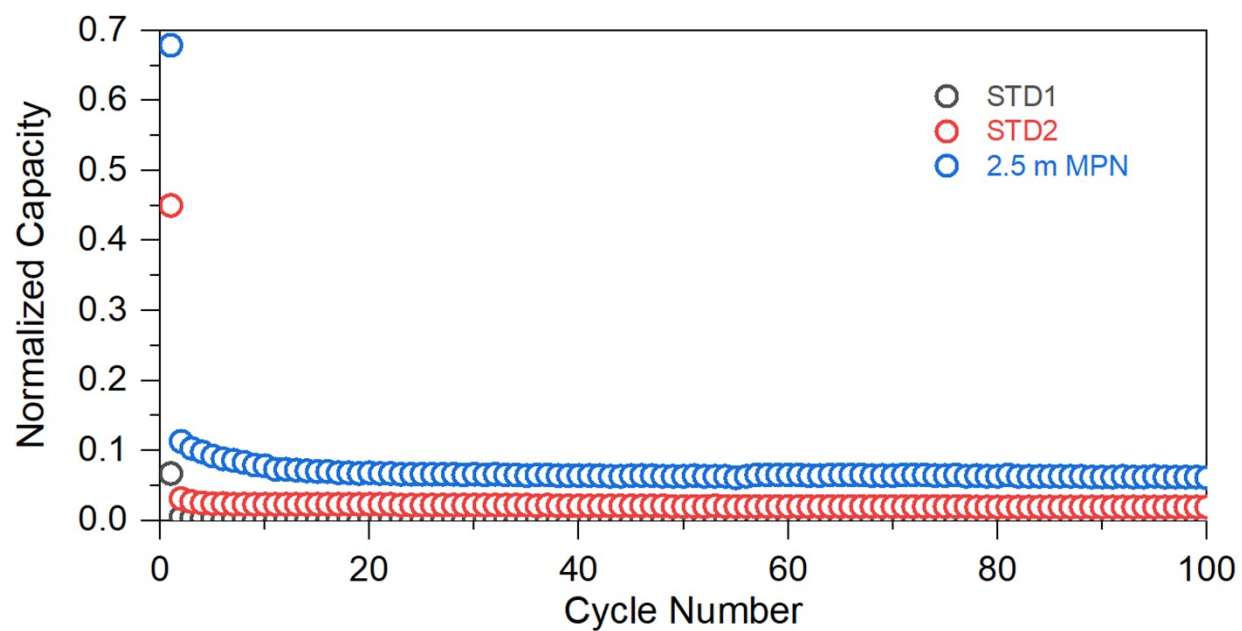


Figure S3. Long-term cycling stability when subjected to C/10 for 100 cycles of gr||LCO cells with STD1, STD2, and 2.5 m MPN electrolytes at -40°C .

Electrolyte		R_e (Ω)		
	Room Temperature	0°C	-20°C	-40°C
STD1	3.20	5.05	5.29	5.67
STD2	3.75	4.41	6.37	15.44
2.5 m MPN	3.89	5.78	9.40	22.11

Table S2. Summary of R_e values for STD1, STD2, and 2.5 m MPN from AC impedance spectroscopy.

Electrolyte		R_{an} (Ω)		
	Room Temperature	0°C	-20°C	-40°C
STD1	15.3	25.0	21.7	64.3
STD2	14.2	15.59	20.63	74.56
2.5 m MPN	26.1	56.22	101.6	102.9

Table S3. Summary of R_{an} values for STD1, STD2, and 2.5 m MPN from AC impedance spectroscopy.

Electrolyte		R_{ca} (Ω)		
	Room Temperature	0°C	-20°C	-40°C
STD1	45.0	100.1	278.3	385.7
STD2	82.8	214.41	529.4	1025.4
2.5 m MPN	173.8	323.78	709.4	1497.2

Table S4. Summary of R_{ca} values for STD1, STD2, and 2.5 m MPN from AC impedance spectroscopy.

Electrolyte		τ for R_e (s)		
	Room Temperature	0°C	-20°C	-40°C
STD1	-	0.001	0.005	0.006
STD2	-	0.001	0.007	0.009
2.5 m MPN	-	0.001	0.005	0.009
τ for R_{SEI} (s)				
STD1	0.0005	0.01	0.05	0.06
STD2	0.02	0.014	0.04	0.09
2.5 m MPN	0.003	0.012	0.06	0.06
τ for R_{an} (s)				
STD1	0.01	0.1	0.53	1
STD2	0.18	0.082	0.52	0.98
2.5 m MPN	0.05	0.1	0.48	0.59
τ for R_{CEI} (s)				
STD1	0.27	3.7	-	-
STD2	0.18	1.1	-	-
2.5 m MPN	0.14	1.1	-	-

Table S5. Summary of relaxation time constant (τ) values for STD1, STD2, and 2.5 m MPN electrolytes.