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Effect of the Linker and Substituents on the Ionic Conductivity of Borate Single-Ion Polymers for Lithium Batteries

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Supplementary Information

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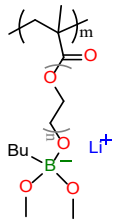
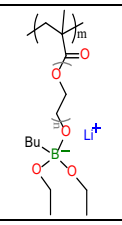
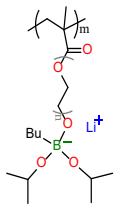
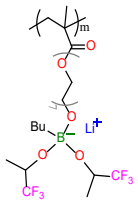
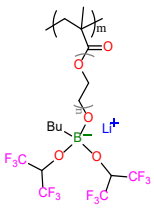
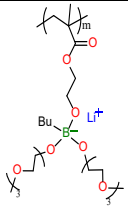
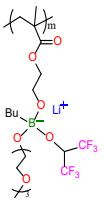
Polymers synthetized

Table S1. Chemical structures and names of SLICPEs.

Structure	n	Name	Full name
	1	***pLBBn$_1$(OMe)$_2$***	*Poly[lithium(ethylene glycoxyl-dimethoxyl-butyl)borate]methacrylate*
	7	***pLBBn$_7$(OMe)$_2$***	*Poly[lithium(hepta(ethylene glycoxyl)-dimethoxyl-butyl)borate]methacrylate*
	9	***pLBBn$_9$(OMe)$_2$***	*Poly[lithium(nona(ethylene glycoxyl)-dimethoxyl-butyl)borate]methacrylate*
	1	***pLBBn$_1$(OEt)$_2$***	*Poly[lithium(ethylene glycoxyl-diethoxyl-butyl)borate]methacrylate*
	7	***pLBBn$_7$(OEt)$_2$***	*Poly[lithium(hepta(ethylene glycoxyl)-diethoxyl-butyl)borate]methacrylate*
	1	***pLBBn$_1$(OiP)$_2$***	*Poly[lithium(ethylene glycoxyl-diisopropyl-butyl)borate]methacrylate*
	7	***pLBBn$_7$(OiP)$_2$***	*Poly[lithium(hepta(ethylene glycoxyl)-diisopropyl-butyl)borate]methacrylate*
	7	***pLBBn$_7$(OF$_3$iP)$_2$***	*Poly[lithium(hepta(ethylene glycoxyl)-di(1,1,1-trifluoropropan-2-oxyl)-butyl)borate]methacrylate*
	1	***pLBBn$_1$(OF$_6$iP)$_2$***	*Poly[lithium(ethylene glycoxyl-di(1,1,1,3,3,3-hexafluoropropan-2-oxyl)-butyl)borate]methacrylate*
	7	***pLBBn$_7$(OF$_6$iP)$_2$***	*Poly[lithium(hepta(ethylene glycoxyl)-di(1,1,1,3,3,3-hexafluoropropan-2-oxyl)-butyl)borate]methacrylate*
	1	***pLBBn$_1$(OGly)$_2$***	*Poly[lithium(ethylene glycoxyl-di(tri(ethylene glycoxyl)-butyl)borate]methacrylate*
	1	***pLBBn$_1$(OGlyOF$_6$iP)***	*Poly[lithium(ethylene glycoxyl-(tri(ethylene glycoxyl)-(1,1,1,3,3,3-hexafluoropropan-2-oxyl)-butyl)borate]methacrylate*

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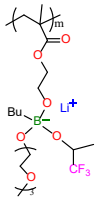	1	***pLBBn1(OGlyOF3iP)***	*Poly[lithium(ethylene glycoxyl-(tri(ethylene glycoxyl)-(1,1,1-trifluoropropan-2-oxyl)borate]methacrylate*

Structure and thermal characterizations of lithium borate SLICPEs

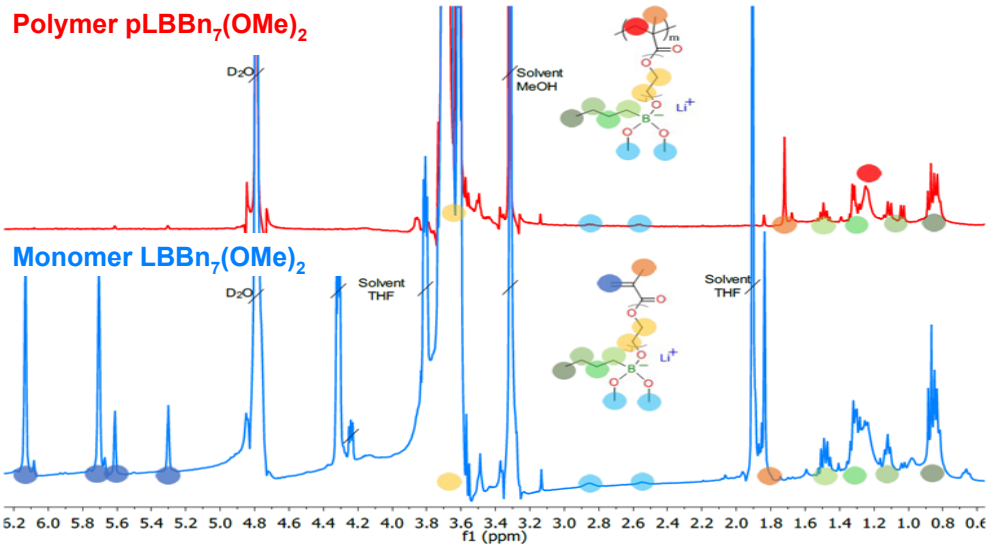

Fig. S1. ^{1}H NMR spectra for monomer LBBn$_7$(OMe)$_2$ and polymer pLBBn$_7$(OMe)$_2$.

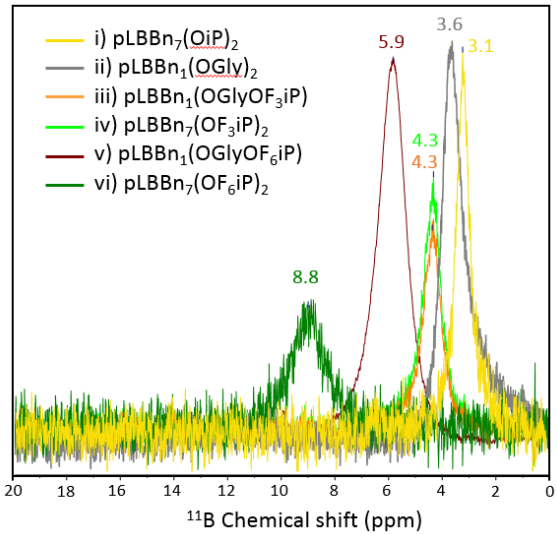

Fig. S2. ^{11}B NMR spectra for polymers i) pLBBn$_7$(OiP)$_2$, ii) pLBBn$_1$(OGly)$_2$, iii) pLBBn$_1$(OGlyOF$_3$iP), iv) pLBBn$_7$(OF$_3$iP)$_2$, v) pLBBn$_1$(OGlyOF$_6$iP), and vi) pLBBn$_1$(OF$_6$iP)$_2$.

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Table S2. Glass transition temperature (Tg).

Name	Tg (°C)
pLBBn$_1$(OGly)$_2$	-73
pLBBn$_1$(OGlyOF$_6$iP)$_2$	-60
pLBBn$_1$(OMe)$_2$	-65
pLBBn$_7$(OMe)$_2$	-55
pLBBn$_7$(OEt)$_2$	-50
pLBBn$_7$(OF$_6$iP)$_2$	-40

Ionic conductivity

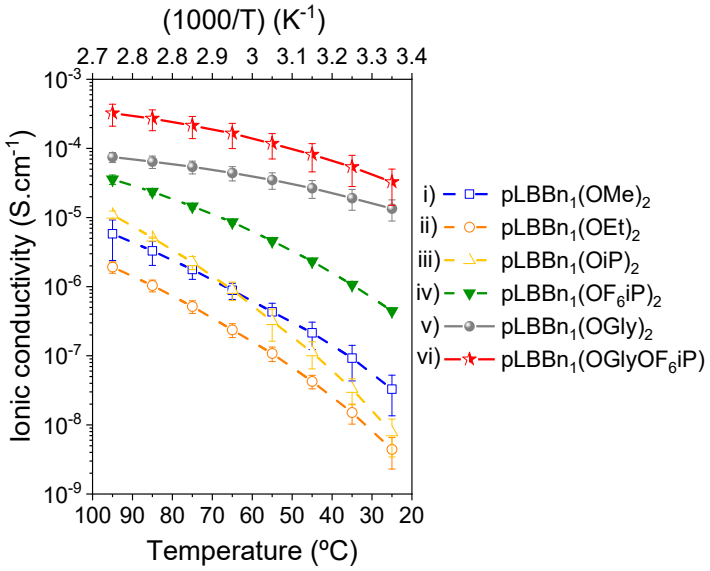

Fig. S3. Temperature dependence of ionic conductivity for SLICPEs with several oxy-substituents and ethoxy unit of 1: pBBn$_1$(OR)$_2$.