Supporting Information

Solvate Ionic Liquids: Past, Present and Future

Timothy Harte,[a,b] Bhagya Dharmasiri,*[,a] Žan Simon,[a] David J Hayne,[a] Daniel J. Eyckens,[b] and Luke C. Henderson.*[,a]

[a]Institute for Frontier Materials, Deakin University, Waurn Ponds, Victoria 3216, Australia

[b]Manufacturing, Commonwealth Scientific and Industrial Research Organisation, Clayton, Victoria 3168, Australia

* Corresponding authors. E-mail addresses: luke.henderson@deakin.edu.au (L.C. Henderson) & k.dharmasiri@deakin.edu.au (B. Dharmasiri).

Table 1. Literature sources for the review arranged chronologically and categorised based on the use of multiple anions, ligands, metal centres or solvent/s dilution in the research work. Note review articles, book chapters, and non-peer reviewed thesis's on the topic of SILs are noted here but are not discussed specifically in the review.

Year	Title	Citation	Type	Anion	Ligand	Metal	Solvent
2010	Physicochemical properties of glyme–Li salt complexes as a new family of room-temperature ionic liquids	Tamura *et al.*[1]	Experimental		x		
2011	Change from Glyme Solutions to Quasi-ionic Liquids for Binary Mixtures Consisting of Lithium Bis(trifluoromethanesulfonyl)amide and Glymes	Yoshida *et al.*[2]	Experimental		x		
2012	Glyme–Lithium Salt Equimolar Molten Mixtures: Concentrated Solutions or Solvate Ionic Liquids?	Ueno *et al.*[3]	Experimental	x	x		
2012	Ionic Liquids: Past, present and future	Angell *et al.*[4]	Review article (IL focused, not SIL focused)				
2013	Solvate Ionic Liquid Electrolyte for Li–S Batteries	Dokko *et al.*[5]	Application		x		
2013	Anionic Effects on Solvate Ionic Liquid Electrolytes in Rechargeable Lithium–Sulfur Batteries	Ueno *et al.*[6]	Experimental	x	x		
2013	Solvate Ionic Liquid, $[Li(triglyme)_1][NTf_2]$, as Electrolyte for Rechargeable Li–Air Battery: Discharge Depth and Reversibility	Tatara *et al.*[7]	Application				
2014	Electrodeposition of Lithium from Lithium-Containing Solvate Ionic Liquids	Vanhoutte *et al.*[8]	Experimental	x	x		
2014	Gelation of Solvate Ionic Liquid by Self-Assembly of Block Copolymer and Characterization as Polymer Electrolyte	Kitazawa *et al.*[9]	Application				
2014	Mechanism of Li Ion Desolvation at the Interface of Graphite Electrode and Glyme–Li Salt Solvate Ionic Liquids	Moon *et al.*[10]	Application				
2014	Physicochemical properties of pentaglyme–sodium bis(trifluoromethanesulfonyl)amide solvate ionic liquid	Terada *et al.*[11]	Experimental		x	x	
2014	Criteria for solvate ionic liquids	Mandai *et al.*[12]	Review article				
2014	Chelate Effects in Glyme/Lithium Bis(trifluoromethanesulfonyl)amide Solvate Ionic Liquids. I. Stability of Solvate Cations and Correlation with	Zhang *et al.*[13]	Experimental		x		

	Electrolyte Properties						
2014	Chelate Effects in Glyme/Lithium Bis(trifluoromethanesulfonyl)amide Solvate Ionic Liquids, Part 2: Importance of Solvate-Structure Stability for Electrolytes of Lithium Batteries	Zhang *et al.*[14]	Application		x		x
2015	Nanostructure of [Li(G4)] TFSI and [Li(G4)] NO3 solvate ionic liquids at HOPG and Au(111) electrode interfaces as a function of potential	McLean *et al.*[15]	Experimental	x			
2015	A structural study of LiTFSI–tetraglyme mixtures: From diluted solutions to solvated ionic liquids	Aguilera *et al.*[16]	Experimental				
2015	Li^+ Ion Transport in Polymer Electrolytes Based on a Glyme-Li Salt Solvate Ionic Liquid	Kido *et al.*[17]	Application				
2015	A Highly Concentrated Catholyte Based on a Solvate Ionic Liquid for Rechargeable Flow Batteries	Takechi *et al.*[18]	Application				
2015	Effect of Ionic Size on Solvate Stability of Glyme-Based Solvate Ionic Liquids	Mandai *et al.*[19]	Experimental		x	x	
2015	Li^+ solvation in glyme–Li salt solvate ionic liquids	Ueno *et al.*[20]	Experimental	x	x		
2015	Structural and aggregate analyses of (Li salt + glyme) mixtures: the complex nature of solvate ionic liquids	Shimizu *et al.*[21]	Experimental	x	x		
2015	Excellent Compatibility of Solvate Ionic Liquids with Sulfide Solid Electrolytes: Toward Favorable Ionic Contacts in Bulk-Type All-Solid-State Lithium-Ion Batteries	Oh *et al.*[22]	Application				
2015	Ionic Conductivity and Viscosity of Solvate Ionic Liquids Composed of Glymes and Excess Lithium Bis(Trifluoromethylsulfonyl)Amide	Hirayama *et al.*[23]	Experimental		x		
2015	A Solvate Ionic Liquid as the Anolyte for Aqueous Rechargeable Li–O_2 Batteries	Wang *et al.*[24]	Application	x			
2015	Conformation of poly(ethylene oxide) dissolved in the solvate ionic liquid [Li(G4)]TFSI	Chen *et al.*[25]	Application				
2015	Lithium-tin Alloy/Sulfur Battery with a Solvate Ionic Liquid Electrolyte	Ikeda *et al.*[26]	Application				
2015	Deposition and Dissolution of Lithium through Lithium Phosphorus Oxynitride Thin Film in Lithium Bis(trifluoromethylsulfonyl)amide-Glyme Solvate Ionic Liquid	Tachikawa *et al.*[27]	Application				

2016	Li^+ Local Structure in Li–Tetraglyme Solvate Ionic Liquid Revealed by Neutron Total Scattering Experiments with the $^{6/7}$Li Isotopic Substitution Technique	Saito *et al.*[28]	Experimental				
2016	Bulk nanostructure of the prototypical 'good' and 'poor' solvate ionic liquids [Li(G4)][TFSI] and [Li(G4)][NO_3]	Murphy *et al.*[29]	Experimental	x			
2016	A Design Approach to Lithium-Ion Battery Electrolyte Based on Diluted Solvate Ionic Liquids	Ueno *et al.*[30]	Experimental		x		x
2016	Solvate Ionic Liquids as Reaction Media for Electrocyclic Transformations	Eyckens *et al.*[31]	Application		x		
2016	Li^+ Local Structure in Hydrofluoroether Diluted Li-Glyme Solvate Ionic Liquid	Saito *et al.*[32]	Application				
2016	Li^+ Solvation and Ionic Transport in Lithium Solvate Ionic Liquids Diluted by Molecular Solvents	Ueno *et al.*[33]	Experimental		x		x
2016	Determination of Kamlet–Taft parameters for selected solvate ionic liquids	Eyckens *et al.*[34]	Experimental		x		
2016	Kamlet–Taft Solvation Parameters of Solvate Ionic Liquids	Dolan *et al.*[35]	Experimental	x	x		
2016	Promising Cell Configuration for Next-Generation Energy Storage: Li_2S/Graphite Battery Enabled by a Solvate Ionic Liquid Electrolyte	Li *et al.*[36]	Application				
2016	Si/Li_2S Battery with Solvate Ionic Liquid Electrolyte	Li *et al.*[37]	Application				
2016	Effects of compatibility of polymer binders with solvate ionic liquid electrolytes on discharge and charge reactions of lithium-sulfur batteries	Nakazawa *et al.*[38]	Application				
2016	Solvate ionic liquid electrolyte with 1,1,2,2-tetrafluoroethyl 2,2,2-trifluoroethyl ether as a support solvent for advanced lithium–sulfur batteries	Lu *et al.*[39]	Application				
2016	The thermoelectrochemistry of lithium–glyme solvate ionic liquids: towards waste heat harvesting	Black *et al.*[40]	Application				
2016	Optimization of Pore Structure of Cathodic Carbon Supports for Solvate Ionic Liquid Electrolytes Based Lithium–Sulfur Batteries	Zhang *et al.*[41]	Application				x
2016	Structural effect of glyme–Li^+ salt solvate ionic liquids on the conformation of poly(ethylene oxide)	Chen *et al.*[42]	Application	x	x		

2016	Effects of non-equimolar lithium salt glyme solvate ionic liquid on the control of interfacial degradation in lithium secondary batteries	Seki *et al.*[43]	Application				
2016	A study on acute toxicity and solvent capacity of solvate ionic liquids in vivo using a zebrafish model (*Danio rerio*)	Yogananthar ajah *et al.*[44]	Experimental		x		
2016	Effects of Pore Volume and Pore Size Distribution of Carbon Supports of Sulfur on Performance of Li-S Batteries with Solvate Ionic Liquid Electrolyte.	Ando *et al.*[45]	Application				
2016	Lithium - Redox Battery Using a Solvate Ionic Liquid	Sugiyama *et al.*[46]	Application				
2017	Improving the Catalytic Performance of (S)-Proline as Organocatalyst in Asymmetric Aldol Reactions in the Presence of Solvate Ionic Liquids: Involvement of a Supramolecular Aggregate	Obregón-Zúñiga *et al.*[47]	Application	x	x		
2017	Synthesis of α-aminophosphonates using solvate ionic liquids	Eyckens *et al.*[48]	Application		x		
2017	Boundary layer friction of solvate ionic liquids as a function of potential	Li *et al.*[49]	Experimental	x			
2017	The nanostructure of a lithium glyme solvate ionic liquid at electrified interfaces	Coles *et al.*[50]	Simulation				
2017	TFSI and TDI Anions: Probes for Solvate Ionic Liquid and Disproportionation-Based Lithium Battery Electrolytes	Jankowski *et al.*[51]	Simulation	x			
2017	Stability of Glyme Solvate Ionic Liquid as an Electrolyte for Rechargeable Li−O_2 Batteries	Kwon *et al.*[52]	Application				
2017	Long-cycle-life Lithium-sulfur Batteries with Lithium Solvate Ionic Liquids	Seki *et al.*[53]	Application				
2017	Effect of Variation in Anion Type and Glyme Length on the Nanostructure of the Solvate Ionic Liquid/Graphite Interface as a Function of Potential	Cook *et al.*[54]	Experimental	x	x		
2017	Thermophysical and transport properties of blends of an ether-derivatized imidazolium ionic liquid and a Li^+-based solvate ionic liquid	Wang *et al.*[55]	Application				
2017	Thermosensitive Phase Separation Behavior of Poly(benzyl methacrylate)/Solvate Ionic Liquid Solutions	Kobayashi *et al.*[56]	Experimental		x		
2017	A Polymer Electrolyte Containing	Kawazoe *et*	Application				

	Solvate Ionic Liquid with Increased Mechanical Strength Formed by Self-assembly of ABA-type Ionomer Triblock Copolymer	*al.*[57]					
2017	Exploiting Solvate Ionic Liquids for Amine Gas Analysis on a Quartz Crystal Microbalance	Li *et al.*[58]	Application		x		
2017	Electrochemical Deposition and Dissolution of Lithium on a Carbon Fiber Composite Electrode in a Solvate Ionic Liquid	Tachikawa *et al.*[59]	Application				
2018	Liquid Structures and Transport Properties of Lithium Bis(fluorosulfonyl)amide/Glyme Solvate Ionic Liquids for Lithium Batteries	Terada *et al.*[60]	Experimental		x		
2018	Polymer Electrolytes Containing Solvate Ionic Liquids: A New Approach To Achieve High Ionic Conductivity, Thermal Stability, and a Wide Potential Window	Kitazawa *et al.*[61]	Application				
2018	How efficient is Li+ ion transport in solvate ionic liquids under anion-blocking conditions in a battery?	Dong *et al.*[62]	Application				
2018	Partially Naked Fluoride in Solvate Ionic Liquids	Chen *et al.*[63]	Experimental				
2018	From Ionic Liquids to Solvate Ionic Liquids: Challenges and Opportunities for Next Generation Battery Electrolytes	Watanabe *et al.*[64]	Review article				
2018	Solvate Ionic Liquids at Electrified Interfaces	Yu *et al.*[65]	Simulation				
2018	Molecular dynamics study of thermodynamic stability and dynamics of $[Li(glyme)]^{+}$ complex in lithium-glyme solvate ionic liquids	Shinoda *et al.*[66]	Simulation	x	x		
2018	Solvation Structure of Sodium Bis(fluorosulfonyl)imide-Glyme Solvate Ionic Liquids and Its Influence on Cycling of Na-MNC Cathodes	Geysens *et al.*[67]	Experimental		x		
2018	Charge Transport in [Li(tetraglyme)][bis(trifluoromethane) sulfonimide] Solvate Ionic Liquids: Insight from Molecular Dynamics Simulations	Dong *et al.*[68]	Simulation				
2018	A Hydronium Solvate Ionic Liquid: Facile Synthesis of Air-Stable Ionic Liquid with Strong Brønsted Acidity	Kitada *et al.*[69]	Experimental				
2018	A Hydronium Solvate Ionic Liquid:	Kitada *et*	Experimental				

	Ligand Exchange Conduction Driven by Labile Solvation	*al.*[70]					
2018	Electrodeposition of Al, Al-Li Alloy, and Li from an Al-Containing Solvate Ionic Liquid under Ambient Conditions	Zhang *et al.*[71]	Application				
2018	Kamlet–Taft solvent parameters, NMR spectroscopic analysis and thermoelectrochemistry of lithium–glyme solvate ionic liquids and their dilute solutions	Black *et al.*[72]	Experimental		x		
2018	Interfacial nanostructure of solvate ionic liquids and ionic liquid solutions	Coles *et al.*[73]	Thesis				
2018	Direct Electrochemical Deposition of Lithium from Lithium Oxide in a Highly Stable Aluminium-Containing Solvate Ionic Liquid	Zhang *et al.*[74]	Application				
2018	Redox Active Glyme-Li Salt Solvate Ionic Liquids Based on Tetrabromoferrate(III)	Kemmizaki *et al.*[75]	Experimental	x			
2018	Thermally induced cationic polymerization of isobutyl vinyl ether in toluene in the presence of solvate ionic liquid	Hirano *et al.*[76]	Application				
2018	Pre-Film Formation and Cycle Performance of Silicon-Flake-Powder Negative Electrode in a Solvate Ionic Liquid for Silicon-Sulfur Rechargeable Batteries	Haruta *et al.*[77]	Application				
2018	Comparison of solvate ionic liquids and DMSO as an *in vivo* delivery and storage media for small molecular therapeutics	Yoganantharajah *et al.*[78]	Application		x		
2019	Solvation Structure of Poly(benzyl methacrylate) in a Solvate Ionic Liquid: Preferential Solvation of Li–Glyme Complex Cation	Hashimoto *et al.*[79]	Application				
2019	Design of Stretchable and Self-Healing Gel Electrolytes via Fully Zwitterionic Polymer Networks in Solvate Ionic Liquids for Li-Based Batteries	D'Angelo *et al.*[80]	Application				
2019	Dynamic Chelate Effect on the Li+-Ion Conduction in Solvate Ionic Liquids	Arai *et al.*[81]	Experimental		x		
2019	Understanding the effects of solvate ionic liquids as solvents on substitution processes	McHale *et al.*[82]	Application		x		
2019	Simulation of a Solvate Ionic Liquid at a Polarizable Electrode with a Constant	Coles *et al.*[83]	Simulation				

	Potential						
2019	A Review of Solvate Ionic Liquids: Physical Parameters and Synthetic Applications	Eyckens *et al.*[84]	Review article				
2019	Solvate Ionic Liquids for Li, Na, K, and Mg Batteries	Mandai *et al.*[85]	Review article				
2019	Gel Electrolyte Comprising Solvate Ionic Liquid and Methyl Cellulose	Chereddy *et al.*[86]	Application				
2019	Slurry-Fabricable Li^+-Conductive Polymeric Binders for Practical All-Solid-State Lithium-Ion Batteries Enabled by Solvate Ionic Liquids	Oh *et al.*[87]	Application				
2019	Design of S-Substituted Fluorinated Aryl Sulfonamide-Tagged (S-FAST) Anions To Enable New Solvate Ionic Liquids for Battery Applications	Huang *et al.*[88]	Experimental	x			
2019	Effects of Sulfur Loading, Cathode Porosity, and Electrolyte Amount on Li-S Battery Performance with Solvate Ionic Liquid Electrolyte	Matsumae *et al.*[89]	Application				
2019	Low-temperature electrochemical codeposition of aluminum-neodymium alloy in a highly stable solvate ionic liquid	Zhang *et al.*[90]	Application				
2019	Physicochemical compatibility of highly-concentrated solvate ionic liquids and a low-viscosity solvent	Takahashi *et al.*[91]	Experimental				
2019	Solvate Ionic Liquid Electrolytes for Mg Batteries	Dokko *et al.*[92]	Experimental		x		
2019	Remarkable Effect of [Li(G4)]TFSI Solvate Ionic Liquid (SIL) on the Regio- and Stereoselective Ring Opening of α-Gluco Carbasugar 1,2-Epoxides	Di Pietro *et al.*[93]	Application		x		
2019	Communication—Solvate Ionic Liquid Incorporating Lithium Nitrate as a Redox Mediator for Lithium-Oxygen Batteries	Togasaki *et al.*[94]	Application				
2020	Rapid Cross-Linking of Epoxy Thermosets Induced by Solvate Ionic Liquids	Hameed *et al.*[95]	Application	x	x	x	
2020	Solvate ionic liquids based on lithium bis(trifluoromethanesulfonyl)imide–glyme systems: coordination in MD simulations with scaled charges	Thum *et al.*[96]	Simulation		x		
2020	Active learning and neural network potentials accelerate molecular screening of ether-based solvate ionic	Wang *et al.*[97]	Simulation		x	x	

	liquids						
2020	Solvate Cation Migration and Ion Correlations in Solvate Ionic Liquids	Schmidt *et al.*[98]	Experimental	x			
2020	Solvate ionic liquid boosting favorable interfaces kinetics to achieve the excellent performance of $Li_4Ti_5O_{12}$ anodes in $Li_{10}GeP_2S_{12}$ based solid-state batteries	Cao *et al.*[99]	Application				
2020	Effects of fluoroethylene carbonate addition to Li-glyme solvate ionic liquids on their ionic transport properties and Si composite electrode performance	Shobukawa *et al.*[100]	Application				
2020	Analysis of Solid-Electrolyte Interphase at the Interface between a Graphite Negative Electrode and a Diluted Solvate Ionic Liquid-Based Quasi-Solid-State Electrolyte	Kawaji *et al.*[101]	Application				
2020	Reversible electrodeposition and stripping of magnesium from solvate ionic liquid–tetrabutylammonium chloride mixtures	Geysens *et al.*[102]	Application		x		

2020	Characterization of the Solid-Electrolyte Interphase between a Cu Electrode and $LiN(CF_3SO_2)_2$-triglyme Solvate Ionic Liquid	Serizawa *et al.*[103]	Application				
2020	Electrochemical behavior of tantalum in ethylene carbonate and aluminum chloride solvate ionic liquid	Liu *et al.*[104]	Application				
2020	Redox-active glyme–Li tetrahalogenoferrate(III) solvate ionic liquids for semi-liquid lithium secondary batteries	Kemmizaki *et al.*[105]	Application	x	x		
2020	Correlation of the empirical polarity parameters of solvate ionic liquids (SILs) with molecular structure	Potangale *et al.*[106]	Experimental	x	x		
2020	Ag Electrodeposition from Silver Solvate Ionic Liquid	Mori *et al.*[107]	Application		x		
2020	High Energy Density "Bezel-less" Lithium-ion Battery Using Solvate Ionic Liquid-based Quasi-solid-state Electrolyte	Unemoto *et al.*[108]	Application				
2020	Suppression of Fast Proton Conduction by Dilution of a Hydronium Solvate Ionic Liquid: Localization of Ligand Exchange	Kawata *et al.*[109]	Experimental				
2020	High performance electric double layer transistors using solvate ionic liquids	Saito *et al.*[110]	Application				
2020	Photo-crosslinked Polymer Electrolytes Containing Solvate Ionic Liquids: An Approach to Achieve Both Good Mechanical and Electrochemical Performances for Rechargeable Lithium Ion Batteries	Grewal *et al.*[111]	Application				
2021	An Ammonium Solvate Ionic Liquid	Kawata *et al.*[112]	Experimental				
2021	*In situ* interferometry study of ionic mass transfer phenomenon during the electrodeposition and dissolution of Li metal in solvate ionic liquids	Miki *et al.*[113]	Experimental				
2021	Molecularly Tunable Polyanions for Single-Ion Conductors and Poly(solvate ionic liquids)	Zhang *et al.*[114]	Application				
2021	Electrodeposition of aluminum–magnesium alloys from an aluminum-containing solvate ionic liquid at room temperature	Zhang *et al.*[115]	Application				
2021	$LiNO_3$-Supported Electrodeposition of Metallic Nd from Nd-Containing Solvate Ionic Liquid	Zhang *et al.*[116]	Application				

2021	Competing characters of Li^+-Glyme complex in a solvate ionic liquid: High stability in the bulk and rapid desolvation on an electrode surface	Motobayashi *et al.*[117]	Application				
2021	Glyme-Lithium Bis(trifluoromethylsulfonyl)amide Super-concentrated Electrolytes: Salt Addition to Solvate Ionic Liquids Lowers Ionicity but Liberates Lithium Ions	Kitada *et al.*[118]	Experimental		x		
2021	Proton conduction in hydronium solvate ionic liquids affected by ligand shape	Kawata *et al.*[119]	Experimental		x		
2021	Thermodynamic and Structural Aspects of Solvate Ionic Liquid Formation	Umebayashi *et al.*[120]	Book chapter				
2022	High-Performance and Highly Safe Solvate Ionic Liquid-Based Gel Polymer Electrolyte by Rapid UV-Curing for Lithium-Ion Batteries	Gao *et al.*[121]	Application				
2022	Li^+ transference number and dynamic ion correlations in glyme-Li salt solvate ionic liquids diluted with molecular solvents	Sudoh *et al.*[122]	Experimental				
2022	Solvate ionic liquid-based ionogels for lithium metal batteries over a wide temperature range	Xu *et al.*[123]	Application				
2022	Triglyme-based solvate ionic liquid gelled in a polymer: A novel electrolyte composition for sodium ion battery	Parveen *et al.*[124]	Application				
2022	The Effect of Fluorinated Solvents on the Physicochemical Properties, Ionic Association, and Free Volume of a Prototypical Solvate Ionic Liquid	Burba *et al.*[125]	Experimental				x
2022	Rapidly Deformable Vitrimer Epoxy System with Supreme Stress-Relaxation Capabilities via Coordination of Solvate Ionic Liquids	Shin *et al.*[126]	Application	x	x	x	
2022	Improved Capacity Retention for a Disordered Rocksalt Cathode via Solvate Ionic Liquid Electrolytes	Wichmann *et al.*[127]	Application				
2022	Perfluoroinated Ionomer as an Artificial SEI for Silicon Nano-Flake Anode in LiTFSI/Tetraglyme Solvate Ionic Liquid	Haruta *et al.*[128]	Application				
2022	Development of solvate ionic liquid immobilized MCM-41 ionogel electrolytes for lithium battery	Lu *et al.*[129]	Application				
2022	Cationic homopolymerization of trans-anethole in the presence of solvate	Hirano *et al.*[130]	Application		x		

	ionic liquid comprising $LiN(SO_2CF_3)_2$ and Lewis bases						
2022	Solvate Ionic Liquids: Assessing the Possibility of Determining the Composition by Means of Gas–Liquid Chromatography	Sheina *et al.*[131]	Detection				
2022	Electrodeposition of Zn–Ta Coating from DMI–$ZnCl_2$–$TaCl_5$ Solvate Ionic Liquids	Liu *et al.*[132]	Application				
2023	Flexible carbon fiber based structural supercapacitor composites with solvate ionic liquid-epoxy solid electrolyte	Dharmasiri *et al.*[133]	Application				
2023	Accelerated lithium-ion diffusion *via* a ligand 'hopping' mechanism in lithium enriched solvate ionic liquids	Harte *et al.*[134]	Experimental		x		
2023	Stable Li|LAGP Interface Enabled by Confining Solvate Ionic Liquid in a Hyperbranched Polyanionic Copolymer for NASICON-Based Solid-State Batteries	Lei *et al.*[135]	Application				
2023	Discharge Behavior within Lithium–Sulfur Batteries Using Li–Glyme Solvate Ionic Liquids	Watanabe *et al.*[136]	Application				
2023	Diglyme-Based "Solvate Ionic Liquid" Gelled in Poly(vinylidine fluoride-co-hexafluoropropylene): A Flexible Electrolyte for High-Performance Magnesium-Ion Batteries	Kumari *et al.*[137]	Application				
2023	A robust solid electrolyte interphase enabled by solvate ionic liquid for high-performance sulfide-based all-solid-state lithium metal batteries	Yi *et al.*[138]	Application				
2023	In situ observation of the formation and relaxation processes of concentration gradients in a lithium bis(fluorosulfonyl) amide–tetraglyme solvate ionic liquid using digital holographic interference microscopy	Kamesui *et al.*[139]	Application				
2024	Transitioning from Regular Electrolytes to Solvate Ionic Liquids to High-Concentration Electrolytes: Changes in Transport Properties and Ionic Speciation	Nachaki *et al.*[140]	Experimental	x	x		
2024	Solid–electrolyte interphase formation during Li metal deposition in LiN(SO2F)2-based solvate ionic liquids	Tatara *et al.*[141]	Application				
2024	Solvate Ionic Liquids based on branched	Lingua *et*	Application		x		

	glymes enabling high performance lithium metal batteries	*al.*[142]					
2024	From stress to charge: investigating the piezoelectric response of solvate ionic liquid in structural energy storage composites	Simon *et al.*[143]	Experimental				
2024	Closing the Loop: Recyclable Solvate Ionic Liquids in Solid Polymer Electrolytes for Circular Economy	Harte *et al.*[144]	Application				
2024	Bicontinuous solid polymer electrolytes using Li+ enriched ionic liquids	Harte *et al.*[145]	Application		x		
2024	A transferable classical force field to describe glyme based lithium solvate ionic liquids	Carrillo-Bohórquez *et al.*[146]	Simulation		x		
2024	Imidazolium Functionalized Copolymer Supported Solvate Ionic Liquid Based Gel Polymer Electrolyte for Lithium Ion Batteries	More *et al.*[147]	Application				
2024	A Computational and Spectroscopic Analysis of Solvate Ionic Liquids Containing Anions with Long and Short Perfluorinated Alkyl Chains	Shimizu *et al.*[148]	Simulation	x			
2024	Effect of Solvate Ionic Liquids in the Enantioselective (S)-Proline-Catalyzed Mechanochemical Robinson Annulation	Gamboa-Velázquez *et al.*	Application	x	x		
2024	Al(III) and Ga(III) triflate complexes as solvate ionic liquids: speciation and application as soluble and recyclable Lewis acidic catalysts	Więcławik *et al.*[149]	Application			x	
2024	Improved Stability of Oxysulfide Solid-State Electrolytes in Li(G3)TFSI Solvate Ionic Liquid Electrolyte	Yersak *et al.*[150]	Application				
2024	Functional Macromolecular Complexes Chapter 14: Glyme-based Solvate Ionic Liquids and Their Electrolyte Properties	Watanabe[151]	Book chapter				
2024	Interface Ionics: For All-Solid-State Batteries and Solid State Ionics Devices Chapter: Lithium Metal/Organic Solid Electrolyte Interfaces to Stabilize Li Plating/Stripping Reaction	Maeyoshi *et al.*[152]	Book chapter				
2024	A Pentabasic High-Concentration Peo-Based Polymer Layer Optimizes the Electrode/Ceramic Electrolyte Interface	luo *et al.*[153]	Application				
2024	Trends in ionic liquids and quasi-solid-state electrolytes for Li-S batteries: A review on recent progress and future perspectives	Santos *et al.*[154]	Review article (IL focused, not SIL focused)				

2024	Electrodeposition behaviour of samarium in 1,3-dimethyl-2-imidazolidone solvent	Andrew *et al.*[155]	Application	x			
2024	Multi-pronged analysis of secondary lithium metal batteries with various cathode chemistries	Kochetkov *et al.*[156]	Thesis		x		
2024	Speciation and dipole reorientation dynamics of glass-forming liquid electrolytes: Li[N(SO2CF3)2] mixtures of 1,3-propane sultone or tetrahydrothiophene-1,1-dioxide	Umebayashi *et al.*[157]	Experimental		x		
2024	Seeing the Unseen: Mg^{2+}, Na^{+}, and K^{+} Transference Numbers in Post-Li Battery Electrolytes by Electrophoretic Nuclear Magnetic Resonance	Mönich *et al.*[158]	Experimental			x	
2024	Boosting the electrochemical performance with functionalized dry electrodes for practical all-solid-state batteries	Lee *et al.*[159]	Application				
2024	Analysis of Electrochemical Reaction in Polysulfide-Insoluble Lithium Sulfur Battery with in-Situ Electrochemical Impedance Spectroscopic Method	Watanabe *et al.*[160]	Application				
2024	Influence of magnesium chloride on the electrodeposition of zinc from the 1,3-dimethyl-2-imidazolidinone/ZnCl2 system	Zhang *et al.*[161]	Application				
2024	Correlation between Electrolyte Concentration and Lithium Morphology during Lithium Bis(fluorosulfonyl)amide–Tetraglyme Electrolyte Deposition–Dissolution Reactions	Kamesui *et al.*[162]	Application				
2024	A Promising Gel Polymer Electrolyte Composition Comprising a Green-Glyme Di(propylene glycol) Dimethyl Ether for Application in Sodium-Ion Batteries	Parveen *et al.*[163]	Application				
2024	In Situ-Polymerized Separator-Free Ionogel Electrolyte with Enhanced Interfacial Compatibility for Integrated Solid-State Lithium Batteries	Wei *et al.*[164]	Application				
2024	An all-in-one free-standing single-ion conducting semi-solid polymer electrolyte for high-performance practical Li metal batteries	Zhang *et al.*[165]	Application				
2024	Unraveling the energy storage mechanism in graphene-based	Yin *et al.*[166]	Application				

	nonaqueous electrochemical capacitors by gap-enhanced Raman spectroscopy						
2024	In situ SPM studies of electrochemical interfaces in high ionic strength electrolytes	Yin *et al*.[167]	Review article (not SIL focused)				
2024	Unexpected Energy Applications of Ionic Liquids	Matuszek *et al*.[168]	Review article (IL focused, not SIL focused)				
2024	$Li_8P_2S_9$ solid electrolyte with high ionic conductivity and air stability by Bi_2Se_3 co-doping	Zhen *et al*.[169]	Application				
2024	Bioinspired Synaptic Branched Network within Quasi-Solid Polymer Electrolyte for High-Performance Microsupercapacitors	Lee *et al*.[170]	Application				
2024	Ion Transport in (Localized) High Concentration Electrolytes for Li-Based Batteries	Bergstrom *et al*.[171]	Experimental				x
2024	Structure and Physicochemical Properties of Solutions of Lithium Polysulfides in Tetrasolvate of Lithium Perchlorate with Sulfolane Molecular Dynamics Modeling	Kuzmina *et al*.[172]	Application				
2024	Electrolytes for Sodium Ion Batteries: The Current Transition from Liquid to Solid and Hybrid systems	Darjazi *et al*.[173]	Review article (not SIL focused)				
2024	Basic properties of glyme-based electrolytes doped with lithium 2,4,5-tricyanoimidazolide (LiTIM)	Żukowska *et al*.[174]	Experimental		x		
2024	Optimization of Carbon/Sulfur Composite and Application of Al-LLZO Solid Electrolyte and Highly Concentrated Electrolytes for Lithium-Sulfur Cell	Oho *et al*.[175]	Application		x		
2025	The Competition Between Cation-Anion and Cation-Triglyme Interaction in Solvate Ionic Liquids Probed by Far Infrared Spectroscopy and Molecular Dynamics Simulations	Philipp *et al*.[176]	Simulation				
2025	Cathode-supported solid polymer electrolyte with solvate ionic liquid and polysulfide modification towards rechargeable lithium metal batteries	Yuan *et al*.[177]	Application				
2025	Gel polymer electrolyte membranes consisted of solvate ionic liquid and crosslinked network polymers bearing different main chains: Fabrication and	Dong *et al*.[178]	Application				

	lithium battery application						

Table 2. A summary table of the physicochemical properties of 4 SILs compared with 4 ILs.

Property	[Li(G3)][TFSI][64]	[Li(G4)][TFSI][38]	[Li(THF)$_4$][TFSI][11]	[Li(G1)$_2$][TFSI][12]	[Bmim][TFSI][179]	[C$_2$mim][TFSI][180]	[Bmim][PF$_6$][181]	[C$_4$mim][PF$_6$][182]
Electrical Conductivity (mS/cm) 30 °C	1.1	1.6	7.2	3.7	1.2	0.9	1.0	1.0
Thermal Stability (°C) (5% mass loss)	250	270	230	260	350	370	330	400
Melting Point (T_m) (°C)	-50	-45	-60	-55				
Glass Transition Temperature (T_g) (°C)	-80	-75	-85	-78	-20	-10	-30	-5
Toxicity (Qualitative)	Moderate	Low	Moderate	Moderate to High	Varies	Moderate	Low to Moderate	Moderate to High

References

1. T. Tamura, K. Yoshida, T. Hachida, M. Tsuchiya, M. Nakamura, Y. Kazue, N. Tachikawa, K. Dokko and M. Watanabe, Physicochemical properties of glyme–Li salt complexes as a new family of room-temperature ionic liquids, *Chem. Lett.*, 2010, **39**, 753-755.
2. K. Yoshida, M. Tsuchiya, N. Tachikawa, K. Dokko and M. Watanabe, Change from glyme solutions to quasi-ionic liquids for binary mixtures consisting of lithium bis (trifluoromethanesulfonyl) amide and glymes, *J. Phys. Chem. C*, 2011, **115**, 18384-18394.
3. K. Ueno, K. Yoshida, M. Tsuchiya, N. Tachikawa, K. Dokko and M. Watanabe, Glyme–lithium salt equimolar molten mixtures: concentrated solutions or solvate ionic liquids?, *J. Phys. Chem. B*, 2012, **116**, 11323-11331.
4. C. A. Angell, Y. Ansari and Z. Zhao, Ionic liquids: past, present and future, *Faraday Discuss.*, 2012, **154**, 9-27.
5. K. Dokko, N. Tachikawa, K. Yamauchi, M. Tsuchiya, A. Yamazaki, E. Takashima, J.-W. Park, K. Ueno, S. Seki and N. Serizawa, Solvate ionic liquid electrolyte for Li–S batteries, *J. Electrochem. Soc.*, 2013, **160**, A1304.
6. K. Ueno, J.-W. Park, A. Yamazaki, T. Mandai, N. Tachikawa, K. Dokko and M. Watanabe, Anionic effects on solvate ionic liquid electrolytes in rechargeable lithium–sulfur batteries, *J. Phys. Chem. C*, 2013, **117**, 20509-20516.
7. R. Tatara, N. Tachikawa, H.-M. Kwon, K. Ueno, K. Dokko and M. Watanabe, Solvate Ionic Liquid,[Li (triglyme) 1][NTf2], as Electrolyte for Rechargeable Li–Air Battery: Discharge Depth and Reversibility, *Chem. Lett.*, 2013, **42**, 1053-1055.
8. G. Vanhoutte, N. R. Brooks, S. Schaltin, B. Opperdoes, L. Van Meervelt, J.-P. Locquet, P. M. Vereecken, J. Fransaer and K. Binnemans, Electrodeposition of lithium from lithium-containing solvate ionic liquids, *J. Phys. Chem. C*, 2014, **118**, 20152-20162.
9. Y. Kitazawa, K. Iwata, S. Imaizumi, H. Ahn, S. Y. Kim, K. Ueno, M. J. Park and M. Watanabe, Gelation of solvate ionic liquid by self-assembly of block copolymer and characterization as polymer electrolyte, *Macromol.*, 2014, **47**, 6009-6016.
10. H. Moon, R. Tatara, T. Mandai, K. Ueno, K. Yoshida, N. Tachikawa, T. Yasuda, K. Dokko and M. Watanabe, Mechanism of Li Ion Desolvation at the Interface of Graphite Electrode and Glyme–Li Salt Solvate Ionic Liquids, *J. Phys. Chem. C*, 2014, **118**, 20246-20256.
11. S. Terada, T. Mandai, R. Nozawa, K. Yoshida, K. Ueno, S. Tsuzuki, K. Dokko and M. Watanabe, Physicochemical properties of pentaglyme–sodium bis (trifluoromethanesulfonyl) amide solvate ionic liquid, *Phys. Chem. Chem. Phys.*, 2014, **16**, 11737-11746.
12. T. Mandai, K. Yoshida, K. Ueno, K. Dokko and M. Watanabe, Criteria for solvate ionic liquids, *Phys. Chem. Chem. Phys.*, 2014, **16**, 8761-8772.
13. C. Zhang, K. Ueno, A. Yamazaki, K. Yoshida, H. Moon, T. Mandai, Y. Umebayashi, K. Dokko and M. Watanabe, Chelate effects in glyme/lithium bis (trifluoromethanesulfonyl) amide solvate ionic liquids. I. Stability of solvate cations and correlation with electrolyte properties, *J. Phys. Chem. B*, 2014, **118**, 5144-5153.
14. C. Zhang, A. Yamazaki, J. Murai, J.-W. Park, T. Mandai, K. Ueno, K. Dokko and M. Watanabe, Chelate effects in glyme/lithium bis (trifluoromethanesulfonyl) amide solvate ionic liquids, part 2: Importance of solvate-structure stability for electrolytes of lithium batteries, *J. Phys. Chem. C*, 2014, **118**, 17362-17373.
15. B. McLean, H. Li, R. Stefanovic, R. J. Wood, G. B. Webber, K. Ueno, M. Watanabe, G. G. Warr, A. Page and R. Atkin, Nanostructure of [Li (G4)] TFSI and [Li (G4)] NO 3 solvate ionic liquids at HOPG

and Au (111) electrode interfaces as a function of potential, *Phys. Chem. Chem. Phys.*, 2015, **17**, 325-333.
16. L. Aguilera, S. Xiong, J. Scheers and A. Matic, A structural study of LiTFSI–tetraglyme mixtures: From diluted solutions to solvated ionic liquids, *J. Mol. Liq.*, 2015, **210**, 238-242.
17. R. Kido, K. Ueno, K. Iwata, Y. Kitazawa, S. Imaizumi, T. Mandai, K. Dokko and M. Watanabe, Li+ ion transport in polymer electrolytes based on a glyme-Li salt solvate ionic liquid, *Electrochim. Acta*, 2015, **175**, 5-12.
18. K. Takechi, Y. Kato and Y. Hase, A Highly Concentrated Catholyte Based on a Solvate Ionic Liquid for Rechargeable Flow Batteries, *Adv. Mater.*, 2015, **27**, 2501-2506.
19. T. Mandai, K. Yoshida, S. Tsuzuki, R. Nozawa, H. Masu, K. Ueno, K. Dokko and M. Watanabe, Effect of ionic size on solvate stability of glyme-based solvate ionic liquids, *J. Phys. Chem. B*, 2015, **119**, 1523-1534.
20. K. Ueno, R. Tatara, S. Tsuzuki, S. Saito, H. Doi, K. Yoshida, T. Mandai, M. Matsugami, Y. Umebayashi and K. Dokko, Li+ solvation in glyme–Li salt solvate ionic liquids, *Phys. Chem. Chem. Phys.*, 2015, **17**, 8248-8257.
21. K. Shimizu, A. A. Freitas, R. Atkin, G. G. Warr, P. A. FitzGerald, H. Doi, S. Saito, K. Ueno, Y. Umebayashi and M. Watanabe, Structural and aggregate analyses of (Li salt+ glyme) mixtures: the complex nature of solvate ionic liquids, *Phys. Chem. Chem. Phys.*, 2015, **17**, 22321-22335.
22. D. Y. Oh, Y. J. Nam, K. H. Park, S. H. Jung, S. J. Cho, Y. K. Kim, Y. G. Lee, S. Y. Lee and Y. S. Jung, Excellent compatibility of solvate ionic liquids with sulfide solid electrolytes: toward favorable ionic contacts in bulk-type all-solid-state lithium-ion batteries, *Adv. Energy Mater.*, 2015, **5**, 1500865.
23. H. Hirayama, N. Tachikawa, K. Yoshii, M. Watanabe and Y. Katayama, Ionic conductivity and viscosity of solvate ionic liquids composed of glymes and excess lithium bis (trifluoromethylsulfonyl) amide, *Electrochemistry (Tokyo)*, 2015, **83**, 824-827.
24. H. Wang, S. Sunahiro, M. Matsui, P. Zhang, Y. Takeda, O. Yamamoto and N. Imanishi, A solvate ionic liquid as the anolyte for aqueous rechargeable Li–O2 batteries, *ChemElectroChem*, 2015, **2**, 1144-1151.
25. Z. Chen, P. A. FitzGerald, G. G. Warr and R. Atkin, Conformation of poly (ethylene oxide) dissolved in the solvate ionic liquid [Li (G4)] TFSI, *Phys. Chem. Chem. Phys.*, 2015, **17**, 14872-14878.
26. K. Ikeda, S. Terada, T. Mandai, K. Ueno, K. Dokko and M. Watanabe, Lithium-tin alloy/sulfur battery with a solvate ionic liquid electrolyte, *Electrochemistry (Tokyo)*, 2015, **83**, 914-917.
27. N. Tachikawa, R. Furuya, K. Yoshii, M. Watanabe and Y. Katayama, Deposition and dissolution of lithium through lithium phosphorus oxynitride thin film in lithium bis (trifluoromethylsulfonyl) amide-glyme solvate ionic liquid, *Electrochemistry (Tokyo)*, 2015, **83**, 846-848.
28. S. Saito, H. Watanabe, Y. Hayashi, M. Matsugami, S. Tsuzuki, S. Seki, J. N. Canongia Lopes, R. Atkin, K. Ueno and K. Dokko, Li+ local structure in Li–tetraglyme solvate ionic liquid revealed by neutron total scattering experiments with the 6/7Li isotopic substitution technique, *J. Phys. Chem. Lett.*, 2016, **7**, 2832-2837.
29. T. Murphy, S. K. Callear, N. Yepuri, K. Shimizu, M. Watanabe, J. N. C. Lopes, T. Darwish, G. G. Warr and R. Atkin, Bulk nanostructure of the prototypical ‘good’and ‘poor’solvate ionic liquids [Li (G4)][TFSI] and [Li (G4)][NO 3], *Phys. Chem. Chem. Phys.*, 2016, **18**, 17224-17236.
30. K. Ueno, J. Murai, H. Moon, K. Dokko and M. Watanabe, A design approach to lithium-ion battery electrolyte based on diluted solvate ionic liquids, *J. Electrochem. Soc.*, 2016, **164**, A6088.
31. D. J. Eyckens, M. E. Champion, B. L. Fox, P. Yoganantharajah, Y. Gibert, T. Welton and L. C. Henderson, Solvate ionic liquids as reaction media for electrocyclic transformations, *Eur. J. Org. Chem.*, 2016, 913–917.

32. S. Saito, H. Watanabe, K. Ueno, T. Mandai, S. Seki, S. Tsuzuki, Y. Kameda, K. Dokko, M. Watanabe and Y. Umebayashi, Li+ local structure in hydrofluoroether diluted Li-glyme solvate ionic liquid, *J. Phys. Chem. B*, 2016, **120**, 3378-3387.
33. K. Ueno, J. Murai, K. Ikeda, S. Tsuzuki, M. Tsuchiya, R. Tatara, T. Mandai, Y. Umebayashi, K. Dokko and M. Watanabe, Li+ solvation and ionic transport in lithium solvate ionic liquids diluted by molecular solvents, *J. Phys. Chem. C*, 2016, **120**, 15792-15802.
34. D. J. Eyckens, B. Demir, T. R. Walsh, T. Welton and L. C. Henderson, Determination of Kamlet–Taft parameters for selected solvate ionic liquids, *Phys. Chem. Chem. Phys.*, 2016, **18**, 13153-13157.
35. D. A. Dolan, D. A. Sherman, R. Atkin and G. G. Warr, Kamlet–taft solvation parameters of solvate ionic liquids, *ChemPhysChem*, 2016, **17**, 3096-3101.
36. Z. Li, S. Zhang, S. Terada, X. Ma, K. Ikeda, Y. Kamei, C. Zhang, K. Dokko and M. Watanabe, Promising cell configuration for next-generation energy storage: Li2S/graphite battery enabled by a solvate ionic liquid electrolyte, *ACS Appl. Mater. Interfaces*, 2016, **8**, 16053-16062.
37. Z. Li, Y. Kamei, M. Haruta, T. Takenaka, A. Tomita, T. Doi, S. Zhang, K. Dokko, M. Inaba and M. Watanabe, Si/Li2S battery with solvate ionic liquid electrolyte, *Electrochemistry (Tokyo)*, 2016, **84**, 887-890.
38. T. Nakazawa, A. Ikoma, R. Kido, K. Ueno, K. Dokko and M. Watanabe, Effects of compatibility of polymer binders with solvate ionic liquid electrolytes on discharge and charge reactions of lithium-sulfur batteries, *J. Power Sources*, 2016, **307**, 746-752.
39. H. Lu, Y. Yuan, Z. Hou, Y. Lai, K. Zhang and Y. Liu, Solvate ionic liquid electrolyte with 1, 1, 2, 2-tetrafluoroethyl 2, 2, 2-trifluoroethyl ether as a support solvent for advanced lithium–sulfur batteries, *RSC Adv.*, 2016, **6**, 18186-18190.
40. J. J. Black, T. Murphy, R. Atkin, A. Dolan and L. Aldous, The thermoelectrochemistry of lithium–glyme solvate ionic liquids: Towards waste heat harvesting, *Phys. Chem. Chem. Phys.*, 2016, **18**, 20768-20777.
41. S. Zhang, A. Ikoma, Z. Li, K. Ueno, X. Ma, K. Dokko and M. Watanabe, Optimization of pore structure of cathodic carbon supports for solvate ionic liquid electrolytes based lithium–sulfur batteries, *ACS Appl. Mater. Interfaces*, 2016, **8**, 27803-27813.
42. Z. Chen, S. McDonald, P. A. Fitzgerald, G. G. Warr and R. Atkin, Structural effect of glyme–Li+ salt solvate ionic liquids on the conformation of poly (ethylene oxide), *Phys. Chem. Chem. Phys.*, 2016, **18**, 14894-14903.
43. S. Seki, N. Serizawa, K. Takei, S. Tsuzuki, Y. Umebayashi, Y. Katayama, T. Miura, K. Dokko and M. Watanabe, Effects of non-equimolar lithium salt glyme solvate ionic liquid on the control of interfacial degradation in lithium secondary batteries, *RSC Adv.*, 2016, **6**, 33043-33047.
44. P. Yoganantharajah, D. J. Eyckens, J. L. Pedrina, L. C. Henderson and Y. Gibert, A study on acute toxicity and solvent capacity of solvate ionic liquids in vivo using a zebrafish model (Danio rerio), *New J. Chem.*, 2016, **40**, 6599-6603.
45. A. Ando, A. Ikoma, K. Obata, Y. Kamei, K. Dokko and M. Watanabe, 2016.
46. M. Sugiyama, N. Tachikawa, K. Yoshii and Y. Katayama, 2016.
47. A. Obregón-Zúñiga, M. Milán and E. Juaristi, Improving the catalytic performance of (S)-proline as organocatalyst in asymmetric aldol reactions in the presence of solvate ionic liquids: Involvement of a supramolecular aggregate, *Org. Lett.*, 2017, **19**, 1108-1111.
48. D. J. Eyckens and L. C. Henderson, Synthesis of α-aminophosphonates using solvate ionic liquids, *RSC Adv.*, 2017, **7**, 27900-27904.
49. H. Li, M. W. Rutland, M. Watanabe and R. Atkin, Boundary layer friction of solvate ionic liquids as a function of potential, *Faraday Discuss.*, 2017, **199**, 311-322.

50. S. W. Coles, M. Mishin, S. Perkin, M. V. Fedorov and V. B. Ivaništšev, The nanostructure of a lithium glyme solvate ionic liquid at electrified interfaces, *Phys. Chem. Chem. Phys.*, 2017, **19**, 11004-11010.
51. P. Jankowski, M. Dranka, W. Wieczorek and P. Johansson, TFSI and TDI anions: Probes for solvate ionic liquid and disproportionation-based lithium battery electrolytes, *J. Phys. Chem. Lett.*, 2017, **8**, 3678-3682.
52. H.-M. Kwon, M. L. Thomas, R. Tatara, Y. Oda, Y. Kobayashi, A. Nakanishi, K. Ueno, K. Dokko and M. Watanabe, Stability of Glyme Solvate Ionic Liquid as an Electrolyte for Rechargeable Li− O2 Batteries, *ACS Appl. Mater. Interfaces*, 2017, **9**, 6014-6021.
53. S. Seki, N. Serizawa, K. Takei, Y. Umebayashi, S. Tsuzuki and M. Watanabe, Long-cycle-life lithium-sulfur batteries with lithium solvate ionic liquids, *Electrochemistry (Tokyo)*, 2017, **85**, 680-682.
54. A. Cook, K. Ueno, M. Watanabe, R. Atkin and H. Li, Effect of variation in anion type and glyme length on the nanostructure of the solvate ionic liquid/graphite interface as a function of potential, *J. Phys. Chem. C*, 2017, **121**, 15728-15734.
55. Y. Wang, M. C. Turk, M. Sankarasubramanian, A. Srivatsa, D. Roy and S. Krishnan, Thermophysical and transport properties of blends of an ether-derivatized imidazolium ionic liquid and a Li+-based solvate ionic liquid, *J. Mater. Sci.*, 2017, **52**, 3719-3740.
56. Y. Kobayashi, Y. Kitazawa, K. Hashimoto, T. Ueki, H. Kokubo and M. Watanabe, Thermosensitive phase separation behavior of poly (benzyl methacrylate)/solvate ionic liquid solutions, *Langmuir*, 2017, **33**, 14105-14114.
57. T. Kawazoe, K. Hashimoto, Y. Kitazawa, H. Kokubo and M. Watanabe, A Polymer electrolyte containing solvate ionic liquid with increased mechanical strength formed by self-assembly of ABA-type ionomer triblock copolymer, *Electrochim. Acta*, 2017, **235**, 287-294.
58. H.-Y. Li and Y.-H. Chu, Exploiting solvate ionic liquids for amine gas analysis on a quartz crystal microbalance, *Anal. Chem.*, 2017, **89**, 5186-5192.
59. N. Tachikawa, R. Kasai, K. Yoshii, M. Watanabe and Y. Katayama, Electrochemical deposition and dissolution of lithium on a carbon fiber composite electrode in a solvate ionic liquid, *Electrochemistry (Tokyo)*, 2017, **85**, 667-670.
60. S. Terada, K. Ikeda, K. Ueno, K. Dokko and M. Watanabe, Liquid structures and transport properties of lithium bis (fluorosulfonyl) amide/glyme solvate ionic liquids for lithium batteries, *Aust. J. Chem.*, 2018, **72**, 70-80.
61. Y. Kitazawa, K. Iwata, R. Kido, S. Imaizumi, S. Tsuzuki, W. Shinoda, K. Ueno, T. Mandai, H. Kokubo and K. Dokko, Polymer electrolytes containing solvate ionic liquids: A new approach to achieve high ionic conductivity, thermal stability, and a wide potential window, *Chem. Mater.*, 2018, **30**, 252-261.
62. D. Dong, F. Sälzer, B. Roling and D. Bedrov, How efficient is Li+ ion transport in solvate ionic liquids under anion-blocking conditions in a battery?, *Phys. Chem. Chem. Phys.*, 2018, **20**, 29174-29183.
63. Z. Chen, Y. Tonouchi, K. Matsumoto, M. Saimura, R. Atkin, T. Nagata, M. Katahira and R. Hagiwara, Partially naked fluoride in solvate ionic liquids, *J. Phys. Chem. Lett.*, 2018, **9**, 6662-6667.
64. M. Watanabe, K. Dokko, K. Ueno and M. L. Thomas, From ionic liquids to solvate ionic liquids: challenges and opportunities for next generation battery electrolytes, *Bull. Chem. Soc. Jpn.*, 2018, **91**, 1660-1682.
65. Z. Yu, C. Fang, J. Huang, B. G. Sumpter and R. Qiao, Solvate ionic liquids at electrified interfaces, *ACS Appl. Mater. Interfaces*, 2018, **10**, 32151-32161.

66. W. Shinoda, Y. Hatanaka, M. Hirakawa, S. Okazaki, S. Tsuzuki, K. Ueno and M. Watanabe, Molecular dynamics study of thermodynamic stability and dynamics of [Li (glyme)]+ complex in lithium-glyme solvate ionic liquids, *J. Chem. Phys.*, 2018, **148**, 193809.
67. P. Geysens, V. S. Rangasamy, S. Thayumanasundaram, K. Robeyns, L. Van Meervelt, J.-P. Locquet, J. Fransaer and K. Binnemans, Solvation structure of sodium bis (fluorosulfonyl) imide-glyme solvate ionic liquids and its influence on cycling of Na-MNC cathodes, *J. Phys. Chem. B*, 2018, **122**, 275-289.
68. D. Dong and D. Bedrov, Charge transport in [Li (tetraglyme)][bis (trifluoromethane) sulfonimide] solvate ionic liquids: insight from molecular dynamics simulations, *J. Phys. Chem. B*, 2018, **122**, 9994-10004.
69. A. Kitada, S. Takeoka, K. Kintsu, K. Fukami, M. Saimura, T. Nagata, M. Katahira and K. Murase, A Hydronium Solvate Ionic Liquid: Facile Synthesis of Air-Stable Ionic Liquid with Strong Brønsted Acidity, *J. Electrochem. Soc.*, 2018, **165**, H121.
70. A. Kitada, K. Kintsu, S. Takeoka, K. Fukami, M. Saimura, T. Nagata, M. Katahira and K. Murase, A Hydronium Solvate Ionic Liquid: Ligand Exchange Conduction Driven by Labile Solvation, *J. Electrochem. Soc.*, 2018, **165**, H496.
71. B. Zhang, Z. Shi, L. Shen, A. Liu, J. Xu and X. Hu, Electrodeposition of Al, Al-Li alloy, and Li from an Al-containing solvate ionic liquid under ambient conditions, *J. Electrochem. Soc.*, 2018, **165**, D321.
72. J. J. Black, A. Dolan, J. B. Harper and L. Aldous, Kamlet–Taft solvent parameters, NMR spectroscopic analysis and thermoelectrochemistry of lithium–glyme solvate ionic liquids and their dilute solutions, *Phys. Chem. Chem. Phys.*, 2018, **20**, 16558-16567.
73. S. Coles, University of Oxford, 2018.
74. B. Zhang, Y. Yao, Z. Shi, J. Xu and Z. Wang, Direct Electrochemical Deposition of Lithium from Lithium Oxide in a Highly Stable Aluminium-Containing Solvate Ionic Liquid, *ChemElectroChem*, 2018, **5**, 3368-3372.
75. Y. Kemmizaki, H. Tsutsumi and K. Ueno, Redox active Glyme-Li salt solvate ionic liquids based on tetrabromoferrate (III), *Electrochemistry (Tokyo)*, 2018, **86**, 46-51.
76. T. Hirano, R. Kizu, J. Hashimoto, N. Munekane, Y. Miwa, M. Oshimura and K. Ute, Thermally induced cationic polymerization of isobutyl vinyl ether in toluene in the presence of solvate ionic liquid, *Polym. Chem.*, 2018, **9**, 1421-1429.
77. M. Haruta, T. Moriyasu, A. Tomita, T. Takenaka, T. Doi and M. Inaba, Pre-film formation and cycle performance of silicon-flake-powder negative electrode in a solvate ionic liquid for silicon-sulfur rechargeable batteries, *J. Electrochem. Soc.*, 2018, **165**, A1874.
78. P. Yoganantharajah, A. P. Ray, D. J. Eyckens, L. C. Henderson and Y. Gibert, Comparison of solvate ionic liquids and DMSO as an in vivo delivery and storage media for small molecular therapeutics, *BMC Biotechnol.*, 2018, **18**, 1-7.
79. K. Hashimoto, Y. Kobayashi, H. Kokubo, T. Ueki, K. Ohara, K. Fujii and M. Watanabe, Solvation Structure of Poly (benzyl methacrylate) in a Solvate Ionic Liquid: Preferential Solvation of Li–Glyme Complex Cation, *J. Phys. Chem. B*, 2019, **123**, 4098-4107.
80. A. J. D'Angelo and M. J. Panzer, Design of stretchable and self-healing gel electrolytes via fully zwitterionic polymer networks in solvate ionic liquids for Li-based batteries, *Chem. Mater.*, 2019, **31**, 2913-2922.
81. N. Arai, H. Watanabe, T. Yamaguchi, S. Seki, K. Ueno, K. Dokko, M. Watanabe, Y. Kameda, R. Buchner and Y. Umebayashi, Dynamic chelate effect on the Li+-ion conduction in solvate ionic liquids, *J. Phys. Chem. C*, 2019, **123**, 30228-30233.

82. K. S. S. McHale, M. J. Wong, A. K. Evans, A. Gilbert, R. S. Haines and J. B. Harper, Understanding the effects of solvate ionic liquids as solvents on substitution processes, *Org. Biomol. Chem.*, 2019, **17**, 9243-9250.
83. S. W. Coles and V. B. Ivaništšev, Simulation of a solvate ionic liquid at a polarizable electrode with a constant potential, *J. Phys. Chem. C*, 2019, **123**, 3935-3943.
84. D. J. Eyckens and L. C. Henderson, A review of solvate ionic liquids: Physical parameters and synthetic applications, *Front. Chem.*, 2019, **7**, 263.
85. T. Mandai, K. Dokko and M. Watanabe, Solvate ionic liquids for Li, Na, K, and Mg batteries, *Chem. Rec.*, 2019, **19**, 708-722.
86. S. Chereddy, J. Aguirre, D. Dikin, S. L. Wunder and P. R. Chinnam, Gel electrolyte comprising solvate ionic liquid and methyl cellulose, *ACS Appl. Energy Mater.*, 2019, **3**, 279-289.
87. D. Y. Oh, Y. J. Nam, K. H. Park, S. H. Jung, K. T. Kim, A. R. Ha and Y. S. Jung, Slurry-fabricable Li+-conductive polymeric binders for practical all-solid-state lithium-ion batteries enabled by solvate ionic liquids, *Adv. Energy Mater.*, 2019, **9**, 1802927.
88. M. Huang, S. Feng, W. Zhang, J. Lopez, B. Qiao, R. Tatara, L. Giordano, Y. Shao-Horn and J. A. Johnson, Design of S-substituted fluorinated aryl sulfonamide-tagged (S-FAST) anions to enable new solvate ionic liquids for battery applications, *Chem. Mater.*, 2019, **31**, 7558-7564.
89. Y. Matsumae, K. Obata, A. Ando, M. Yanagi, Y. Kamei, K. Ueno, K. Dokko and M. Watanabe, Effects of sulfur loading, cathode porosity, and electrolyte amount on li-s battery performance with solvate ionic liquid electrolyte, *Electrochemistry (Tokyo)*, 2019, **87**, 254-259.
90. B. Zhang, Z. Shi, L. Shen, X. Liu, J. Xu and Z. Wang, Low-temperature electrochemical codeposition of aluminum-neodymium alloy in a highly stable solvate ionic liquid, *J. Solid State Electrochem.*, 2019, **23**, 1903-1909.
91. K. Takahashi, Y. Ishino, W. Murata, Y. Umebayashi, S. Tsuzuki, M. Watanabe, H. Takaba and S. Seki, Physicochemical compatibility of highly-concentrated solvate ionic liquids and a low-viscosity solvent, *RSC Adv.*, 2019, **9**, 24922-24927.
92. K. Dokko, S. Suzuki, S. Terada, K. Hashimoto, S. Tsuzuki, M. L. Thomas, T. Mandai and M. Watanabe, 2019.
93. S. Di Pietro, V. Bordoni, A. Mezzetta, C. Chiappe, G. Signore, L. Guazzelli and V. Di Bussolo, Remarkable effect of [Li (G4)] TFSI solvate ionic liquid (SIL) on the regio-And stereoselective ring opening of α-gluco carbasugar 1, 2-epoxides, *Molecules*, 2019, **24**, 2946.
94. N. Togasaki, T. Naruse, T. Momma and T. Osaka, Communication—solvate ionic liquid incorporating lithium nitrate as a redox mediator for lithium-oxygen batteries, *J. Electrochem. Soc.*, 2019, **166**, A3391.
95. N. Hameed, D. J. Eyckens, B. M. Long, N. V. Salim, J. C. Capricho, L. Servinis, M. De Souza, M. D. Perus, R. J. Varley and L. C. Henderson, Rapid Cross-Linking of Epoxy Thermosets Induced by Solvate Ionic Liquids, *ACS Appl. Polym. Mater.*, 2020, **2**, 2651-2657.
96. A. Thum, A. Heuer, K. Shimizu and J. N. C. Lopes, Solvate ionic liquids based on lithium bis (trifluoromethanesulfonyl) imide–glyme systems: Coordination in MD simulations with scaled charges, *Phys. Chem. Chem. Phys.*, 2020, **22**, 525-535.
97. W. Wang, T. Yang, W. H. Harris and R. Gómez-Bombarelli, Active learning and neural network potentials accelerate molecular screening of ether-based solvate ionic liquids, *Chem. Commun.*, 2020, **56**, 8920-8923.
98. F. Schmidt and M. Schönhoff, Solvate cation migration and ion correlations in solvate ionic liquids, *J. Phys. Chem. B*, 2020, **124**, 1245-1252.
99. Y. Cao, S. Lou, Z. Sun, W. Tang, Y. Ma, P. Zuo, J. Wang, C. Du, Y. Gao and G. Yin, Solvate ionic liquid boosting favorable interfaces kinetics to achieve the excellent performance of Li4Ti5O12 anodes in Li10GeP2S12 based solid-state batteries, *Chem. Eng. J.*, 2020, **382**, 123046.

100. H. Shobukawa, K. Shigenobu, S. Terada, S. Kondou, K. Ueno, K. Dokko and M. Watanabe, Effects of fluoroethylene carbonate addition to Li-glyme solvate ionic liquids on their ionic transport properties and Si composite electrode performance, *Electrochim. Acta*, 2020, **353**, 136559.
101. J. Kawaji, A. Unemoto, T. Hirano, D. Takamatsu, E. Seki, M. Morishima and T. Okumura, Analysis of solid-electrolyte interphase at the interface between a graphite negative electrode and a diluted solvate ionic liquid-based quasi-solid-state electrolyte, *J. Electrochem. Soc.*, 2020, **167**, 140525.
102. P. Geysens, J. Fransaer and K. Binnemans, Reversible electrodeposition and stripping of magnesium from solvate ionic liquid–tetrabutylammonium chloride mixtures, *RSC Adv.*, 2020, **10**, 42021-42029.
103. N. Serizawa, K. Kitta, N. Tachikawa and Y. Katayama, Characterization of the Solid-Electrolyte Interphase between a Cu Electrode and LiN (CF3SO2) 2-triglyme Solvate Ionic Liquid, *J. Electrochem. Soc.*, 2020, **167**, 110560.
104. A.-m. Liu, M.-x. Guo, Z.-y. LÜ, B.-g. Zhang, F.-g. Liu, W.-j. Tao, Y.-j. Yang, X.-w. Hu, Z.-w. Wang and Y.-b. Liu, Electrochemical behavior of tantalum in ethylene carbonate and aluminum chloride solvate ionic liquid, *T. NONFERR. METAL SOC.*, 2020, **30**, 2283-2292.
105. Y. Kemmizaki, Y. Katayama, H. Tsutsumi and K. Ueno, Redox-active glyme–Li tetrahalogenoferrate (iii) solvate ionic liquids for semi-liquid lithium secondary batteries, *RSC Adv.*, 2020, **10**, 4129-4136.
106. M. Potangale and S. Tiwari, Correlation of the empirical polarity parameters of solvate ionic liquids (SILs) with molecular structure, *J. Mol. Liq.*, 2020, **297**, 111882.
107. T. Mori, N. Tsuchida, A. Kitada, K. Fukami and K. Murase, 2020.
108. A. Unemoto, M. Hirooka, E. Seki, J. Kawaji and T. Okumura, High energy density “Bezel-less” lithium-ion battery using solvate ionic liquid-based quasi-solid-state electrolyte, *Electrochemistry (Tokyo)*, 2020, **88**, 321-324.
109. K. Kawata, A. Kitada, N. Tsuchida, M. Saimura, T. Nagata, M. Katahira, K. Fukami and K. Murase, Suppression of Fast Proton Conduction by Dilution of a Hydronium Solvate Ionic Liquid: Localization of Ligand Exchange, *J. Electrochem. Soc.*, 2020, **167**, 046508.
110. S. Saito, R. Tamate, K. Miwa, S. Shimizu, T. Horii, K. Ueno, S. Ono and M. Watanabe, High performance electric double layer transistors using solvate ionic liquids, *Jpn. J. Appl. Phys.*, 2020, **59**, 030901.
111. M. S. Grewal, K. Kisu, S.-i. Orimo and H. Yabu, Photo-crosslinked polymer electrolytes containing solvate ionic liquids: an approach to achieve both good mechanical and electrochemical performances for rechargeable lithium ion batteries, *Chem. Lett.*, 2020, **49**, 1465-1469.
112. K. Kawata, A. Kitada, K. Fukami, M. Saimura, T. Nagata, M. Katahira and K. Murase, An Ammonium Solvate Ionic Liquid, *J. Electrochem. Soc.*, 2021, **168**, 026515.
113. A. Miki, K. Nishikawa, G. Kamesui, H. Matsushima, M. Ueda and M. Rosso, In situ interferometry study of ionic mass transfer phenomenon during the electrodeposition and dissolution of Li metal in solvate ionic liquids, *J. Mater. Chem. A*, 2021, **9**, 14700-14709.
114. W. Zhang, S. Feng, M. Huang, B. Qiao, K. Shigenobu, L. Giordano, J. Lopez, R. Tatara, K. Ueno and K. Dokko, Molecularly tunable polyanions for single-ion conductors and poly (solvate ionic liquids), *Chem. Mater.*, 2021, **33**, 524-534.
115. X. Zhang, A. Liu, F. Liu, Z. Shi, B. Zhang and X. Wang, Electrodeposition of aluminum–magnesium alloys from an aluminum-containing solvate ionic liquid at room temperature, *Electrochem. Commun.*, 2021, **133**, 107160.
116. B. Zhang, L. Wang, K. Pan, W. Zhang, Y. Liu, Y. Zhang, L. Zhang and Z. Shi, LiNO3-Supported Electrodeposition of Metallic Nd from Nd-Containing Solvate Ionic Liquid, *J. Phys. Chem. C*, 2021, **125**, 20798-20805.

117. K. Motobayashi, K. Matsumoto, S. Tsuzuki and K. Ikeda, Competing characters of Li+-Glyme complex in a solvate ionic liquid: High stability in the bulk and rapid desolvation on an electrode surface, *ELSA*, 2022, **2**, e2100150.
118. A. Kitada, Y. Koujin, M. Shimizu, K. Kawata, C. Yoshinaka, M. Saimura, T. Nagata, M. Katahira, K. Fukami and K. Murase, Glyme-Lithium Bis (trifluoromethylsulfonyl) amide Super-concentrated Electrolytes: Salt Addition to Solvate Ionic Liquids Lowers Ionicity but Liberates Lithium Ions, *J. Electrochem. Soc.*, 2021, **168**, 090521.
119. K. Kawata, A. Kitada, N. Tsuchida, M. Saimura, T. Nagata, M. Katahira, K. Fukami and K. Murase, Proton conduction in hydronium solvate ionic liquids affected by ligand shape, *Phys. Chem. Chem. Phys.*, 2021, **23**, 449-456.
120. Y. Umebayashi, N. Arai and H. Watanabe, *Thermodynamic and Structural Aspects of Solvate Ionic Liquid Formation*, 2021.
121. X. Gao, W. Yuan, Y. Yang, Y. Wu, C. Wang, X. Wu, X. Zhang, Y. Yuan, Y. Tang and Y. Chen, High-performance and highly safe solvate ionic liquid-based gel polymer electrolyte by rapid UV-curing for lithium-ion batteries, *ACS Appl. Mater. Interfaces*, 2022, **14**, 43397-43406.
122. T. Sudoh, K. Shigenobu, K. Dokko, M. Watanabe and K. Ueno, Li+ transference number and dynamic ion correlations in glyme-Li salt solvate ionic liquids diluted with molecular solvents, *Phys. Chem. Chem. Phys.*, 2022, **24**, 14269-14276.
123. Y. Xu, X. Jiang, Z. Liu, Z. Chen, S. Zhang and Y. Zhang, Solvate ionic liquid-based ionogels for lithium metal batteries over a wide temperature range, *J. Power Sources*, 2022, **546**, 231952.
124. S. Parveen, P. Sehrawat and S. Hashmi, Triglyme-based solvate ionic liquid gelled in a polymer: A novel electrolyte composition for sodium ion battery, *Mater. Today Commun.*, 2022, **31**, 103392.
125. C. M. Burba, K. Feightner, M. Liu and A. Hawari, The Effect of Fluorinated Solvents on the Physicochemical Properties, Ionic Association, and Free Volume of a Prototypical Solvate Ionic Liquid, *ChemPhysChem*, 2022, **23**, e202100548.
126. J. H. Shin, M. B. Yi, T. H. Lee and H. J. Kim, Rapidly Deformable Vitrimer Epoxy System with Supreme Stress-Relaxation Capabilities via Coordination of Solvate Ionic Liquids, *Adv. Funct. Mater.*, 2022, **32**, 2207329.
127. L. Wichmann, J. P. Brinkmann, M. Luo, Y. Yang, M. Winter, R. Schmuch, T. Placke and A. Gomez-Martin, Improved Capacity Retention for a Disordered Rocksalt Cathode via Solvate Ionic Liquid Electrolytes, *Batteries Supercaps*, 2022, **5**, e202200075.
128. M. Haruta, H. Konaga, T. Doi and M. Inaba, Perfluoroinated Ionomer as an Artificial SEI for Silicon Nano-Flake Anode in LiTFSI/Tetraglyme Solvate Ionic Liquid, *J. Electrochem. Soc.*, 2022, **169**, 020519.
129. S. Lu, J. Cai, W. Zheng, Z. Lai, B. Xie, Z. Ding and H. He, Development of solvate ionic liquid immobilized MCM-41 ionogel electrolytes for lithium battery, *J. Mater. Sci. Mater. Electron.*, 2022, **33**, 18621-18631.
130. T. Hirano, T. Yuki, R. Kizu, R. Kamiike, M. Oshimura and K. Ute, Cationic homopolymerization of trans-anethole in the presence of solvate ionic liquid comprising LiN (SO2CF3) 2 and Lewis bases, *Polym. J.*, 2022, **246**, 124780.
131. L. Sheina, E. Karaseva, E. Battalova, S. Ivanov and V. Kolosnitsyn, Solvate Ionic Liquids: Assessing the Possibility of Determining the Composition by Means of Gas–Liquid Chromatography, *Russ. J. Phys. Chem.*, 2022, **96**, 1322-1327.
132. A. Liu, M. Guo, Y. Liu, F. Liu, X. Hu and Z. Shi, Electrodeposition of Zn–Ta Coating from DMI–ZnCl2–TaCl5 Solvate Ionic Liquids, *Electrochemistry (Tokyo)*, 2022, **90**, 027006-027006.

133. B. Dharmasiri, F. Stojcevski, K. A. S. Usman, S. A. Qin, J. M. Razal, E. H. Doeven, P. S. Francis, T. U. Connell, Y. Yin and G. G. Andersson, Flexible carbon fiber based structural supercapacitor composites with solvate ionic liquid-epoxy solid electrolyte, *Chem. Eng. J.*, 2023, **455**, 140778.
134. T. Harte, B. Dharmasiri, G. S. DOBHAL, T. R. Walsh and L. C. Henderson, Accelerated lithium-ion diffusion via a ligand 'hopping'mechanism in lithium enriched solvate ionic liquids, *Phys. Chem. Chem. Phys.*, 2023, **25**, 29614-29623.
135. W. Lei, C. Zhang, R. Qiao, M. Ravivarma, H. Chen, F. B. Ajdari, M. Salavati-Niasari and J. Song, Stable Li| LAGP Interface Enabled by Confining Solvate Ionic Liquid in a Hyperbranched Polyanionic Copolymer for NASICON-Based Solid-State Batteries, *ACS Appl. Energy Mater.*, 2023, **6**, 4363-4371.
136. H. Watanabe, Y. Sugiura, S. Seki, J. Han, I. Shitanda, M. Itagaki and Y. Umebayashi, Discharge Behavior within Lithium–Sulfur Batteries Using Li–Glyme Solvate Ionic Liquids, *J. Phys. Chem. C*, 2023, **127**, 6645-6654.
137. P. Kumari, S. Parveen and S. Hashmi, Diglyme-Based "Solvate Ionic Liquid" Gelled in Poly (vinylidine fluoride-co-hexafluoropropylene): A Flexible Electrolyte for High-Performance Magnesium-Ion Batteries, *ACS Appl. Energy Mater.*, 2023.
138. J. Yi, C. Yan, D. Zhou and L.-Z. Fan, A robust solid electrolyte interphase enabled by solvate ionic liquid for high-performance sulfide-based all-solid-state lithium metal batteries, *Nano Res.*, 2023, **16**, 8411-8416.
139. G. Kamesui, K. Nishikawa, M. Ueda and H. Matsushima, In situ observation of the formation and relaxation processes of concentration gradients in a lithium bis (fluorosulfonyl) amide–tetraglyme solvate ionic liquid using digital holographic interference microscopy, *Electrochem. Commun.*, 2023, **151**, 107506.
140. E. O. Nachaki and D. G. Kuroda, Transitioning from Regular Electrolytes to Solvate Ionic Liquids to High-Concentration Electrolytes: Changes in Transport Properties and Ionic Speciation, *J. Phys. Chem. C*, 2024, **128**, 11522-11533.
141. R. Tatara, K. Ikeda, K. Ueno, M. Watanabe and K. Dokko, Solid–electrolyte interphase formation during Li metal deposition in LiN (SO2F) 2-based solvate ionic liquids, *J. Solid State Electrochem.*, 2024, 1-7.
142. G. Lingua, G. Depraetère, J. Wang, J. E. Bara, M. Forsyth and D. Mecerreyes, Solvate Ionic Liquids based on branched glymes enabling high performance lithium metal batteries, *J. Power Sources*, 2024, DOI: https://doi.org/10.1016/j.jpowsour.2024.235535.
143. Ž. Simon, B. Dharmasiri, T. Harte, P. C. Sherrell and L. C. Henderson, From stress to charge: investigating the piezoelectric response of solvate ionic liquid in structural energy storage composites, *Materials Horizons*, 2024.
144. T. Harte, B. Dharmasiri, D. J. Eyckens and L. C. Henderson, Closing the Loop: Recyclable Solvate Ionic Liquids in Solid Polymer Electrolytes for Circular Economy, *ACS Sustain. Chem. Eng.*, 2024.
145. T. Harte, B. Dharmasiri, P. Coia, D. J. Eyckens and L. C. Henderson, Bicontinuous solid polymer electrolytes using Li+ enriched ionic liquids, *J. Mol. Liq.*, 2024, 124689.
146. O. Carrillo-Bohórquez, D. G. Kuroda and R. Kumar, A transferable classical force field to describe glyme based lithium solvate ionic liquids, *J. Chem. Phys.*, 2024, **161**.
147. S. S. More, R. B. Kale, P. J. Ambekar, N. D. Khupse, R. S. Kalubarme, M. V. Kulkarni and B. B. Kale, Imidazolium Functionalized Copolymer Supported Solvate Ionic Liquid Based Gel Polymer Electrolyte for Lithium Ion Batteries, *ACS Appl. Polym. Mater.*, 2024, **6**, 11953-11963.
148. K. Shimizu, A. A. de Freitas, J. T. Allred and C. M. Burba, A Computational and Spectroscopic Analysis of Solvate Ionic Liquids Containing Anions with Long and Short Perfluorinated Alkyl Chains, *Molecules*, 2024, **29**, 2071.

149. J. Więcławik, A. Brzęczek-Szafran, S. Jurczyk, K. Matuszek, M. Swadźba-Kwaśny and A. Chrobok, Al (iii) and Ga (iii) triflate complexes as solvate ionic liquids: speciation and application as soluble and recyclable Lewis acidic catalysts, *Dalton Trans.*, 2024, **53**, 19143-19152.
150. T. A. Yersak, Y. Zhang, H. Hafiz, N. P. Pieczonka, H. J. G. Malabet, H. Cunningham and M. Cai, Improved Stability of Oxysulfide Solid-State Electrolytes in Li (G3) TFSI Solvate Ionic Liquid Electrolyte, *J. Electrochem. Soc.*, 2024, **171**, 070529.
151. M. Watanabe, in *Functional Macromolecular Complexes*, eds. Y. Kimihisa and N. Hiroshi, 2024, vol. 1, ch. Chapter 14: Glyme-based Solvate Ionic Liquids and Their Electrolyte Properties.
152. Y. Maeyoshi, in *Interface Ionics: For All-Solid-State Batteries and Solid State Ionics Devices*, eds. I. Yasutoshi, A. Koji, T. Yoshitaka and Y. Naoaki, Springer, 1 edn., 2024, DOI: https://doi.org/10.1007/978-981-97-6039-8, pp. 117-125.
153. C. luo, G. Zhao, M. Zhang, B. Wu, Y. Sun and Q. Hua, A Pentabasic High-Concentration Peo-Based Polymer Layer Optimizes the Electrode/Ceramic Electrolyte Interface, *SSRN (Elsevier)*, 2024, DOI: http://dx.doi.org/10.2139/ssrn.4719385.
154. É. A. Santos, L. M. Barros, A. F. de FV Peluso, I. Galantini, J. M. Gonçalves, R. Maciel Filho and H. Zanin, Trends in ionic liquids and quasi-solid-state electrolytes for Li-S batteries: A review on recent progress and future perspectives, *Chem. Eng. J.*, 2024, 152429.
155. C. Andrew and J. Mani, Electrodeposition behaviour of samarium in 1, 3-dimethyl-2-imidazolidone solvent, *Pure Appl. Chem.*, 2024.
156. I. Kochetkov, University of Waterloo, 2024.
157. Y. Umebayashi, E. Otani, H. Watanabe and J. Han, Speciation and dipole re-orientation dynamics of glass-forming liquid electrolytes: Li [N (SO2CF3) 2] mixtures of 1, 3-propanesultone or tetrahydrothiophene-1, 1-dioxide, *Faraday Discuss.*, 2024.
158. C. Mönich, R. Andersson, G. Hernández, J. Mindemark and M. Schönhoff, Seeing the Unseen: Mg2+, Na+, and K+ Transference Numbers in Post-Li Battery Electrolytes by Electrophoretic Nuclear Magnetic Resonance, *J. Am. Chem. Soc.*, 2024, **146**, 11105-11114.
159. D. Lee and A. Manthiram, Boosting the electrochemical performance with functionalized dry electrodes for practical all-solid-state batteries, *J. Mater. Chem. A*, 2024, **12**, 3323-3330.
160. H. Watanabe, Y. Sugiura, I. Shitanda and M. Itagaki, 2024.
161. X. Zhang, S. Li, J. Yuan and Z. Shi, Influence of magnesium chloride on the electrodeposition of zinc from the 1, 3-dimethyl-2-imidazolidinone/ZnCl2 system, *J. Electroanal. Chem.*, 2024, **957**, 118131.
162. G. Kamesui, K. Nishikawa, M. Ueda and H. Matsushima, Correlation between Electrolyte Concentration and Lithium Morphology during Lithium Bis (fluorosulfonyl) amide–Tetraglyme Electrolyte Deposition–Dissolution Reactions, *J. Electrochem. Soc.*, 2024, **171**, 100507.
163. S. Parveen, A. Kumar and S. Hashmi, A Promising Gel Polymer Electrolyte Composition Comprising a Green-Glyme Di (propylene glycol) Dimethyl Ether for Application in Sodium-Ion Batteries, *ACS Appl. Energy Mater.*, 2024, **7**, 10441-10453.
164. Z. Wei, S. Zhu, X. Zhu, L. Yu, Z. Jiang, X. Tang, X. Qu, Y. Wang, H. Tang and X. Liu, In Situ-Polymerized Separator-Free Ionogel Electrolyte with Enhanced Interfacial Compatibility for Integrated Solid-State Lithium Batteries, *Energy & Fuels*, 2024, **38**, 8296-8305.
165. J. Zhang, J. Zhu, R. Zhao, J. Liu, X. Song, N. Xu, Y. Liu, H. Zhang, X. Wan and Y. Ma, An all-in-one free-standing single-ion conducting semi-solid polymer electrolyte for high-performance practical Li metal batteries, *Energy Environ. Sci.*, 2024, **17**, 7119-7128.
166. X.-T. Yin, E.-M. You, R.-Y. Zhou, L.-H. Zhu, W.-W. Wang, K.-X. Li, D.-Y. Wu, Y. Gu, J.-F. Li and B.-W. Mao, Unraveling the energy storage mechanism in graphene-based nonaqueous electrochemical capacitors by gap-enhanced Raman spectroscopy, *Nat. Commun.*, 2024, **15**, 5624.

167. X.-T. Yin, W.-W. Wang, Z. Tan, Y. Ding, B.-W. Mao and J.-W. Yan, In situ SPM studies of electrochemical interfaces in high ionic strength electrolytes, *Curr. Opin. Electrochem.*, 2024, 101563.
168. K. Matuszek, S. L. Piper, A. Brzęczek-Szafran, B. Roy, S. Saher, J. M. Pringle and D. R. MacFarlane, Unexpected energy applications of ionic liquids, *Adv. Mater.*, 2024, 2313023.
169. Y. Zhen, Z. Qin, Z. Jia, H. Geng, Y. Feng, Z. Yang, X. Jiang, W. Yang, Y. Qie and Q. Xue, Li8P2S9 solid electrolyte with high ionic conductivity and air stability by Bi2Se3 co-doping, *J. Mater. Sci. Eng., B*, 2024, **301**, 117105.
170. D. Lee, M. Yang, U. H. Choi and J. Kim, Bioinspired Synaptic Branched Network within Quasi-Solid Polymer Electrolyte for High-Performance Microsupercapacitors, *Small*, 2024, DOI: https://doi.org/10.1002/smll.202308821, 2308821.
171. H. K. Bergstrom and B. D. McCloskey, Ion transport in (localized) high concentration electrolytes for Li-based batteries, *ACS Energy Lett.*, 2024, **9**, 373-380.
172. E. V. Kuzmina, A. R. Yusupova, E. V. Karaseva, X. Chen, Q. Zhang and V. S. Kolosnitsyn, Structure and Physicochemical Properties of Solutions of Lithium Polysulfides in Tetrasolvate of Lithium Perchlorate with Sulfolane Molecular Dynamics Modeling, *J. Phys. Chem. B*, 2024, **128**, 7833-7847.
173. H. Darjazi, M. Falco, F. Colò, L. Balducci, G. Piana, F. Bella, G. Meligrana, F. Nobili, G. A. Elia and C. Gerbaldi, Electrolytes for Sodium Ion Batteries: The Current Transition from Liquid to Solid and Hybrid systems, *Adv. Mater.*, 2024, 2313572.
174. G. Z. Żukowska, M. Piszcz, K. Gańko, M. Więckowski, M. Królikowski, M. Poterała and M. Dranka, Basic properties of glyme-based electrolytes doped with lithium 2, 4, 5-tricyanoimidazolide (LiTIM), *Mater. Chem. Phys.*, 2024, **315**, 128999.
175. S. Oho, Y. SHIMBORI and K. Kanamura, Optimization of Carbon/Sulfur Composite and Application of Al-LLZO Solid Electrolyte and Highly Concentrated Electrolytes for Lithium-Sulfur Cell, *Electrochemistry (Tokyo)*, 2024, **92**, 017001-017001.
176. J. K. Philipp, K. Fumino, A. Appelhagen, D. Paschek and R. Ludwig, The competition between cation-anion and cation-triglyme interaction in solvate ionic liquids probed by far infrared spectroscopy and molecular dynamics simulations, *ChemPhysChem*, 2025, e202400991.
177. Y. Yuan, X. Peng, B. Wang, K. Xue, Z. Li, Y. Ma, B. Zheng, Y. Song and H. Lu, Solvate ionic liquid-derived solid polymer electrolyte with lithium bis (oxalato) borate as a functional additive for solid-state lithium metal batteries, *J. Mater. Chem. A*, 2023, **11**, 1301-1311.
178. Y. Dong, X. Qi, M. Tanaka and H. Kawakami, Gel Polymer Electrolyte Membranes Consisted of Solvate Ionic Liquid and Crosslinked Network Polymers Bearing Different Main Chains: Fabrication and Lithium Battery Application, *Electrochim. Acta*, 2025, 145661.
179. S. Zhang, N. Sun, X. He, X. Lu and X. Zhang, Physical properties of ionic liquids: database and evaluation, *J. Phys. Chem. Ref. Data*, 2006, **35**, 1475-1517.
180. D. Rooney, J. Jacquemin and R. Gardas, Thermophysical properties of ionic liquids, *J. Ion. Liq.*, 2010, 185-212.
181. J. O. Valderrama and R. E. Rojas, Critical properties of ionic liquids. Revisited, *Eng. Chem. Res.*, 2009, **48**, 6890-6900.
182. X. Wang, Y. Chi and T. Mu, A review on the transport properties of ionic liquids, *J. Mol. Liq.*, 2014, **193**, 262-266.

Rights/reprint of figure/s permissions:

Figure in '*Gel Polymer Electrolytes (Including Ionogels)*' section from Zhang, W., Feng, S., Huang, M., Qiao, B., Shigenobu, K., Giordano, L., Lopez, J., Tatara, R., Ueno, K., Dokko, K. and Watanabe, M., 2021. Molecularly tunable polyanions for single-ion conductors and poly (solvate ionic liquids). *Chemistry of Materials*, *33*(2), pp.524-534.[114]

Permission sought: 23/01/2025

ACS Publications
Most Trusted. Most Cited. Most Read.

Molecularly Tunable Polyanions for Single-Ion Conductors and Poly(solvate ionic liquids)

Author: Wenxu Zhang, Shuting Feng, Mingjun Huang, et al
Publication: Chemistry of Materials
Publisher: American Chemical Society
Date: Jan 1, 2021

PERMISSION/LICENSE IS GRANTED FOR YOUR ORDER AT NO CHARGE

This type of permission/license, instead of the standard Terms and Conditions, is sent to you because no fee is being charged for your order. Please note the following:

- Permission is granted for your request in both print and electronic formats, and translations.
- If figures and/or tables were requested, they may be adapted or used in part.
- Please print this page for your records and send a copy of it to your publisher/graduate school.
- Appropriate credit for the requested material should be given as follows: "Reprinted (adapted) with permission from {COMPLETE REFERENCE CITATION}. Copyright {YEAR} American Chemical Society." Insert appropriate information in place of the capitalized words.
- One-time permission is granted only for the use specified in your RightsLink request. No additional uses are granted (such as derivative works or other editions). For any uses, please submit a new request.

If credit is given to another source for the material you requested from RightsLink, permission must be obtained from that source.

BACK CLOSE WINDOW

Figure from Piper, S.L., Forsyth, C.M., Kar, M., Gassner, C., Vijayaraghavan, R., Mahadevan, S., Matuszek, K., Pringle, J.M. and MacFarlane, D.R., 2023. Sustainable materials for renewable energy storage in the thermal battery. *RSC Sustainability*, *1*(3), pp.470-480.

Permission sought: 28/01/2025

Sustainable materials for renewable energy storage in the thermal battery

S. L. Piper, C. M. Forsyth, M. Kar, C. Gassner, R. Vijayaraghavan, S. Mahadevan, K. Matuszek, J. M. Pringle and D. R. MacFarlane, *RSC Sustain.*, 2023, **1**, 470
DOI: 10.1039/D2SU00111J

This article is licensed under a Creative Commons Attribution 3.0 Unported Licence. **You can use material from this article in other publications without requesting further permissions** from the RSC, provided that the correct acknowledgement is given.

Read more about how to correctly acknowledge RSC content.

Bicontinuous Polymer Electrolytes figure values:

Kido *et al*. - Ionic conductivity values at RT were kindly provided by the authors upon request. Mechanical properties of these polymer electrolytes were not quantified.[17]

Shin *et al*. - Tensile mechanical properties were reported however flexural mechanical properties and ionic conductivity were not measured or reported. [126]

Table 3. Reported ionic conductivity and flexural mechanical property values from bicontinuous solid polymer electrolytes utilising SILs at room temperature (17.5 °C,[144, 145] & 20 °C[17]).

Sample	Ref	δ Average	δ StdD	Flexural modulus *E*	*E* StdD	Flexural Strength	Flexural Strength StD
Units		**mS cm^{-1}**	**mS cm^{-1}**	**GPa**	**GPa**	**GPa**	**GPa**
PMMA 20%	17	8.8E-02	N/A	N/A	N/A	N/A	N/A
PEO 20%	17	3.8E-01	N/A	N/A	N/A	N/A	N/A
PBA 20%	17	3.4E-01	N/A	N/A	N/A	N/A	N/A
G3 1:1 70 %	145	3.57E-02	3.35E-03	2.79E-03	6.96E-04	9.14E-04	2.44E-04
G3 1:1.5 70 %	145	1.13E-02	2.57E-03	1.49E-02	2.75E-03	4.09E-03	7.40E-04
G3 1:2 70 %	145	5.16E-03	1.02E-03	3.51E-02	1.40E-02	5.65E-03	1.45E-03
G4 1:1 70%	145	7.39E-02	7.44E-03	2.26E-03	3.24E-04	7.36E-04	8.43E-05
G4 1:1.25 70 %	145	6.56E-02	7.59E-03	2.62E-03	1.34E-04	7.82E-04	5.43E-05
G4 1:1.5 70 %	145	2.24E-02	3.00E-03	7.88E-03	6.55E-04	2.36E-03	3.69E-04
G4 1:1.75 70 %	145	1.23E-02	8.54E-04	1.87E-02	9.69E-03	4.38E-03	1.70E-03
G4 1:2 70 %	145	1.22E-02	8.79E-04	2.52E-02	7.37E-03	4.32E-03	1.15E-03
G3 1:1 65%	145	2.61E-02	7.42E-03	4.35E-03	3.22E-04	1.15E-03	1.30E-04
G4 1:1 65%	145	5.45E-02	8.78E-03	2.75E-03	5.29E-04	7.07E-04	1.78E-04
G3 1:1 60%	145	2.51E-03	7.85E-04	1.23E-02	1.59E-02	2.88E-03	2.75E-03
G4 1:1 60%	145	1.82E-02	2.71E-03	5.02E-03	8.92E-04	1.26E-03	1.12E-04
G3 1:1 55%	145	1.79E-03	2.22E-04	1.30E-02	1.32E-03	4.02E-03	6.01E-04
G4 1:1 55%	145	5.55E-03	6.92E-04	6.19E-03	8.49E-04	1.74E-03	2.91E-04
G3 1:1 50%	145	5.54E-07	4.73E-05	1.91E-02	1.08E-02	6.10E-03	3.30E-03
G4 1:1 50%	145	9.55E-07	1.32E-04	7.70E-03	7.20E-04	2.22E-03	3.12E-04
Proof of Concept G4-1:1-IL70 Recycled	144	1.09E-01	3.77E-02	1.86E-03	1.57E-04	1.86E-03	1.57E-04
Recycled G4-1:1-IL70 Cycle 1	144	9.33E-02	1.77E-02	1.30E-03	3.32E-04	1.30E-03	3.32E-04
Recycled G4-1:1-IL70 Cycle 2	144	1.09E-01	6.77E-03	1.99E-03	2.00E-04	1.99E-03	2.00E-04

Recycled G4-1:1-IL70 Cycle 3	144	1.22E-01	8.42E-03	2.48E-03	4.92E-04	2.48E-03	4.92E-04
Recycled G4-1:1-IL70 Cycle 4	144	1.15E-01	1.01E-02	1.54E-03	1.34E-04	1.54E-03	1.34E-04
Recycled G4-1:1-IL70 Cycle 5	144	6.64E-02	8.46E-03	2.51E-03	2.74E-04	2.51E-03	2.74E-04