

## REFERENCES

Abraham K.M., Jiang Z., Carroll B., Highly conductive PEO-like polymer electrolytes, *Chem. Mater.* 9 (1997) 1978–1988

Adebahr J., Gavelin P., Jannasch P., Ostrovskii D., Wesslen B., Jacobsson P., Cation coordination in ion-conducting gels based on PEO-grafted polymers, *Solid State Ionics* 135 (2001) 149

Agrawal R.C, and Pandey G.P., Solid polymer electrolytes: materials designing and all-solid-state battery applications: an overview, *Journal of Physics D* 41 (2008) Article ID 223001

Ahmad A., Rahman M.Y.A., Low S.P., Hamzah H., Effect of LiBF<sub>4</sub> salt concentration on the properties of plasticized MG49–TiO<sub>2</sub> based nanocomposite polymer electrolyte, *ISRN Material Science* (2011) Article ID 401280.

Ahmad S., Polymer Electrolytes: Characteristics and peculiarities, *Ionics* 15 (2009) 309–321

Ahmad S., Deepa M., Agnihotry S.A., Effect of salts on the fumed silica-based composite polymer electrolytes, *Solar Energy Materials and Solar Cells* 92 (2008) 184–189

Ahmad S., Saxena T.K., Ahmad S., Agnihotry S.A., The effect of nanosized TiO<sub>2</sub> addition on poly(methyl methacrylate) based polymer electrolytes, *Journal of Power Sources* 159 (2006) 205–209

Alamgir M., Abraham K.M., Lithium batteries: New materials, developments and perspectives (ed. G. Pistoia) 1994, Amsterdam, Elsevier, pg. 93

Alasdair M. Christie, Scott J. Lilley, Edward Staunton, Yuri G. Andreev, Peter G. Bruce, Increasing the conductivity of crystalline polymer electrolytes, *Nature* 433 (2005) 50–53

Ali A.M.M., Yahya M.Z.A., Bahron H., Subban R.H.Y., Electrochemical studies on polymer electrolytes based on poly(methyl methacrylate)-grafted natural rubber for lithium polymer battery, *Ionics* 12 (2006) 303–307

Ali A.M.M., Yahya M.Z.A., Bahron H., Winie T., Latif F., Yahya M.Z.A., Grafted natural rubber-based polymer electrolytes: ATR-FTIR and conductivity studies, *Ionics* 14 (2008) 491–500.

- Alias Y., Ling I., Kumutha K., Structural and Electrochemical Characteristics of 49% PMMA Grafted Polyisoprene–LiCF<sub>3</sub>SO<sub>3</sub>–PC Based Polymer Electrolytes, *Ionics* 11 (2005) 414–417
- Appetecchi G.B., Croce F., Scrosati B., Kinetics and stability of the lithium electrode in poly (methyl methacrylate)–based gel electrolytes, *Electrochimica Acta*, 40 (1995) 991–997
- Arayaprane W., Prasassarakich P., Rempel G.L., Process variables and their effects on grafting reactions of styrene and methyl methacrylate onto natural rubber, *Journal of Applied Polymer Science* 89 (2003) 63–74
- Arias–Pardilla J., Plesse C., Khaldi A., Vidal F., Chevrot C., Otero T.F., Self–supported semi–interpenetrating polymer networks as reactive ambient sensors, *Journal of Electroanalytical Chemistry* 652 (2011) 37–43
- Armand M.B., Chabagno J.M., Dudot M., *Fast ion transport in solids*, 1979 Elsevier, Amsterdam.
- Austin Suthanthiraraj S., Joice Sheeba D., Joseph Paul B., Impact of ethylene carbonate on ion transport characteristics of PVdF–AgCF<sub>3</sub>SO<sub>3</sub> polymer electrolyte system, *Materials Research Bulletin* 44 (2009) 1534–1539
- Austin Suthanthiraraj S., Kumar R., Joseph Paul B., Vibrational spectroscopic and electrochemical characteristics of poly (propylene glycol)–silver triflate polymer electrolyte system, *Ionics* 16 (2010) 145–151
- Avellaneda C.O., Vieira D.F., Al–Kahlout A., Leite E.R., Pawlicka A., Aegerter M.A., Solid–state electrochromic devices with Nb<sub>2</sub>O<sub>5</sub>:Mo thin film and gelatin–based electrolyte, *Electrochimica Acta* 53 (2007) 1648–1654
- Awadhia A., Patel S.K., Agrawal S.L., Dielectric investigations in PVA based gel electrolytes, *Progress in Crystal Growth and Characterization of Materials* 52 (2006) 61–68
- Awwad A.M. , Al–Dujaili A.A., Salman H.E. Relative permittivities, densities, and refractive indices of the binary mixtures of sulfolane with ethylene glycol, diethylene glycol, and poly(ethylene glycol) at 303.15 K, *Journal of Chemical and Engineering Data* 47 (2002) 421–442
- Badr S., Sheha E., Impact of hydroquinone on thermal and electrical properties of plasticized [poly(vinyl alcohol)]<sub>0.7</sub>(LiBr)<sub>0.3</sub>(H<sub>2</sub>SO<sub>4</sub>), *Polymer International Volume* 60 (2011) 1142–1148

- Bakker A., Gejji S., Lindgren J., Hermansson K., Probst M.M., Contact ion pair formation and ether oxygen coordination in the polymer electrolytes  $M[N(CF_3SO_2)_2]_2PEO_n$  for  $M = Mg, Ca, Sr$  and  $Ba$ , *Polymer*, Vol 36 (1995) 4371–4378
- Balaji Bhargav P., Sarada B.A., Sharma A.K., Rao V.V.R.N., Electrical conduction and dielectric relaxation phenomena of PVA based polymer electrolyte films, *Journal of Macromolecular Science A: Pure and applied chemistry* 47 (2010) 131–137
- Baskaran R., Selvasekarapandian S., Hirankumar G., Bhuvaneswari M.S., Vibrational, ac impedance and dielectric spectroscopic studies of poly(vinylacetate)-*N,N*-dimethylformamide- $LiClO_4$  polymer gel electrolytes, *Journal of Power Sources* 134 (2004) 235–240
- Baskaran R., Selvasekarapadian S., Kuwata N., Kawamura J., Hatton T., Conductivity and thermal studies of blend polymer electrolytes based on PVAc-PMMA, *Solid State Ionics* 15 (2006) 2679–2682
- Bernson A., Lindgren J., Coordination and conformation in PEO, PEGM and PEG systems containing lithium or lanthanum triflate, *Polymer* 36 (1995) 4471–4478
- Berthier C., Gorecki W., Minier M., Armand M.B., Chabagno J.M., Rigaud P., Microscopic investigation of ionic conductivity in alkali metal salts-poly(ethylene oxide) adducts, *Solid State Ionics* 11 (1983) 91–95.
- Blackley D.C., *Polymer lattices, science and technology*, 2<sup>nd</sup> edn. Chapman & Hall, London (1997).
- Bohnke O., Rousselot C., Gillet P., Truche C., Gel electrolyte for solid-state electrochromic cell, *Journal of Electrochemical Society* 139 (1992) 1862–1865
- Bohnke O., Frand G., Rezrazi M., Rousselot C., Truche C., Fast ion transport in new lithium electrolytes gelled with PMMA. 1. Influence of polymer concentration, *Solid State Ionics* 66 (1993) 97–104
- Brooksby P.A., Fawcett W.R., Infrared (ATR) study of hydrogen bonding in solutions containing water and ethylene carbonate, *Journal of Physical Chemistry A* 104 (2000) 8307–8314
- Buraidah M.H., Arof A.K., Characterization of chitosan/PVA blended electrolyte doped with  $NH_4I$ , *Journal of Non-crystalline Solids* 357 (2011) 3261–3266
- Bushkova O.V., Popov S.E., Yaroslavtseva T.V., Zhukovsky V.M., Nikiforov A.E., Ion-molecular and ion-ion interactions in solvent-free polymer electrolytes based on amorphous butadiene-acrylonitrile copolymer and  $LiAsF_6$ , *Solid State Ionics* 178 (2008) 1817–1830

---

Ceresa R.J., Block and graft copolymerization, (1973) Wiley, New York.

Chandar Shekar B., Veeravazhuthi V., Sakthivel S., Mangalaraj D., Narayandass Sa. K., Growth, structure, dielectric and AC conduction properties of solution grown PVA films, *Thin Solid Films* 348 (1999) 122–129

Chandra A., Chandra S., Mixed-anion effect in polyethylene-oxide-based sodium-ion-conducting polymer electrolytes, *J. Phys. D: Appl. Phys.* 27 (1994) 2171–2179.

Chiu C.Y., Yen Y.J., Kuo S.W., Chen H.W., Chang F.C., Complicated phase behavior and ionic conductivities of PVP-co-PMMA-based polymer electrolytes, *Polymer* 48 (2007) 1329–1342

Dafader N.C., Haque M.E., Akhtar F., Ahmad M.U., Study on grafting of different types of acrylic monomers onto natural rubber by  $\gamma$ -rays, *Radiation physics and chemistry* 75 (2006) 168–172

David C. Mowery, Richard R. Nelson, Ben R. Martin, Technology policy and global warming: Why new policy models are needed (or why putting new wine in old bottles won't work), *Research policy* 39 (2010) 1011–1023

Deepa M., Sharma N., Varshney P., Agnihotry S.A., Chandra R., An insight into the interactions between  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ - $\gamma$ BL/DMF-PMMA by FTIR spectroscopy, *Ionics* 6 (2000) 408–414

Deepa M., Agnihotry S.A., Gupta D., Chandra R., Ion-pairing effects and ion-solvent-polymer interactions in  $\text{LiN}(\text{CF}_3\text{SO}_3)_2$ -PC-PMMA electrolytes: a FTIR study, *Electrochimica Acta*, Vol. 49 (2004) 373–383

Deepa M., Sharma N., Agnihotry S.A., Chandra R., FTIR investigations on ion-ion interaction in liquid and gel polymeric electrolytes:  $\text{LiCF}_3\text{SO}_3$ -PC-PMMA, *Journal of Material Science* 37 (2002a) 1759–1765

Deepa M., Sharma N., Agnihotry S.A., Chandra R., Sekhon S.S., Effect of mixed salts on the properties of gel polymeric electrolytes, *Solid State Ionics* 148 (2002b) 451–455

Fenton D.E., Parker J.M., Wright P.V., Complexes of alkali metal ions with poly (ethylene oxide), *Polymer* 14 (1973) 589

Ferry A., Jacobsson P., Torell L.M., The molar conductivity behavior in polymer electrolytes at low salt concentrations; A Raman study of poly (propylene glycol) complexed with  $\text{LiCF}_3\text{SO}_3$ , *Electrochimica Acta*, Vol. 40 (1995) 2369–2373

Gauthier M., Bélanger A., Kapfer B., Vassort G., Armand M., in: MacCallum J.R., Vincent C.A. (Eds.), *Polymer Electrolyte Reviews*, Elsevier, London, 1989, pp. 285–332.

Glasse M.D., Idris R., Latham R.J., Linford R.G., Schlindwein W.S., *Solid State Ionics* 147 (2002) 289–294

Gray F.M., *Solid polymer electrolytes: Fundamentals and technological applications*, (1991) VCH Publishers, Chapter 1.

Giua M., Panero S., Scrosati B., Cao X., Greenbaum S.G., Investigation of mixed cation effects in  $\text{PEO}_9\text{Zn}_{1-x}\text{Cu}_x(\text{CF}_3\text{SO}_3)_2$  polymer electrolytes, *Solid State Ionics* 83 (1996) 73–78

Hashim A.S., Tho N.V., Kadir M.O.A., A comparative study of styrene polymerization in deproteinized and undeproproteinized natural rubber latex, *Rubber Chemistry and Technology* 75 (2002) 111–118

Hashim H., Adam N.I., Zaki N.H.M., Mahmud Z.S., Said CM.S., and Yahya M.Z.A., Ali A.M.M., Natural rubber-grafted with 30% poly(methylmethacrylate) characterization for application in lithium polymer battery, *International conference on science and social research (CSSR 2010)*, 2010

Hema M., Selvasekerapandian S., Sakunthala A., Arunkumar D., Nithya N., Structural, vibrational and electrical characterization of PVA– $\text{NH}_4\text{Br}$  polymer electrolyte system, *Physica B* 403 (2008) 2740–2747

Hema M., Selvasekarapadian S., Nithya H., Sakunthala A., Arunkumar D., Structural and ionic conductivity studies on proton conducting polymer electrolyte based on polyvinyl alcohol, *Ionics* 15 (2009) 487–491

Henderson W.A., Passerini S., Smyrl W.H., in: *Lithium batteries: proceedings of the international symposium* (eds. S. Surampudi, R.A. Marsh, Z. Ogumi, J. Prakash), Mixed salt polymer electrolytes –  $\text{PEO}_n(x)\text{LiCF}_3\text{SO}_3(1-x)\text{LiClO}_4$  ( $n = 12$ ), *Electrochemical Society Proceedings Volume 99–25*, 2000, The Electrochemical Society, New Jersey, USA, 515–523

Hodge R.M., Edward G.H., Simon G.P., Water absorption and states of water in semicrystalline poly(vinyl alcohol)films, *Polymer* 37 (1996) 1371–1376

Huang W.W., Frech R., Raman spectra of PPO–salt complexes: mixed cations and mixed anions, *Solid State Ionics* 53–56 (1992) 1095–1101

Idris R., Glasse M.D., Latham R.J., Linford R.G., Schlindwein W.S., Polymer electrolyte based on modified natural rubber for use in rechargeable lithium batteries, *Journal of Power Sources* 94 (2001) 206–211

Iijima T., Tyoguchi Y., Eda N., Quasi–solid organic electrolytes gelatinized with PMMA and their applications for lithium batteries, *Denki Kagaku* 53 (1985) 619

- Jacob M.M.E., Arof A.K., FTIR studies of DMF plasticized polyvinylidene fluoride based polymer electrolytes, *Electrochimica Acta* 45 (2000) 1701–1706
- Jacob M.M.E., Prabaharan S.R.S., Radhakrishna S., Effect of PEO addition on the electrolytic and thermal properties of PVDF–LiClO<sub>4</sub> polymer electrolytes, *Solid State Ionics* 104 (1997) 104
- Janaki Rami Reddy T., Achari V.B.S., Sharma A.K., Narasimha Rao V.V.R., Preparation and electrical characterization of (PVC + KBrO<sub>3</sub>) polymer electrolytes for solid state battery applications, *Ionics* 13 (2007) 435–439
- Jarvis C.R., Macklin W.J., Macklin A.J., Mattingley N.J., Kronfli E., Use of grafted PVdF–based polymers in lithium batteries, *Journal of Power Sources* 97 (2001) 664
- Kadir M.F.Z., Aspanut Z., Majid S.R., Arof A.K., FTIR studies of plasticized PVA–chitosan blend doped with NH<sub>4</sub>NO<sub>3</sub> polymer electrolyte membrane, *Spectrochimica Acta Part A* 78 (2011) 1068–1074
- Kadir M.F.Z., Majid S.R., Arof A.K., Plasticized chitosan–PVA blend polymer electrolyte based proton battery. *Electrochimica Acta* 55, (2010) 1475–1482
- Kamisan A.S., Kudin T.I.T., Ali A.A.M., Yahya M.Z.A., Gel polymer electrolyte based on methyl–grafted natural rubber for proton batteries, *Material Research Innovation* 13 (2009) 263–265
- Kamisan A.S., Ali, A.M.M., Yahya M.Z.A., Conductivity modification of polymer gel electrolytes: addition of MG49 and SiO<sub>2</sub>, *Material Research Innovation* 15 (2011) 153–156
- Kang B., Ceder G., Battery materials for ultrafast charging and discharging, *Nature* 458 (2009) 190–193
- Khair A.S.A., Puteh R., Arof A.K., Conductivity study of a chitosan–based polymer electrolyte, *Physica B* 373 (2006) 23–27
- Kim J. H., Min B. R., Won J., Joo S. H., Kim H. S., Kang Y. S., Role of polymer matrix in polymer/ silver complexes for structure, interactions and facilitated olefin transport *Macromolecules* 36 (2003) 6183–6188
- Kim C.S., Oh S.M., Spectroscopic and electrochemical studies of PMMA–based gel polymer electrolytes modified with interpenetrating networks, *Journal of Power Sources* 109 (2002) 98–104
- Kinart C.M., Klimczak M., Cwilinska A., Kinart W.J. Relative permittivity of the binary mixtures of 2–methoxyethanol with diethylene glycol, triethylene glycol, tetraethylene

- glycol, and polyethylene glycol 200 at various temperatures, *Journal of Chemical Thermodynamics* 39 (2007) 822–826
- Klinklai W., Kawahara S., Mizumo T., Yoshizawa M., Isono Y., Ohno H., Ionic conductivity of highly deproteinized natural rubber having epoxy group mixed with alkali metal salts, *Solid State Ionics* 168 (2004) 131–136
- Kumar R., Sharma J.P., Sekhon S.S., FTIR study of ion dissociation in PMMA based gel electrolytes containing ammonium triflate: Role of dielectric constant of solvent, *European Polymer Journal*, 41 (2005) 2718–2725
- Kumutha K., Alias Y., Said R., FTIR and thermal studies of modified natural rubber based polymer electrolyte, *Ionics* 11 (2005) 472–476
- Kumutha K., Alias Y., FTIR spectra of plasticized grafted natural rubber–LiCF<sub>3</sub>SO<sub>3</sub> electrolytes, *Spectrochimica Acta Part A* 64 (2006) 442–447
- Latif F., Aziz M., Katun N., Ali A.M.M., Yahya M.Z.A., The role and impact of rubber in poly(methyl methacrylate)/lithium triflate electrolyte, *Journal of Power Sources* 159 (2006) 1401–1404
- Lewandowski A., Zajder M., Frackowiak E., Beguin F., Supercapacitor based on activated carbon and polyethylene oxide–KOH–H<sub>2</sub>O polymer electrolyte, *Electrochimica Acta* 46 (2001) 2777–2780
- Liu, H., Yang, S., Wang, S., Fang, J., Jiang, L., Sun, G., Preparation and characterization of radiation-grafted poly (tetrafluoroethylene-co-perfluoropropyl vinyl ether) membranes for alkaline anion-exchange membrane fuel cells, *Journal of Membrane Science* 369, (2011) 277–283
- Li G.C., Li Z.H., Zhang P., Zhang H.P., Wu Y.P., Research on gel polymer electrolyte for Li-ion batteries, *Pure Application Chemistry* 80 (2008) 2553–2563
- Lindley D., The energy storage problem, *Nature* 463 (2010) 18–20
- Low S.P., Ahmad A., Rahman M.Y.A., Effect of ethylene carbonate plasticizer and TiO<sub>2</sub> nanoparticles on 49% poly(methyl methacrylate) grafted natural rubber-based polymer electrolyte, *Ionics* 16 (2010) 821–826
- Low S.P., Ahmad A., Hamzah H., Rahman M.Y.A., Nanocomposite solid polymeric electrolyte of 49% poly(methyl methacrylate)-grafted natural rubber-titanium dioxide-lithium tetrafluoroborate (MG49–TiO<sub>2</sub>–LiBF<sub>4</sub>), *Journal of Solid State Electrochemistry* 15 (2011) 2611–2618
- Lu G., Li Z.F., Li S.D., Xie J., Blends of natural rubber latex and methyl methacrylate-grafted rubber latex, *Journal of Polymer Science* 85 (2001) 1736–1741

- MacFarlane D.R., Meakin P., Bishop A., McNaughton D., Rosaliet J.M., Forsyth M., FTIR study of ion-pairing effects in plasticized polymer electrolytes, *Electrochimica Acta* 40 (1995) 2333–2337
- Mahmoudian M.R., Alias Y., Basirum W.J., Ebadi M., Poly (N-methyl pyrrole) and its copolymer with o-toluidine electrodeposited on steel in mixture of DBSA and oxalic acid electrolytes, *Current Applied Physics* 11 (2011) 368–375
- Majid S.R., Arof A.K., Proton-conducting polymer electrolyte films based on chitosan acetate complexed with  $\text{NH}_4\text{NO}_3$  salt, *Physica B* 355 (2005) 78–82
- Majid S.R., Arof A.K., Mobility and density of ions in chitosan-orthophosphoric acid-ammonium nitrate electrolytes, *Physica status solidi (A) applications and materials*, 204(7), 2007, 2396–2401
- Majid S.R., Arof A.K., FTIR studies of chitosan-orthophosphoric acid ammonium nitrate-aluminosilicate polymer electrolyte, *Molecular Crystals and Liquid Crystals* 484 (2008) 117–126
- Majid S.R., Idris N.H., Hassan M.F., Winie T., Khiar A.S.A., Arof A.K., Transport studies on filler-doped chitosan based polymer electrolyte, *Ionics* 11 (2005) 451–455
- Malathi J., Kumaravadiel M., Brahmanandhan G.M., Hema M., Baskaran R., Selvasekarapadian S., Structural, thermal and electrical properties of PVA-LiCF<sub>3</sub>SO<sub>3</sub> polymer electrolyte, *Journal of Non-Crystalline Solids* 356 (2010) 2277–2281
- Man S.H.C., Hashim A.S., Akil H.M., Studies on the curing behaviour and mechanical properties of styrene/methylmethacrylate grafted deproteinized natural rubber latex, *Journal of Polymer Research* 15 (2008) 357–364
- Marwanta E., Mizumo T., Nakamura N., Ohno H. Improved ionic conductivity of nitrile rubber/ionic liquid composites *Polymer* 46 (2005) 3795–3800
- Marwanta E., Mizumo T., Ohno H., Improved ionic conductivity of nitrile rubber/Li(CF<sub>3</sub>SO<sub>2</sub>)<sub>2</sub>N composites by adding imidazolium-type zwitterion, *Solid State Ionics* 178 (2007) 227–232
- Marzantowicz M., Dygas J.R., Krok F., Florjanczyk Z., Zygadlo-Monikowska E., Influence of crystallization on dielectric properties of PEO:LiTFSI polymer electrolyte, *Electrochemical Acta* 53 (2007) 1518–1526
- Marzantowicz M., Dygas J.R., Krok F., Florjanczyk Z., Zygadlo-Monikowska E., Influence of crystallization on dielectric properties of PEO:LiTFSI polymer electrolyte, *Journal of Non-Crystalline Solids* 352 (2006) 5216–5223



Matsumoto M., Polymer electrolytes with dual-phase structure composed of NBR/SBR blend polymer, *Polymer* 36 (1995) 3243–3244

Matsumoto M., Polymer electrolytes with a dual-phase structure composed of poly(acrylonitrile-co-butadiene)/ poly(styrene-co-butadiene) blend films impregnated with lithium salt solution, *Polymer* 37 (1996) 625–631

Mattos R.I., Tambelli C., Donoso J.P., Pawlicka A., NMR study of starch based polymer gel electrolytes:: Humidity effects, *Electrochimica Acta* 53 (2007) 1461–1465

McLin M.G., Angell C.A., Ion-pairing effects on viscosity/ conductance relations in Raman-characterized polymer electrolytes: LiClO<sub>4</sub> and NaCF<sub>3</sub>SO<sub>3</sub> in PPG(4000), *Journal of Physical Chemistry* 95 (1991) 9464–9469

Miao R., Liu B., Zhu Z., Liu Y., Li J., PVDF-HFP-based porous polymer electrolyte membranes for lithium-ion batteries, *Journal of Power Sources* 184 (2008) 420–426

Mohamad A.A., Mohamed N.S., Alias Y., Arof A.K, Studies of alkaline solid polymer electrolyte and mechanically alloyed polycrystalline Mg<sub>2</sub>Ni for use in nickel metal hydride batteries, *Journal of Alloys and Compounds* 337 (2002) 208–213

Mohamed S.N., Johari N.A., Ali A.M.M., Harun M.K., Yahya M.Z.A., Electrochemical studies on epoxidised natural rubber-based gel polymer electrolytes for lithium-air cells, *J. Power Sources* 183 (2008) 351

Moryoussef A., Bonat M., Fouletier M., Hicter P., Proceedings, 6<sup>th</sup> Riso International Symposium on Metallurgy and Materials Science (F.W.Poulsen, N. Hassel Andersen, K. Clausen, S. Skaarup, O.T. Sorensen, Eds.), Riso National Lab., Roskilde (1985) p. 335

Ng L.S., Mohamad A.A., Proton battery based on plasticized chitosan-NH<sub>4</sub>NO<sub>3</sub> solid polymer electrolyte, *Journal of Power Sources* 163 (2006) 382–385

Ng L.S., Mohamad A.A., Effect of temperature on the performance of proton batteries based on chitosan-NH<sub>4</sub>NO<sub>3</sub>-EC membrane, *Journal of Membrane Science* (2008) 325, 653–657

Nithya H., Selvasekarapadian S., Christopher Selvin P., Arun Kumar D., Hema M., Prakash D., Characterization of nanocomposite polymer electrolyte based P(ECH-EO), *Physica B* 406 (2011) 3367–3373

Nishio K., Tsuchiya T., Organic-inorganic hybrid ionic conductor prepared by sol-gel process, *Solar Energy Materials & Solar Cells* 68 (2001) 295–306

Noor S.A.M., Ahmad A., Talib I. A., Rahman M.Y.A., Morphology, chemical interaction, and conductivity of a PEO-ENR50 based on solid polymer electrolyte, *Ionics* 16 (2010) 161–170

- Noor S.A.M., Ahmad A., Talib I. A., Rahman M.Y.A., Effect of ZnO nanoparticles filler concentration on the properties of PEO–ENR50–LiCF<sub>3</sub>SO<sub>3</sub> solid polymeric electrolyte, *Ionics* 17 2010 451–456
- Ozturk N., Ucun F., Muhtar A.D., Bahceli S., Infrared and SEM analyses of polyethyleneglycol–400 adsorbed on zeolites NaA, CaA, NaX and NaY, *Journal of Molecular Structure* 922 (2009) 35–38
- Pandey G.P., Agrawal R.C., Hashmi S.A., Magnesium ion–conducting gel polymer electrolytes dispersed with nanosized magnesium oxide, *Journal of Power Sources* 190 (2009) 563–572
- Pawlicka A., Dragunski Douglas C., Guimaraes Karine V., Electrochromic devices with solid electrolyte based on natural polymers, *Molecular Crystals and Liquid Crystals*, Vol 416 (2004) 105–112
- Pehlivan I.B., Marsal R., Georen P., Granqvist C.G., Niklasson G.A., Ionic relaxation in polyethyleneimine–lithium bistrifluoromethylsulfonylimide polymer electrolytes, *Journal of Applied Physics* 108 (2010) 074102
- Prajapati G.K., Gupta P.N., Conduction mechanism in un–irradiated and  $\gamma$ –irradiated PVA–H<sub>3</sub>PO<sub>4</sub> polymer electrolytes, *Nuclear instruments and methods in physics research B* 267 (2009) 3328–3332
- Prabu M., Selvasekarapadian S., Kulkarni A.R., Hirankumar, Sanjeeviraja C., Conductivity and dielectric studies on LiCeO<sub>2</sub>, *Journal of Rare Earths* 28, 435
- Pradhan D.K., Choudhary R.N.P., Samantaray B.K., Studies of dielectric and electrical properties of plasticized polymer nanocomposite electrolytes, *Materials Chemistry and Physics* 115 (2009) 557–561
- Pradhan D.K., Choudhary R.N.P., Samantaray B.K., Karan N.K., Katiyar R.S., Effect of plasticizer on structural and electrical properties of polymer nanocomposite electrolytes, *International Journal of Electrochemical Science* 2 (2007) 861–871
- Pradhan D.K., Samantaray B.K., Choudary R.N.P., Thakur A.K., Effect of plasticizer on structure–property relationship in composite polymer electrolytes, *Journal of Power Sources* 139 (2005) 384–393
- Perera M.C.S., Rowen C.C., Radiation degradation of MG rubber studied by dynamic mechanical analysis and solid state NMR, *Polymer* 41 (2000) 323–334
- Polu A.R., Kumar R., Impedance spectroscopy and FTIR studies of PEG–based polymer electrolytes, *E–Journal of Chemistry* 8(1), (2011) 347–353

- Rajendran S., Sivakumar M., Subadevi R., Investigation on the effect of various plasticizers in PVA–PMMA solid polymer blend electrolytes, *Materials letters* 58 (2004) 641–649
- Rajendran S., Babu R.S., Renuka Devi K., Ionic conduction behaviour in PVC–PEG blend polymer electrolytes upon the addition of TiO<sub>2</sub>, *Ionics* 15 (2009) 61–66
- Rajendran S., Mahendran O., Mahalingam T., Thermal and ionic conductivity studies of plasticized PMMA/PVdF blend polymer electrolytes, *European Polymer Journal* 38 (2002) 49–55
- Rajendran S., Ramesh Prabhu M., Usha R., Characterization of PVC/PEMA based polymer blend electrolytes, *International Journal Electrochemical Science* 3 (2008) 282–290
- Rajendran S., Sivakumar R., Ravi Shanker Babu, Investigation on poly (vinylidene fluoride) based gel polymer electrolytes, *Bulletin of Material Science* 29 (2006) 673–678
- Rajendran S., Sivakumar M., Subadevi R., Investigations on the effect of various plasticizers in PVA–PMMA solid polymer blend electrolytes, *Materials Letters* 58 (2004) 641–649
- Rajendran S., Sivakumar M., Subadevi R., Li-ion conduction of plasticized PVA solid polymer electrolytes complexed with various salts, *Solid State Ionics* (2004) 335–339
- Rajendran S., Shanthi Bama V., Ramesh Prabhu M., Effect of lithium salt concentration in PVAc/PMMA–based gel polymer electrolytes, *Ionics* 16 (2010) 27–32
- Ramesh S., Ang G.P., Impedance and FTIR studies on plasticized PMMA–LiN(CF<sub>3</sub>SO<sub>2</sub>)<sub>2</sub> nanocomposite polymer electrolytes, *Ionics* 16 (2010), 465–473
- Ramesh S., Arof A.K., Electrical conductivity studies of polyvinyl chloride–based electrolytes with double salt system, *Solid State Ionics* 136–137 (2000) 1197–1200
- Ramesh S., Chai M.F., Conductivity, dielectric behaviour and FTIR studies of high molecular weight poly(vinylchloride)–lithium triflate polymer electrolytes, *Material Science and Engineering B* 139 (2007) 240–245
- Ramesh S., Fung Y.T., Jun S.C., Conductivity and FTIR studies on PEO–LiX [X: CF<sub>3</sub>SO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>] polymer electrolytes, *Spectrochimica Acta Part A* 69 (2008) 670–675
- Ramesh S., Teh G.B., Louh R.F., Yong K. H., Pung Y.S., Lim J.Y., Preparation and characterization of plasticized high molecular weight PVC–based polymer electrolytes, *Sadhana–Academic Proceedings In Engineering Science* 35 (2010) 87–95

- Ramesh S., Shanti R., Durairaj R., Effect of ethylene carbonate in PMMA–lithium tetraborate based polymer electrolytes, *Journal of Non–Crystalline Solids* 357 (2011) 1357–1363
- Ramesh S., Lu S.C., Structural, morphological, thermal, and conductivity studies of magnesium ion conducting P(VdF–HFP)–based solid polymer electrolytes with good prospects, *Journal of Applied Polymer Science* 117 (2010) 2050–2058
- Ramya C.S., Selvasekarapandian S., Hirankumar G., Savitha T., Angelo P.C., Investigation on dielectric relaxations of PVP–NH<sub>4</sub>SCN polymer electrolyte, *Journal of Non–Crystalline Solids* 354 (2008) 1494–1502
- Ratner M.A., Johansson P., Shriver D.F., Polymer electrolytes: ionic transport mechanisms and relaxation coupling, *MRS Bulletin* 25 (2000) 31–37
- Ratner M.A., Nitzan A., Dynamics of ionic motion in polymeric ionic conductors *Solid State Ionics* III 28–30 (1988) 120–128
- Reddy T.J.R., Achari V.B.S., Sharma A.K., Narasimha Rao V.V.R., Preparation and electrical characterization of (PVC + KBrO<sub>3</sub>) polymer electrolytes for solid state battery applications, *Ionics* 13 (2007) 435–439
- Reeve D.E., Chen Y., Pan S., Magar V., Simmonds D.J., Zacharioudaki A., An investigation of the impacts of climate change on wave energy generation: The wave hub, Cornwall, UK, *Renewable Energy* 36 (2011) 2404–2413
- Ren Z., Sun K., Liu Y., Zhou X., Zhang N., Zhu X., Polymer electrolytes based on poly(vinylidene fluoride–co–hexafluoropropylene) with crosslinked poly(ethylene glycol) for lithium batteries, *Solid State Ionics* 180 (2009) 693–697
- Rhoo H.J., Kim H.T., Park J.K., Hwang T.S., Ionic conduction in plasticized PVC/PMMA blend polymer electrolytes, *Electrochimica Acta* 42 (1997) 1571–1579
- Saikia. D., Kumar A., Ionic conduction in PVDF–HFP/ PVDF–(PC + DEC)–LiClO<sub>4</sub> polymer gel electrolytes, *Electrochimica Acta* 49, 2581–2589
- Sanchez J–Y, In: Chowdari BVR (ed) *Solid State Ionics: Materials and Applications*. World Scientific, Singapore, (1992) 549
- Shanmukaraj D., Murugan R., Characterization of PEG: LiClO<sub>4</sub> + SrBi<sub>4</sub>Ti<sub>4</sub>O<sub>15</sub> nanocomposite polymer electrolytes for lithium secondary batteries, *Journal of Power Sources* 149 (2005) 90–95
- Sharma, J.P. & Sekhon, S.S., Nanodispersed polymer gel electrolytes: Conductivity modification with the addition of PMMA and fumed silica. *Solid State Ionics* 178 (2007) 439–445

Shuhaimi N.E.A., Teo L.P., Majid S.R., Arof A.K., Transport studies of  $\text{NH}_4\text{NO}_3$  doped methyl cellulose electrolyte, *Synthetic Metals* 160 (2010) 1040–1044

Silva M.M., Barbosa P., Evans A., Smith M.J., Novel solid polymer electrolytes based on poly (trimethylene carbonate) and lithium hexafluoroantimonate, *Solid State Science* 8 (2006a) 1318–1321

Silva M.M., Barros C.S., Smith M.J., MacCallum J.R., Characterization of solid polymer electrolytes based on poly (trimethylenecarbonate) and lithium tetrafluoroborate, *Electrochimica Acta* 49 (2004) 1887–1891

Silva M.M., Nunes S.C., Zea Bermudez V., Barbosa P.C., Evans A., Smith M.J., Ostrovskii D., Sol-gel preparation of a di-ureasil electrolyte doped with lithium perchlorate, *Electrochimica Acta* 52 (2006b) 1542–1548

Sim L.N., Majid S.R., Arof A.K., FTIR studies of PEMA/PVdF–HFP blend polymer electrolyte system incorporated with  $\text{LiCF}_3\text{SO}_3$  salt, *Vibrational Spectroscopy* 58 (2012) 57–66

Sivakumar M., Subadevi R., Rajendran S., Wu N.-L., Lee J.-Y., Electrochemical studies on [(1-x) PVA-xPMMA] solid polymer blend electrolytes complexed with  $\text{LiBF}_4$ , *Materials Chemical and Physics* 97 (2006) 330–336

Selvasekarapadian S., Baskaran R., Hema M., Complex AC impedance, transference number and vibrational spectroscopy studies of proton conducting PVAc- $\text{NH}_4\text{SCN}$  polymer electrolytes, *Physica B* 357 (2005) 412–419

Singh K.P., Gupta P.N., Study of dielectric relaxation in polymer electrolytes, *Europe Polymer Journal* vol. 34, No.7, (1998) 1023–1029

Singh, R., Gupta, N., Poole, K.F., Global green energy conversion revolution in 21<sup>st</sup> century through solid state devices, 26<sup>th</sup> International Conference on Microelectronics Proceedings, MIEL 2008, 45–54

Song J.Y., Wang Y.Y., Wan C.C., Review of gel-type polymer electrolytes for lithium-ion batteries, *Journal of Power Sources*, 77 (1999) 183–197

Song J.Y., Wang Y.Y., Wan C.C., Conductivity study of porous plasticized polymer electrolytes based on poly (vinylidene fluoride) a comparison with polypropylene separators, *Journal of The Electrochemical Society* 147 (2000) 3219–3225

Sreekath T., Jaipal Reddy M., Ramalingaiah S., Subba Rao U.V., Ion-conducting polymer electrolyte based on poly(ethylene oxide) complexed with  $\text{NaNO}_3$  salt application as an electrochemical cell, *Journal of Power Sources* 79 (1999) 105–110

Srinivasan S., Enayetullah M.A., Somasundaram S., Swan D.H., Manko D., Koch H., Appleby A.J., Recent advances in solid polymer electrolyte fuel cell technology with low platinum loading electrodes, Energy Conversion Engineering Conference, Proceedings of the 24th Intersociety, (1989) 1623–1629

Srinivasan S., Manko D.J., Enayetullah A., Applyby A.J., Koch H., Recent advances in solid polymer electrolyte fuel cell technology with low platinum loading electrodes, Journal of Power Sources, 29 (1990) 367–387

Srivastava N., Chandra S., Studies on a new proton conducting polymer system: poly(ethylene succinate) +  $\text{NH}_4\text{ClO}_4$  European Polymer Journal 36 (2000) 421–433

Su'ait M.S., Ahmad A., Hamzah H., Rahman M.Y.A., Preparation and characterization of PMMA–MG30– $\text{LiClO}_4$  solid polymeric electrolyte, J. Physics D: Applied Physics, Institute of Physics Publishing, United Kingdom, 42:055410 (IF2008–2.104) 2009

Subban R.H.Y., Ahmad A.H., Kamarulzaman N., Ali A.M.M., Effects of plasticizer on the lithium ionic conductivity of polymer electrolyte PVC– $\text{LiCF}_3\text{SO}_3$ , Ionics 11 (2005) 442–445

Shuhaimi N.E.A., Alias N.A., Kufian M.Z., Majid S.R., Arof A.K., Characteristics of methy cellulose– $\text{NH}_4\text{NO}_3$ –PEG electrolyte and application in fuel cells, Journal of Solid State Electrochemistry 14 (2010) 2153–2159

Stuart B.H., Infrared Spectroscopy: Fundamentals and Applications, Wiley, England, 2004.

Su'ait M.S., Ahmad A., Rahman M.Y.A., Ionic conductivity studies of 49% poly(methyl methacrylate)–grafted natural rubber–based solid polymer electrolytes, Ionics 15 (2009) 497–500

Subban R.H.Y., Arof A.K., Plasticiser interactions with polymer and salt in PVC– $\text{LiCF}_3\text{SO}_3$ –DMF electrolytes, European Polymer Journal 40 (2004) 1841–1847

Sunderrajan S., Freeman B.D., and Hall C.K., Fourier transform infrared spectroscopic characterization of olefin complexation by silver salts in solution, Ind. Eng. Chem. Res. 38 (1999) 4051–4059

Suksawad P., Kosugi K., Yamamoto Y., Akabori K., Kuroda H., Kawahara S., Polymer electrolyte membrane with nanomatrix channel prepared by sulfonation of natural rubber grafted with polystyrene, Journal of Applied Polymer Science (2011) DOI:10.1002/app.34352

Takeshita H., Portable Li–ion, Worldwide, Proc. Conf., Power 2000 San Diego, CA.

Tan Winie, Arof A.K., Transport properties of hexanoyl chitosan-based gel electrolyte, *Ionics* 12 (2006) 149–152

Tan Winie, Ramesh S., Arof A.K., Studies on the structure and transport properties of hexanoyl chitosan-based polymer electrolytes, *Physica B* 404 (2009) 4308–4311

Vickraman P., Aravindan V., Lee Y.-S., Lithium ion transport in PVC/PEG 2000 blend polymer electrolytes complexed with LiX ( $X=\text{ClO}_4^-$ ,  $\text{BF}_4^-$ , and  $\text{CF}_3\text{SO}_3^-$ ), *Ionics* 16 (2010) 263–267

Vieira D.F., Pawlicka A., Optimization of performances of gelatin/ $\text{LiBF}_4$ -based polymer electrolytes by plasticizing effects, *Electrochimica Acta* 55 (2010) 1489–1494

Vijaya N., Selvasekarapandian S., Hirankumar G., Karthikeyan S., Nithya H., Ramya C.S., Prabu M., Structural, vibrational, thermal, and conductivity studies on proton-conducting polymer electrolyte based on poly (*N*-vinylpyrrolidone), *Ionics* 18 (2012) 91–99

Di Noto V., Vittadello M., Jayakody R.P., Ameesh N. Khalfan, Steve G. Greenbaum, Two new siloxanic proton conducting membranes part II. Proton conductivity mechanism and NMR study, *Electrochimica Acta* 50 (2005) 4007–4014

Walkowiak, M., Waszak, D., Osińska-Broniarz M., Gierczyk B., Schroeder G., Structure and lithium transport phenomena in a new tripod and-grafted polysiloxane, *Polimery/Polymer* 56(4), (2011), 294–301

Wang Z., Ikeda M., Hirata N., Kubo M., Itoh T., Yamamoto O., Thermal, electrochemical and spectroscopic characterizations of hyperbranched polymer electrolyte, *Journal of Electrochemical Society* 146 (1999) 2209–2215

Wang Y., Xia T.D., Feng H.X., Zhang H., Stearic acid/ PMMA composite as form-stable phase change materials for latent heat thermal energy storage , *Renewable Energy* 36 (2011) 1814–1820

Wang Y.-P., Gao X.-H., Li H.-K., Li H.-J., Liu H.-G., Guo H.-X, Effect of Active Filler Addition on the ionic conductivity of PVDF-PEG polymer electrolyte, *Journal of Macromolecular Science Part A: Pure and Applied Chemistry* 46 (2009) 461–467

Wakihara M., Recent developments in lithium ion batteries, *Materials Science and Engineering R33* (2001) 109–134

Webber A., Conductivity and viscosity of solutions of  $\text{LiCF}_3\text{SO}_3$ ,  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ , and their mixtures, *Journal of Electrochemical Society* 138 (1991) 2586–2590

- Wen S.J., Richardson T.J., Ghantous D.I., Striebel K.A., Ross P.N., Cairns E.J., FTIR characterization of PEO + LiN(CF<sub>3</sub>SO<sub>2</sub>)<sub>2</sub> electrolytes, *Journal of Electroanalytical Chemistry* 408 (1996) 113–118
- Xu K., Nonaqueous liquid electrolytes for lithium-based rechargeable batteries, *Chem. Rev.* 104 (2004) 4303–4417
- Yang H., Farrington G.C., Poly(ethylene oxide) electrolytes containing mixed salts, *Journal of Polymer Science Part B: Polymer Physics*, 31 (1993) 157–163
- Yap K.S., Teo L.P., Sim L.N., Majid S.R., Arof A.K., Characteristics of the PMMA grafted natural rubber–LiCF<sub>3</sub>SO<sub>3</sub>–PEG200 plasticized polymer electrolytes, *Material Research Innovations* 15 (2011) 34–38
- Ye H., Xu J.J., Zinc ion conducting polymer electrolytes based on oligomeric polyether/PVDF–HFP blends, *Journal of Power Sources* 165 (2007) 500–508
- Yoshizawa M., Marwanta E., Ohno H., Preparation and characteristics of natural rubber/poly(ethylene oxide) salt hybrid mixtures as novel polymer electrolytes, *Polymer* 41 (2000) 9049–9053
- Yuichi K., Kishino K., Koichi N., Synthesis of *N*-cyclohexylmaleimide for heat-resistant transparent methacrylic resin, *Journal of Applied Polymer Science* 63 (1997) 363–368
- Yu B., Zhou F., Wang C., Liu W., A novel gel polymer electrolyte based on poly ionic liquid 1-ethyl 3-(2-methacryloyloxy ethyl) imidazolium iodide, *European Polymer Journal* 43 (2007) 2699–2707
- Zhang Z., Fang S., Novel network polymer electrolytes based on polysiloxane with internal plasticizer, *Electrochimica Acta* 45 (2000) 2131–2138