Jingshuai Yang - DTU Orbit (06/08/2016)

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Organisations

Energy and Materials
25/02/2012 → 25/02/2012 Former
VIP

Publications:

Benzimidazole grafted polybenzimidazoles for proton exchange membrane fuel cells
High molecular weight polybenzimidazole (PBI) was synthesized and grafted with benzimidazole pendant groups. The high molecular weight of PBI resulted in good film-forming properties and superior tensile strength. With a phosphoric acid doping level (ADL) of 13.1, a tensile strength of 16 MPa was achieved at room temperature. Grafting of benzimidazole moieties onto the PBI macromolecular chain introduced additional basic sites which allowed the membrane to achieve higher phosphoric acid uptakes. A molar acid conductivity, defined as the specific conductivity of each mole of doping acid, was proposed to evaluate the effective conductivity contributed from the doping acids. With a grafting degree of 5.3% and an ADL of 13.1, the PBI membranes exhibited a total conductivity of 0.15 S cm-1. A H2-air fuel cell based on this membrane showed a peak power density of 378 mW cm-2 at 180 °C without humidification. © 2013 The Royal Society of Chemistry.

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Proton conductors, Northeastern University
Authors: Yang, J. (Intern), Aili, D. (Intern), Li, Q. (Intern), Xu, Y. (Ekstern), Liu, P. (Ekstern), Che, Q. (Ekstern), Jensen, J. O. (Intern), Bjerrum, N. J. (Intern), He, R. (Ekstern)
Keywords: (Molecular weight, Phosphoric acid, Proton exchange membrane fuel cells (PEMFC), Semiconductor doping, Tensile strength, Grafting (chemical))
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BFI (2015): BFI-level 1
Scopus rating (2015): 2.02 1.129
BFI (2014): BFI-level 1
Scopus rating (2014): 2.074 1.229
BFI (2013): BFI-level 1
Scopus rating (2013): 2.003 1.329
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): 2.097 1.201
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): 2.089 1.162
ISI indexed (2011): ISI indexed no
Original language: English
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Source-ID: n::oai:DTIC-ART:compendex/390769555::31324
Publication: Research - peer-review › Journal article – Annual report year: 2014

Covalently Cross-Linked Sulfone Polybenzimidazole Membranes with Poly(Vinylbenzyl Chloride) for Fuel Cell Applications
Covalently cross-linked polymer membranes were fabricated from poly(aryl sulfone benzimidazole) (SO(2) PBI) and poly(vinylbenzyl chloride) (PVBCl) as electrolytes for high-temperature proton-exchange-membrane fuel cells. The cross-linking imparted organo insolubility and chemical stability against radical attack to the otherwise flexible SO(2) PBI

membranes. Steady phosphoric acid doping of the cross-linked membranes was achieved at elevated temperatures with little swelling. The acid-doped membranes exhibited increased mechanical strength compared to both pristine SO(2) PBI and poly[2,2'-(m-phenylene)-5,5'-bibenzimidazole] (mPBI). The superior characteristics of the cross-linked SO(2) PBI membranes allowed higher acid doping levels and, therefore, higher proton conductivity. Fuel-cell tests with the cross-linked membranes demonstrated a high open circuit voltage and improved power performance and durability.

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Proton conductors, Northeastern University
Authors: Yang, J. (Intern), Aili, D. (Intern), Li, Q. (Intern), Cleemann, L. N. (Intern), Jensen, J. O. (Intern), Bjerrum, N. J. (Intern), He, R. (Ekstern)
Keywords: (Electrochemistry, Fuel cells, Materials Science, Membranes, Polymers)
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Main Research Area: Technical/natural sciences

Publication information
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ISSN (Print): 1864-5631
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BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
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ISI indexed (2012): ISI indexed yes
ISI indexed (2011): ISI indexed no
BFI (2008): BFI-level 1
Original language: English
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Oxidative degradation of acid doped polybenzimidazole membranes and fuel cell durability in the presence of ferrous ions
Phosphoric acid doped polybenzimidazole membranes have been explored as proton exchange membranes for high temperature polymer electrolyte membrane fuel cells. Long-term durability of the membrane is of critical concern and has been evaluated by accelerated degradation tests under Fenton conditions. In this study effects of phosphoric acid and ferrous ions were investigated by measurements of the weight loss, intrinsic viscosity and size exclusion chromatography (SEC) of the polymer membranes. Ferrous ions resulted in, as expected, catalytic formation of peroxide radicals and hence the accelerated polymer degradation in terms of weight loss and molecular weight decrease. The presence of phosphoric acid as an inevitable dopant of the membranes, on the other hand, significantly impeded the membrane degradation by means of metal ion complexing, decreased pH, and acid–base interactions with the amino groups of the polymer. Fuel cell durability tests with contaminations of ferrous ions did show considerable performance degradation, however, primarily due to the catalyst deterioration rather than the membrane degradation.

General information
State: Published
Organisations: Energy and Materials, Department of Energy Conversion and Storage, Proton conductors, Chinese Academy of Sciences, Northeastern University
Authors: Liao, J. (Ekstern), Yang, J. (Intern), Li, Q. (Intern), Cleemann, L. N. (Intern), Jensen, J. O. (Intern), Bjerrum, N. J. (Intern), He, R. (Ekstern), Xing, W. (Ekstern)
Keywords: (PBI membranes, Oxidative degradation, Fenton test, Ferrous ions, Fuel cell durability)
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Main Research Area: Technical/natural sciences

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BFI (2015): BFI-level 1
Scopus rating (2015): 2.008 1.64
BFI (2014): BFI-level 1
Scopus rating (2014): 2.039 2.071
BFI (2013): BFI-level 1
Scopus rating (2013): 2.017 2.146
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): 2.339 2.025
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): 2.285 2.204
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): 2.333 1.974
BFI (2009): BFI-level 1
Scopus rating (2009): 2.136 1.796
BFI (2008): BFI-level 2
Scopus rating (2008): 1.978 1.752
Scopus rating (2007): 1.597 1.498
Scopus rating (2006): 1.807 2.245
Scopus rating (2005): 1.661 1.86
Scopus rating (2004): 1.829 1.872
Scopus rating (2003): 1.659 1.629
Scopus rating (2002): 1.964 1.451
Scopus rating (2001): 1.134 1.524
Scopus rating (2000): 1.112 0.959
Scopus rating (1999): 0.869 1.052
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Cross-linked aromatic cationic polymer electrolytes with enhanced stability for high temperature fuel cell applications

Diamine-cross-linked membranes were prepared from cross-linkable poly(arylene ether ketone) containing pendant cationic quaternary ammonium group (QPAEK) solution by a facile and general thermal curing method using 4,4′-diaminodiphenylmethane with rigid framework and 1,6-diaminohexane with flexible framework as cross-linker, respectively. Self-cross-linked cationic polymer electrolytes membranes were also prepared for comparison. The diamines were advantageously distributed within the polymeric matrix and its amine function groups interacted with the benzyl bromide of QPAEK, resulting in a double anchoring of the molecule. Combining the excellent thermal stability, the addition of a small amount of diamines enhanced both the chemical and mechanical stability and the phosphoric acid doping (PA) ability of membranes. Fuel cell performance based on impregnated cross-linked membranes have been successfully operated at temperatures up to 120 °C and 180 °C with unhumidified hydrogen and air under ambient pressure, the maximum performance of diamine-cross-linked membrane is observed at 180 °C with a current density of 1.06 A cm−2 and the peak power density of 323 mW cm−2. The results also indicate that the diamine-cross-linked membranes using the rigid cross-linker show much improved properties than that using the flexible cross-linker. More properties relating to the feasibility in high temperature proton exchange membrane fuel cell applications were investigated in detail.

General information

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Organisations: Department of Energy Conversion and Storage, Proton conductors, Jilin University, Interdisciplinary Nanoscience Center
Authors: Ma, W. (Ekstern), Zhao, C. (Ekstern), Yang, J. (Intern), Ni, J. (Ekstern), Wang, S. (Ekstern), Zhang, N. (Ekstern), Lin, H. (Ekstern), Wang, J. (Forskerdatabase), Zhang, G. (Forskerdatabase), Li, Q. (Intern), Na, H. (Ekstern)
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Main Research Area: Technical/natural sciences

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BFI (2014): BFI-level 2
Scopus rating (2014): 8.001 4.025
BFI (2013): BFI-level 1
Scopus rating (2013): 6.101 3.028
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): 5.973 2.609
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): 3.798 2.554
ISI indexed (2011): ISI indexed no
Scopus rating (2010): 3.914 2.379
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Polybenzimidazoles – Synthesis, characterizations and applications in the form of membranes

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Authors: Li, Q. (Intern), Aili, D. (Intern), Rudbeck, H. C. (Ekstern), Yang, J. (Intern), Jensen, J. O. (Intern), Bjerrum, N. (Intern)
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ISBN (Electronic): 978-1-61942-947-5

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Recent Development of Acid Doped Polybenzimidazole Membranes in Denmark - Polymer Chemistry and Durability Issues

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Authors: Li, Q. (Intern), Jensen, J. O. (Intern), Cleemann, L. N. (Intern), Aili, D. (Intern), Yang, J. (Intern), Steenberg, T. (Ekstern), Terkelsen, C. (Ekstern), Hjuler, H. A. (Ekstern), Bjerrum, N. (Intern)

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Synthesis and properties of poly(aryl sulfone benzimidazole) and its copolymers for high temperature membrane electrolytes for fuel cells
Poly(aryl sulfone benzimidazole) (SO2PBI) and its copolymers with poly[2,2′-p-(phenylene)-5,5′-bibenzimidazole] (pPBI), termed as Co-SO2PBI, were synthesized with varied feeding ratios of 4,4′-sulfonyldibenzoic acid (SDBA) to terephthalic acid (TPA). Incorporation of the stiff para-phenylene and flexible aryl sulfone linkages in the macromolecular structures resulted in high molecular weight copolymers with good solubility. The chemical stability towards radical oxidation was improved for SO2PBI and its copolymer membranes due to the electron-withdrawing sulfone functional groups. Upon acid doping, the membrane swelling was reduced and the mechanical strength was improved, as compared with their meta structured analogues. At an acid doping level of 11 mol H3PO4 per average molar repeat unit, the Co-20%SO2PBI membrane exhibited a tensile strength of 16 MPa at room temperature and an H2-air fuel cell peak power density of 346 mW cm−2 at 180 °C at ambient pressure. Durability tests with the membrane under a constant current density of 300 mA cm−2 at 160 °C showed a degradation rate of 6.4 μV h−1 during a period of 2400 h, which was significantly lower than that for meta PBI membranes with a similar acid doping level.

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Organisations: Department of Energy Conversion and Storage, Proton conductors, Energy and Materials, Functional organic materials, Department of Chemistry, Newcastle University, Northeastern University
Authors: Yang, J. (Intern), Li, Q. (Intern), Cleemann, L. N. (Intern), Xu, C. (Ekstern), Jensen, J. O. (Intern), Pan, C. (Intern) , Bjerrum, N. (Intern), He, R. (Ekstern)
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BFI (2008): BFI-level 1
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