



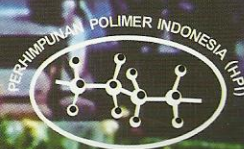
ISBN 978-602-18820-0-9

Proceedings

The International Conference on
**INNOVATION IN POLYMER
SCIENCE AND TECHNOLOGY 2011**
(IPST2011)

November 28 - December 1, 2011
Sanur Paradise Plaza Hotel, Bali
INDONESIA

Published by



Indonesian Polymer Association (HPI)
October 2012

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Table of Content

Preface

Editor in Chiefs and Guest Editors

Organising Committees of IPST2011

Table of Content

Invited Papers

Structural Defects in Poly(vinyl chloride) and the Mechanism of Vinyl Chloride Polymerization: Comments on Recent

Studies

W.H. Starnes Jr.

Polymers for Enhanced Oil Recovery Technology
A.Z. Abidin, T. Puspasari, W.A. Nugroho

Refinery of Biomass by Utilization of Specific Effects of Microwave Irradiation
J. Azuma, S. Tsubaki, M. Sakamoto, R. Yudianti, E. Hermitati

Novel Epoxy Resins Derived from Biomass Components
S. Hirose, T. Hatakeyama, H. Hatakeyama

Successful Development of Biocompatible Polymers Designed by Natures Original Inspiration
K. Ishihara

Nanostructure Polymer and Composites

Improving Absorption Capacity of Polyacrylamide by Acrylic Acid Copolymerization
A.Z. Abidin, G. Susanto, N.M.T. Sasra

Developing Halpin – Tsai Equation for Hybrid Composite by Theoretical Approach
Arwanto, S. Poerjadi, B. Soegiono

Glass Fiber Reinforced Polymer-Clay Nanocomposites: Processing, Structure and Hygrothermal Effects on Mechanical
Properties
B. Sharma, S. Mahajan, R. Chhibber, R. Mehta

Effect of Pretreatment of Organo Layer Silicate with Surfactant Using Sonication to the Gallery of Silicate Layer for
Biodegradable Nanocomposite Preparation
C. Liza, B. Soegiono, E. Budianto, J. Alinasiri, Jayatin

- 781 The Potential of Nanocellulose from *Acacia Mangium* Pulp for Specialty Paper Making
N. Bahar, T. Hidayat, N. Elyani, I. Rositka
- 776 The Composite of Aramid Fibre, Fibreglass Reinforcement and Epoxy Resin Materials for Railway Insulated Rail Joint
K.A. Suhardjo
- 771 The Use of Small-angle Scattering to Study Wool and Mohair Fibres
C. Franklyn, Gy. Török
- 764 Mechanical Characteristics Rattan Fiber Reinforced Epoxy Composites (RECO) as Above Knee Socket
A.P. Irawan, I.W. Sukania
- 763 Development of Natural Rubber-Fibrous Nano Clay Attapulgite Composites: The Effect of Chemical Treatment of Filler on Mechanical and Dynamic Mechanical Properties of Composites
J.P. Rath, T.K. Chaki, D. Khastgir
- Fibre and Fibrous Polymeric Materials**
- 62 Enzymatic Saccharification and Ethanol Production of Xylems from Eka Karya Bali Botanical Garden Trees
R. Kaida, M. Tokue, M. Sakata, T. Tajiri, Y. Sakata, T. Hayashi, F. Furiya, S.S. Kusumah, T. Darmawan, D.S. Adi, W. Dwianto
- 61 Synthesis and Characterization of Polyimide End-Group Maleic as Electrolyte Membrane for Proton Exchange Membrane Fuel Cell
Sudirman, E. Budianto, E.L. Dewi, R. Yudianti
- 60 Effect of the Amount of Hydrogen on the Polymerization of Propylene by Using Bench Scale Polymerization Apparatus
S. Pebriani, S. Mujitani, T.H. Ujianti, A. Prihandono
- 59 Influence of Composite Electrolyte Membrane for Proton Exchange Membrane Fuel Cells
S. Handayani, E.L. Dewi, J. Hardy, L. Christiani, Kurniawan
- 58 Synthesis and Characterization of Polyelectrolyte Complex N-Succinylchitosan-chitosan for Proton Exchange Membranes
L.O.A.N. Kamadhani, C.L. Radiman, V. Suendo, D. Wahyuningrum, S. Vallyaveetil
- 53 Synthesis and Characterization of Lithium Iron Phosphate Added Polymer as Cathode Materials for Lithium Ion Battery
I. Gumawan, D. Deswita, S. Sugiantoro
- 49 Improvement of Proton Transport via Preparation Composite Membrane of SPSE/Nafion
B. Pihuhario, T. Haryati, C.L. Radiman
- Polymer Technology in New and Renewable Energy**
- 48 Influence of Particle Size and Weight of Kaolin on Tensile Strength and Swelling Index of Natural Rubber Latex Film
Y. Muis, A.L. Paramitha
- 47 Formulation and Their Mechanical Properties of Reinforced Set Acrylic Bone Cement
T. Ismujanto, A. Riswoko

Improvement of Proton Transport via Preparation Composite Membrane of SPSF/Nafion

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Abstract

SPSF/Nafion proton exchange composite membrane has been prepared by phase inversion technique. Here, the matrix of SPSF was impregnated with a 5% Nafion solution in various time of evaporation. The presence of Nafion in the matrix is presumed to affect on structure formation of membrane, consequently affect on physicochemical and proton transport properties. Characterization of the composite membrane was performed include water uptake, ionic exchange capacity, membrane morphology and proton conductivity. As the result, water uptake and hydration capacity decrease with increasing evaporation time up to 10 min, the further evaporation time increase significantly. The proton conductivity of the composite membrane increase up to 10 min the further evaporation times tend to decrease. Nevertheless, compared with SPSF membrane, the composite membrane shows improvement the proton conductivity.

Keywords: Composite membrane; proton exchange membrane; phase inversion; proton transport.

Introduction

In fuel cell applications, Nafion is commonly used as the proton exchange membrane (PEM) due to mechanical and thermal stability and high proton conductivity (0.08 S/cm). However, this material have some drawbacks such as high cost (600-1000 \$/m²), high methanol crossover and undergo dehydration when operated in high temperature [1,2]. Hence, exploring to alternative membrane materials which can be overcome the major drawback of Nafion is very necessary.

The sulfonated polysulfon-based electrolyte membrane is one of the PEM alternatives to replace Nafion for fuel cell application. Polysulfone (PSF) has been chosen because of their good mechanical and thermal stability, toughness, and easy to be processed [3] and in the presence of the sulfonate groups in the polymer chains produces ionic polymer or polyelectrolyte. Increasing the sulfonation degree is one of the efforts to achieve higher proton conductivity. However, an extensive sulfonation leads to swell the polymers and some even change them to become soluble in water, thus they lose their mechanical stability. This is the general problem of sulfonation process of polymers, includes polysulfon, therefore it has to be optimized in order to reduce the loss in mechanical stability without decrease proton conductivity [4,5].

In several study, especially regarding synthesis and modification membranes of sulfonated polysulfone-base (SPSF)[6-8], in generally showed that the resulting membranes could improve some properties such as thermal, mechanical stability and methanol permeability, however proton conductivity still lower if compare with nafion membrane. Therefore, proton conductivity improvement of this membrane is still necessary. In this work, the SPSF membrane has been modified by introducing Nafion in the SPSF membrane. Incorporating Nafion into SPSF matrix provided an additional electrolyte component lead to improve the proton conductivity.