Polyelectrolyte Nanocomposite Membranes Using Imidazole- Functionalized Nanosilica for Fuel Cell Applications

Presentor : Elham Jafarnia
Sharif University Of Technology, Tehran, IRAN
University Canada West, Vancouver, British Columbia, Canada

Abstract

The preparation and characterization of a new type of nano composite polyelectrolyte membrane (PEM), based on DuPont TM Nafion ® / imidazole modified nanosilica (Im-Si), for direct methanol fuel cell (DMFC) applications is described. Related to the interactions between the protonated imidazole groups, grafted on the surface of nanosilica, and negatively charged sulfonic acid groups of Nafion, new electrostatic interactions can be formed in the interface of Nafion and Im- Si which result in both lower methanol permeability and also higher proton conductivity. Physical characteristics of these manufactured nanocomposite membranes were investigated by scanning electron microscopy (SEM), thermogravimetry analysis (TGA), differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FTIR), water uptake, methanol permeability and ion exchange capacity, as well as proton conductivity. The Nafion/Im-Si membranes showed higher proton conductivity, lower methanol permeability and, as a consequence, higher selectivity parameter in comparison to the neat Nafion or Nafion/silica membranes. The obtained results indicated that the Nafion/Im-Si membranes could be utilized as promising polyelectrolyte membranes for direct methanol fuel cell applications.

Image

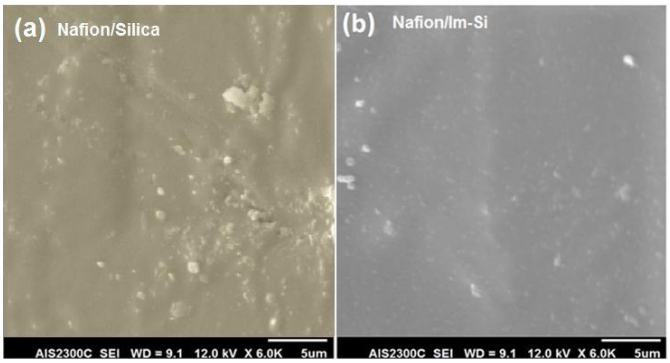


Fig 1. The SEM images of the cross section of Nafion/2wt.% nanosilica (a) and Nafion/2wt.% Im-Si (b)

Recent Publications

1. Rees, N.V.; Compton, R.G. Sustainable energy: a review of formic acid electrochemical Rees, N.V.; Compton, R.G. Sustainable energy: a review of formic acid electrochemical.
2. Hasani-Sadrabadi, M.M.; Dashtimoghadam, E.; Majedi, F.S.; Songmei, W.; Bertsch, A.; Moaddel, H.; Renaud, P. Nafion/chitosan-wrapped CNT nanocomposite membrane for high-performance direct methanol fuel cells. Royal Soc Chem Adv. **2013,** *3, 7337-7346.*
3. Haghighi, A.H.; Hasani-Sadrabadi, M.M.; Dashtimoghadam, E.; Bahlakeh, G.; Shakeri, S.E.; Majedi, F.S.; Hojjati Emami, S.; Moaddel, H. Direct methanol fuel cell performance of sulfonated poly (2, 6-dimethyl-1, 4-phenylene oxide)-polybenzimidazole blend proton exchange membranes. Int J Hydrogen Energy. 2011, 36, 3688-3696.
4. Kreuer, K.D. On the development of proton conducting polymer membranes for hydrogen and methanol fuel cells. J Membr Sci. 2001, 185, 29-39.
5. Smitha, B.; Sridhar, S.; Khan, A. Polyelectrolyte complexes of chitosan and poly (acrylic acid) as proton exchange membranes for fuel cells. Macromolecules. 2004, 37, 2233-2239.



Biography

I developed an early interest in international relations and interdisciplinary studies. I developed a curious mind as to with regards to international relations. Due to this, I decided to take up a course that is related to world modern-knowledge. In 2010, I received my degree in BA Chemical Engineering during three years in Shiraz University of Iran so I have completed my MSc in Nanoscience and Nanotechnology from Sharif University of Technology with the highest honors.I deeply believe in cooperation because working together increase the qualification of research. I have started my group work from 2013 with the best colleagues in Iran and Egypt and we are working on environmental friendly procedure to recycle polymer wastes and nano composite membranes

Email:elhamjaafarnia2000@gmail.com

Notes/Comments: