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Anion conducting poly(vinyl alcohol)/ploy(diallyldimethylammouium chloride) (PVA-PDDA) membranes with high durable alkaline stability for polymer electrolyte membrane fuel cells

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Alkaline polymer electrolyte membrane (PEM) fuel cells, employing alkaline anion (OH^-)-exchange membranes (AAEMs) offer an attractive option as power sources for stationary and portable applications due to their faster electrode kinetics, lower fuel crossover, reduced CO poisoning, and use of non-precious metal catalysts. However, since the mobility of OH^- is only 1/4 of that of the H+ transportation the membranes that can have high OH^- conductivity are highly desired for obtaining a higher power density. In cases where much effort has been undertaken for the above purpose, the problem of low membrane stability has also identified as one of the major barriers that affects their application in alkaline fuel cells.

Regarding the alkaline stability, AAEMs containing quaternary ammonium groups are likely to decompose in concentrated alkali solutions, especially at elevated temperatures (above 60 ^{o}C) via by either an E2 Hofmann elimination or by an SN2 substitution reaction. In our recent work, we have been pursuing the design and the development of new families of cost-effective, readily prepared OH^- conducting membranes. Based on chemically cross-linked PVA polymer networks by incorporating the water-soluble quaternized copolymer as anion charge carriers, we have demonstrated a feasibility in preparing membranes with high hydrolytic stability and the alkaline stability with reasonable OH^- conductivity.

This communication reports promising initial performances of a new type of alkaline anion-exchange membranes by incorporating ploy(diallyldimethylammouium chloride) (PDDA) as anion charge carriers. Because of the cyclic quaternary ammonium structure in PDDA, it contributes the membrane's high chemical stability along with the high dense of cross-linkages of PVA. These PVA/PDDA-based AAEMs (abbreviated PVA/PDDA-OH^-) perform quite high OH^- conductivity, alkaline stability and power density which are much superior to our previously investigated. The details will be reported in the meeting.

Biography

Jinli Qiao is a Professor, Supervisor for both M.Sc. and Ph.D. students, and also a Disciplines Leader of the College of Environmental Science and Engineering, Donghua Universtiy, China. She received her Ph.D. in Electrochemistry from Yamaguchi University, Japan, in 2004. After that, she joined the National Institute of Advanced Industrial Science and Technology (AIST), Japan, as a research scientist working on both acidic/alkaline polymer electrolyte membranes and non-noble metal catalysts for PEM fuel cells. From 2004 to 2008, as a responsible researcher, she carried out 7 projects including two NEDO projects of Japan working on fuel cell catalyst and membrane development. Starting from 2008 to present, she carried out and has been carried out in total 7 projects funded by Chinese Government. As the first author and corresponding author, Dr. Qiao has published over 100 research papers in peer-reviewed journals and conference proceedings, 40 conference and invited oral presentations, 4 co-authored books/ book chapters, and holds over 7 JP/China patents, 6 JP/China patent publications. Prof. Qiao is a referee for the project assessment of National Natural Science Foundation of China, Scientific Research Foundation of State Education Ministry of China, Foundation of Shanghai Science and Technology Committee, Shanghai "twelfth Five -Year Plan" for clean energy, as well as more than twenty high-impacting international journals. Dr. Qiao is also an active member of The Electrochemical Society, The Electrochemical Society of Japan, and China Association of Hydrogen Energy.

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