Asymmetric silica composite polymer electrolyte membrane for water management of fuel cells

Insung Bae, Keun-Hwan Oh, Sung-Hyun Yun, Hyuk Kim

www.elsevier.com/locate/memsci

PII: S0376-7388(17)31001-3
DOI: http://dx.doi.org/10.1016/j.memsci.2017.07.058
Reference: MEMSCI15463

To appear in: *Journal of Membrane Science*

Received date: 16 April 2017
Revised date: 24 July 2017
Accepted date: 30 July 2017

Cite this article as: Insung Bae, Keun-Hwan Oh, Sung-Hyun Yun and Hyuk Kim, Asymmetric silica composite polymer electrolyte membrane for water management of fuel cells, *Journal of Membrane Science* http://dx.doi.org/10.1016/j.memsci.2017.07.058

Asymmetric silica composite polymer electrolyte membrane for water management of fuel cells

Insung Bae[*], *Keun-Hwan Oh, Sung-Hyun Yun and Hyuk Kim*
Corporate R&D, LG Chem, 188, Munji-ro, Yuseong-gu, Daejeon, Korea

[*]**Corresponding Author.** Tel: -82-42-719-3280. Fax: -82-42-861-2057.
insungbae@lgchem.com

Abstract

We prepared an asymmetric composite membrane in which surface modified silica nanoparticles were added to sulfonated poly(arylene ether ketone) (SPAEK). The asymmetric structure, hydrophilic silica to the anode side and hydrophobic silica to the cathode side in the polymer matrix, enhanced the water back diffusion from the cathode to anode within the membrane, which results in an increase of proton conductivity, particularly under low humidity conditions. The improved water back diffusion is attributed to the different water retention character and surface energy gradient of surface modified silica that accelerates water transport. The asymmetric composite membrane exhibited high and stable electrochemical performance of a fuel cell. Analysis of drain water and electrochemical characterization supports the structural effect of the asymmetric composite membrane for efficient water management.

Graphical abstract