A Mesoporous Structure SnP₂O₇/Graphite Oxide Composite as Proton Conducting Electrolyte for High-Temperature Proton Exchange Membrane Fuel Cells

Min Huang¹, Xin Huang¹, MingMing Fei^{1,2}, Yuming Deng^{1,2}, Xiaozhou Huang¹,
Chenxi Xu^{1,*}, Jigui Cheng^{1,*}, Paifeng Luo¹, Yinwei Lu¹

¹ School of Materials Science and Engineering, Hefei University of Technology, Hefei, Anhui, China

² Institute of industry & Equipment technology, Hefei University of Technology, Hefei, Anhui, China

*E-mail: xuchenxi31@126.com, jgcheng63@sina.com

doi: 10.20964/2017.05.78

Received: 25 January 2017 / Accepted: 16 March 2017 / Published: 12 April 2017

Proton conductors operated in over 200°C have received great interest for proton exchange membrane fuel cells (PEMFCs). The tetravalent metal ion pyrophosphates materials (MP₂O₇) are considered as the suitable conductor electrolyte, and the mesopores structure MP₂O₇ are attractive, because capillary condensation of water molecules occurs at relatively low relative humidity, allowing for fast transport of protons without excessive humidification. In this study, we report meso-SnP₂O₇, which is synthesized from mesoporous SnO₂, as promising solid electrolyte candidate for PEMFCs in a temperatures range of 180°C to 280°C. Furthermore, graphite oxide (GO) is incorporated with the meso-SnP₂O₇ to further improve the proton conductivity and water retention. The structure and phase stability of the membranes are analysed by X-ray diffraction (XRD) and thermogravimetric analysis (TGA). The microstructure morphology of SnP₂O₇ particles and pellets is analysed by transmission electron microscope (TEM) and scanning electron microscopy (SEM). The obtained particles and pores size of Meso-SnP₂O₇ are characterized by the ETA potential meter and BET. The Meso-SnP₂O₇ and Meso-SnP₂O₇/GO electrolytes exhibit the high proton conductivities of 0.15 S cm⁻¹ and 0.17 S cm⁻¹ at 220°C, respectively. Moreover, the peak power density of the Meso-SnP₂O₇/GO membrane is 18 mWcm⁻² at 220 °C with OCV of 0.83V.

Keywords: High-temperature proton exchange membrane fuel cells; Graphite Oxide; mesoporous structure; capillary condensation

[FULL TEXT](#)

© 2017 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).