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Data Article

Data on fuel cell performance of Nafion® based hybrid composite membrane containing GO and dihydrogen phosphate functionalized ionic liquid at 70 °C under anhydrous condition



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ABSTRACT

This data provides the fuel cell performance of Nafion based hybrid membranes containing GO and dihydrogen phosphate functionalized ionic liquid (IL) at 70 °C under anhydrous condition. Readers are requested to go through the article entitled “Nafion® based hybrid composite membrane containing GO and dihydrogen phosphate functionalized ionic liquid for high temperature polymer electrolyte membrane fuel cell” (Maiti et al., 2017) [1] for further interpretation and discussion.

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Specifications Table

Subject area	Chemistry
More specific subject area	Polymer Electrolyte Membrane
Type of data	Table, figure

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How data was acquired	BioLogic EC-Lab, VSP-300
Data format	Analyzed
Experimental factors	Fuel cell performance was measured at 70 °C under anhydrous condition
Experimental features	Unit fuel cell performance
Data source location	Energy Materials Lab, Department of Chemical Engineering, Gachon University, Republic of Korea.
Data accessibility	This article

Value of the data

- Unit cell data on H₂/O₂ polymer electrolyte membrane fuel cell.
- Nafion based hybrid membrane containing GO and IL.
- Data on unit cell performance at 70 °C under anhydrous condition.

1. Data

This dataset provides information on the performance of unit H₂/O₂ polymer electrolyte membrane fuel cells using commercial Nafion 117 membrane and Nafion based hybrid membranes containing GO and dihydrogen phosphate functionalized IL at 70 °C under anhydrous condition. Fig. 1 shows the I–V and power density curves obtained using the commercial Nafion 117 membrane and Nafion based hybrid membranes. The characteristic data like maximum power density and open circuit voltage of the unit cells using Nafion based membranes are tabulated in Table 1.

2. Experimental design, materials and methods

2,3 dimethyl-1-butyl imidazolium dihydrogen phosphate (DMBuImH₂PO₄) was prepared from 1,2-Dimethyl imidazole and 1-bromobutane [1]. At first equal moles of 1,2- dimethyl imidazole and 1-bromobutane were mixed in a round bottom flask and stirred for 12 h at room temperature under

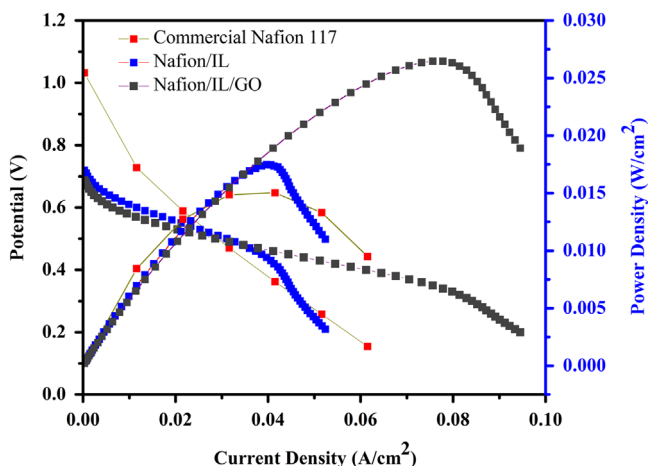


Fig. 1. I–V and power density curves of membranes using H₂ fuel at anode and O₂ at cathode at 70 °C and 1 atm.

Table 1Unit cell performance data of H₂/O₂ fuel cells using Nafion based membranes at 70 °C under anhydrous condition.

Sample	Maximum power density (W/cm ²)	Open circuit potential (V)
Nafion	0.015	1.032
Nafion/IL	0.017	0.719
Nafion/IL/GO	0.026	0.687

argon atmosphere. The product was then washed three times with ethyl acetate and dried at 60 °C in a vacuum oven. The dried product was dissolved in acetonitrile and phosphoric acid was added dropwise. After 48 h of reaction under argon atmosphere the solvent was evaporated using vacuum drying at 60 °C.

Solution casting process was used to prepare the Nafion/IL/GO and Nafion/IL membranes [1]. 0.015 g of GO was dispersed in DMF with 0.75 g of IL and stirred for 24 h. Then 0.75 g of Nafion 117 (vacuum dried at 60 °C for 12 h) was added to the above solution and further stirred for 24 h for a homogeneous solution. The solution was then poured onto a glass petri dish and placed in a vacuum oven at 110 °C for 4 h before peeling it off. Nafion/IL membrane was prepared similarly as above procedure by without adding GO. The thicknesses of membranes were kept at about 150 μm to 250 μm.

The membrane electrode assemblies (MEAs) were prepared by sandwiching the membrane between an anode and a cathode [1]. The anode and cathode were prepared by taking out 5 cm² pieces of Pt/C coated carbon paper with a Pt loading of 1.6 mg cm⁻². H₂ in anode and O₂ in cathode sides were supplied under anhydrous condition with a flow rate of 75 sccm and 150 sccm respectively. The polarization and power density curves of the unit cell were obtained at 70 °C after operating the cell for a activation period of 6 h.

Acknowledgements

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Transparency document. Supplementary material

Transparency document associated with this article can be found in the online version at <https://doi.org/10.1016/j.dib.2017.12.037>.

Reference

- [1] J. Maiti, N. Kakati, S.P. Woo, Y.S. Yoon, Nafion® based hybrid composite membrane containing GO and dihydrogen phosphate functionalized ionic liquid for high temperature polymer electrolyte membrane fuel cell, *Compos. Sci. Technol.* (2017). <http://dx.doi.org/10.1016/j.compscitech.2017.11.030>.