Unprecedented SPEEK-trimetal Oxide Composites: Physicochemical and Electrochemical Performance in Fuel Cell

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Abstract

Advanced polymer composite membranes were prepared from a linear sulfonated poly(ether ether ketone) (SPEEK) with bismuth cobalt zinc oxide [BCZO, $(\text{Bi}_2\text{O}_3)_{0.07}(\text{CoO})_{0.03}(\text{ZnO})_{0.90}$] nanopowder as an inorganic additive for the application of $\text{H}_2\text{-O}_2$ fuel cell. Morphology data tend to provide evidences for the incorporation of BCZO into SPEEK polymer. Indeed, composite membrane loaded with 7.5 wt.% of BCZO was identified to uptake maximum water, while the pristine SPEEK membrane occurred to retain only 24.0 %. As such SPEEK matrix loaded with 7.5 wt.% of BCZO was found to exhibit the maximum proton conductivity of 0.030 S cm^{-1} , whereas the pristine membrane was restricted to 0.021 S cm^{-1} . Evidently, TGA profile of the composite membrane was measured to exhibit sufficient thermal stability to employ as electrolyte in fuel cell. The membrane electrode assembly of pristine SPEEK and SP-BCZO-7.5 wt.% membranes were fabricated and studied for their electrochemical performance. Indeed, the characteristics of newly developed composite membranes led to possess incredible feature towards fuel cell applications.

Full Text

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Figures

Figure 1

Schematic representation for the preparation of SP-BCZO composite membranes

Figure 2

FT-IR spectra of SPEEK and SP-BCZO-10 composite.

Figure 3

XRD patterns of BCZO, SPEEK and SP-BCZO-5.0 membranes.

Figure 4

SEM images of a) SPEEK, b) and c) BCZO and as well as d) SP-BCZO-5.0 samples

Figure 5

Contact angle measurements on a) SPEEK, b) SP-BCZO-7.5 and c) SP-BCZO-10 membranes.

Figure 6

Comparison between water uptake and IEC of the pristine and composite membranes.

Figure 7

Proton conductivity measurements on pristine and composite membranes

Figure 8

TGA profile of a) SPEEK b) SP-BCZO-5.0 and c) SP-BCZO-10.0 composite membranes.

Figure 9

Polarization and power density curves of pristine SPEEK and SP-BCZO-7.5 membranes.