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Chemical stability enhancement of Nafion membrane by impregnation of a novel organic $\cdot\text{OH}$ radical scavenger, 3,4-dihydroxy-cinnamic acid

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Abstract

In this contribution, the effect of a novel organic $\cdot\text{OH}$ scavenger, 3,4-dihydroxy-cinnamic acid (CA), is investigated on the anti-oxidation of Nafion membranes, as the endurance of fuel cell performance is recently a critical issue in the development of proton exchange membrane. As this organic scavenger is possibly kept in the membrane without migration by water flow and does not diminish proton conductivity by ionic interaction with sulfonic acids, much more durable property of the membrane is expected than well-known cerium ion (CE) scavenger. CA contained Nafion membrane (CA-Nafion) were prepared to analyze the effect of CA on the fundamental structure and properties of membrane using a variety of instruments such as SAXs, FTIR, TGA, and UTM. CA and CE leaching out test result showed that CA can be preserved in composite membrane compared to CE. Cell performance and oxidation stability of pristine Nafion, CA-Nafion and CE-Nafion membrane were determined by ex-situ and in-situ method. As a result, both CA-Nafion membrane and CE-Nafion membrane have oxidation stability compare to pristine Nafion, but only CA-Nafion membrane maintained the cell performance of pristine Nafion membrane.

Keywords: Fuel cell, polymer electrolyte membrane, degradation, chemical stability, 3,4-dihydroxy-cinnamic acid

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