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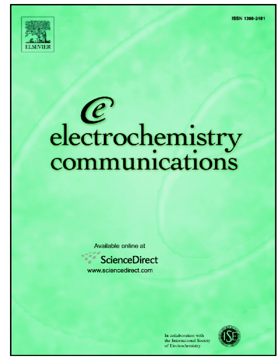

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Noga Ziv, Dario R. Dekel

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A practical method for measuring the true hydroxide conductivity of anion exchange membranes

*Noga Ziv and Dario R. Dekel**

The Wolfson Department of Chemical Engineering and the Nancy & Stephan Grand Technion Energy Program (GTEP), Technion – Israel Institute of Technology, Haifa 3200003, Israel

Abstract

Hydroxide ions in anion exchange membranes (AEMs) are quickly exchanged for larger and less mobile anions (CO_3^{2-} and HCO_3^-) when the membrane is exposed to ambient air. Therefore, reported conductivity values of AEMs in hydroxide form are difficult to reproduce, and existing conductivity measurement techniques are not always reliable. Up to now, comparison of reported data for the hydroxide conductivity of different membranes has not been possible because tests have been performed not just with different anions, but also under different conditions and using different methods. In this work we present a practical and reproducible ex situ method for measuring the true value of the hydroxide conductivity of AEMs.

Keywords: anion exchange membrane; CO_2; carbonation; ambient air; ionic conductivity; hydroxide conductivity

*Corresponding author. E-mail address: dario@technion.ac.il

1. Introduction

Anion exchange membrane fuel cells (AEMFCs) have attracted a lot of attention in recent years due to their potential as highly effective, clean, low-cost sources of energy [1]. In an AEMFC, hydroxide anions (OH^-) are the dominant anions transported through the anion exchange membrane (AEM) from the cathode to the anode side of the cell [2].

The value of OH^- conductivity is therefore critical in distinguishing between different membranes and in determining those most suitable for use in a fuel cell. However, the true OH^- conductivity value is difficult to measure due to the fast reaction of OH^- with CO_2 (ca. 400 ppm in ambient air), which replaces OH^- with larger and less mobile anions – bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) (see reactions (1) and (2)) [3,4].

$$OH^- + CO_2 \rightleftarrows HCO_3^- \qquad (1)$$

$$OH^- + HCO_3^- \rightleftarrows CO_3^{2-} + H_2O \qquad (2)$$