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Membraneless fuel cells using Pt-Ru-Sn/C catalysts for methanol oxidation

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Abstract. In the present work, the continuous flow operation of membraneless methanol fuel cell (MLMFC) using Pt-Ru-Sn/C electrocatalysts with different atomic ratios were prepared by alcohol-reduction process. In this membraneless fuel cell, methanol is used as a fuel, sodium percarbonate is used as an oxidant and sulphuric acid is used as the electrolyte. Sodium percarbonate affords hydrogen peroxide in aqueous medium. The synthesized electrocatalysts were characterized by transmission electron microscopy (TEM), energy dispersive X-ray spectroscopy (EDX) and X-ray diffraction (XRD) analyses. The electrocatalytic activities of the catalysts were characterized by cyclic voltammetry (CV) and chronoamperometry (CA). During the experiments performed on single membraneless fuel cells, Pt-Ru-Sn/C (70:20:10) performed better among all the catalysts prepared with power density of 36.5 $mWcm^{-2}$. The better performance of ternary Pt-Ru-Sn/C catalysts may be due to the formation of a ternary alloy and the smaller particle size.

Keywords: renewable energy; environment-friendly sodium percarbonate; membraneless methanol fuel cells; ternary catalysts; portable power applications

1. Introduction

Pollution free renewable energy is the goal to meet up the global growing energy requirement. Fuel cell technologies have drawn significant attention for high efficiency in direct conversion of chemical energy into electrical energy, as well as environmental compatibility. Many different types of fuel cells are currently under development, with a variety of targeted applications ranging from miniature power supplies to large-scale power plants. Small fuel cells have received much interest in recent years as potential power supplies for the next generation of portable electronic

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