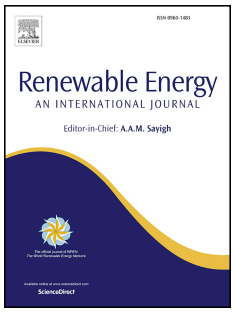
Accepted Manuscript



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Xuan–Vien Nguyen, Guo–Bin Jung, Shih–Hung Chan, Chia–Chen Yeh, Jyun–Wei Yu

PII: S0960-1481(17)30261-6

DOI: 10.1016/j.renene.2017.03.070

Reference: RENE 8663

To appear in: *Renewable Energy*

Received Date: 30 December 2016

Revised Date: 20 March 2017

Accepted Date: 23 March 2017

Please cite this article as: Nguyen X, Jung G, Chan S, Yeh C, Yu J, Improvement on the design and fabrication of planar SOFCs with anode–supported cells based on modified button cells, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.03.070.

Improvement on the Design and Fabrication of Planar SOFCs with Anode–Supported Cells Based on Modified Button Cells

Xuan–Vien Nguyen *, Guo–Bin Jung, Shih–Hung Chan, Chia–Chen Yeh, Jyun–Wei Yu

Department of Mechanical Engineering & Fuel Cell Center, Yuan Ze University, Taoyuan 320, Taiwan;

*Corresponding Author, E–mail: wienheating@gmail.com, s1038705@mail.yzu.edu.tw (Xuan–Vien Nguyen); Tel.: +886–3–463–8800 ext.3623

Abstract

In this study, a planar solid oxide fuel cells (SOFCs) apparatus with a 6 cm × 6 cm anode supported single cell based on a modified button cell was designed for operation in both regular cell and button cell configurations. The apparatus was assembled with a regular cell with an active area of 5 cm × 5 cm and with a button cell with an active area of 2.54 cm^2. They consist of fuel and oxidant chambers that allow heat conversion and thus increase the temperatures of the fuel inlet and oxidant inlet streams. The chambers reduced the cooling effect, thereby improved the cell performance. In addition, a wire–in–tube–type heat exchanger was designed and fabricated. This device was installed in front of the fuel inlet of the SOFC apparatus to improve heat transfer to better increase the temperature of the fuel inlet stream. Results indicate that the fuel outlet temperature of the system with heat exchanger is much higher than that of the system without heat exchanger. Thus, the performance of system with heat exchanger is largely improved. This improvement means that the wire–in–tube type heat exchanger is proved to be effectively increases the hydrogen inlet temperature by enhancing heat transfer.

Keywords: Anode–supported cell, Solid oxide fuel cell (SOFC), Planar SOFC, Button cell, Cooling effect, Heat exchanger.

1. Introduction

Solid oxide fuel cells (SOFCs) are generally regarded as a promising alternative technology to traditional power sources. They are an emerging technology for clean, reliable, and flexible power production. Advantages of power production using SOFCs are the cells' high conversion efficiency, the absence of combustion, and fuel flexibility, which allows use of various fuels, including those derived from renewable sources. SOFC are