Fabrication and Performance Characteristics of Micro-Tube SOFC for Quick Start Operation.

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An anode-supported micro tube SOFC was developed to increase the cell power density and thermal stability by decreasing diameter of tube. The advantage of the micro tube SOFC can reduce the stack volume and therefore increase the output power density, because the effective electrode area per unit volume increases with decreasing the cell diameter. Also, the SOFC is enable to the internal reforming of fuel gases such as natural gas and other hydrocarbons.

In this work, we studied the fabrication and performance characteristics of a small-scale SOFC system running on internally reformed butane fuel for quick start operation. The micro tube cell showed a good thermal shock resistance. Fig. 1 shows the image of gas heated-micro tube cell and it has a good thermal shock resistance than conventional tube cell. Thus, the micro tube cell can prevent the mechanical breakdown by thermal shock during the operation of generation system. To examine the feasibility for quick starting operation of the micro tube SOFC, we fabricated a micro tube SOFC demonstrator using butane as fuel as shown in Fig. 2. The two micro tube cells are connected in series and the output current of the cathode was collected through platinum mesh. The output current of the anode was collected through platinum.

Firstly, the butane is supplied to the cells and the cells were heated at operating temperature by gas burner. After the cell reached to the operating temperature of around 500□ and the electrical fan connected to the cells was operated. After heating the micro tube cells, it took only 20 seconds to operate the fan as compared to the conventional tubular cell with operating time of 180 seconds or more. Fig. 3 shows the current-voltage curve of the micro tube cells. Just before the fan operation, the voltage and the current showed 0.6A at 1.4V. Then, when the fan started turning, the voltage and the current decreased. The output current is about 0.4A at 0.2V and shows a little change with operation time. This result indicates that the anode-supported tubular cell can be quickly heated and operated by decreasing the cell diameter. The fan of the quick starting demonstrator was operated stably. Thus, we conclude that operation condition of the tubular cell in the thermal resistance and in the power density can be improved largely by decreasing the tube diameter and the micro SOFC has an potential application for quick starting power generation such as a portable power, APU, etc..

Reference

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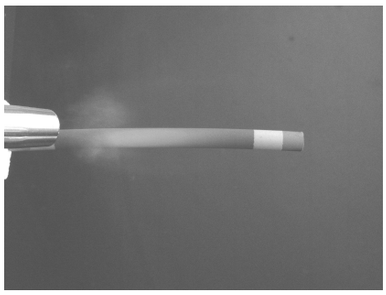

Fig. 1 The thermal shock test of the anode supported micro-tube SOFC.

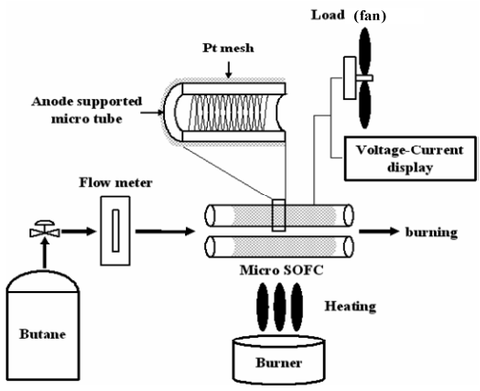

Fig.2 Schematic diagram of the demonstrator for quick starting operation.

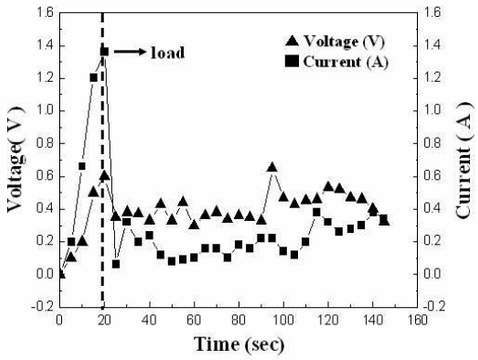

Fig. 3 The current-voltage curve of the micro tube cell.