

A cascade-type PEM fuel cell stack to maximize the fuel utilization efficiency

한인수*, 정지훈, 고백균, 신현길
GS칼텍스(주)
(ishan1969@gscaltex.com*)

A new design of a cascade-type PEM fuel cell stack is presented to improve the fuel utilization efficiency without using any hydrogen recirculation devices. In this design, the anodic cells of the stack are divided into several blocks to constitute a multistage anode and a single-stage cathode by inserting compartments between the anodic cells. High gaseous flowrate is maintained at the outlet of the anodic cells even under dead-end condition. Therefore, one can expect a reduction of purge gas emission because the high gaseous flowrate attenuates liquid water and nitrogen accumulations in the anodic cells. The proposed stack design is addressed together with a design method to determine the major design parameters such as the number of blocks and the number of anodic cells in each block of the stack. To investigate the effectiveness of the proposed design, a 15 kW-class PEM fuel cell stack is designed, fabricated, and tested. From the experimental results, a high fuel utilization of 99.71 % at the maximum power is obtained while maintaining a stable operation. Additionally, the output voltage of the stack fluctuates much less than those of conventional ones by virtue of the multistage anode design.