technology&applications

EUROPEAN FUELCELL CONFERENCE

FINAL PROGRAM

Governo Italiano
Presidenza del Consiglio dei Ministri

Ministero degli Affari Esteri

Ministero dell'Innovazione

Ministro dell'Ambiente e della Tutela del Territorio

ASME

H2CU

ENEA

POS#21

POLYMER ELECTROLYTE FUEL CELL DESIGN FOR LOW-PRESSURE OPERATION

S. Galli, G, Monteleone, I. Laganà, A. Pozio, J. Wu*
ENEA - Hydrogen and Fuel Cell Project - Rome, Italy
Via Anguillarese 301, 00060 - Rome, Italy
*** Dalian Institute of Chemical Physics (China)**

Abstract:

Current engineering R&D activities on polymer electrolyte membrane stack fuel cell (PEMFC) technology in ENEA are focused on development and testing of small power (< 1000 W) low-pressure PEMFCs. Objective of this project is to develop and demonstrate a simple fuel cell stack of small power output with limited passive auxiliaries (with no energy consumption) operating at very low-pressure (less than 50 mbar).

At low-pressure operation innovative design approaches, both in pattern of bipolar plate flow-field and in auxiliaries for cooling and gas supply, are introduced in order to reduced system volume and passive energy consumption.

For bipolar plate in-house manufacturing, a desktop compact Computer Numerical Control 3-D mini-milling machine was used, demonstrating useful at the early explorative stage of research. Alternative designs for bipolar and cooling plates, sometimes with complex flowfield layouts, were realized and tested. In general cathodic compartment consists of vertical open parallel channels with upward flow, while hydrogen stream flows through parallel channels.

First tests on single and few cells stack (50 cm2 area) were devoted to check low-pressure behavior and evaluate performance. Small stack was operated under slightly forced convection using a typical fan for electronic devices. Various fan positions and flow patterns were tested for better and more stable operation. Both fan position and cathodic air flow rates demonstrated critical for water management and humidity membrane control.

Appropriate air fan management can be envisaged as an effective method for steady-state fuel cell control.

Paper will present a description of the low-pressure PEM fuel cell system, focusing on design, manufacturing aspects and on the experimental results.