TurbuGrid – A Turbulence Inducing Device

SIGNIFICANTLY IMPROVING PERFORMANCE & SCALABILITY OF AIR-COOLED FUEL CELLS

Fig. 1

Fig. 2

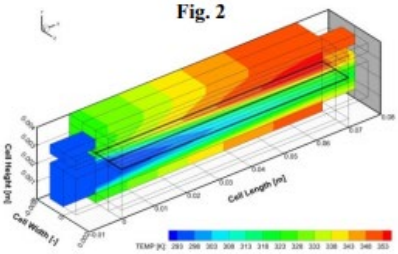


Fig. 3

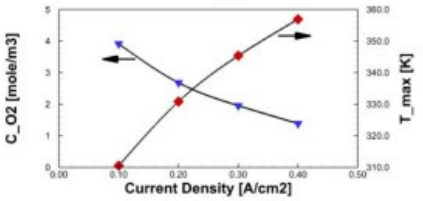


Fig. 4

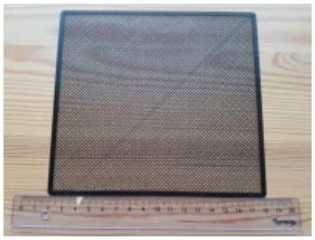


Fig. 5

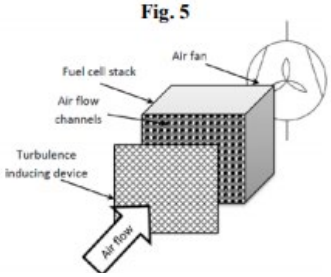
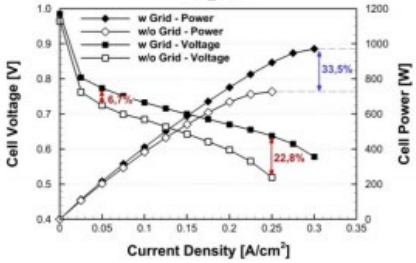


Fig. 6



VALUE PROPOSITION

Air-cooled proton exchange membrane fuel cells have been commercialized for mobile/stationary applications such as telecom back-up power, and are being considered as range-extenders for battery powered vehicles because of their simplicity. However, wider market use of these air-cooled fuel cells has been limited due to high cost and size restrictions. But not any more! Proof of Concept tests, has shown that by

- Adding a simple turbulence inducing grid, costing less than 1 USD in mass production,
- Improved power density/efficiency of at least 33,5% for a retro-fitted fuel cell stack is achieved,
- When optimized for mass production cost reductions of a new fuel cell stack by 50%, maybe more, can be attained.

BUSINESS OPPORTUNITY

As scaling and performance of air-cooled proton exchange membrane fuel cells can be improved dramatically, while reducing overall costs of the fuel cell products. This invention of a simple turbulence inducing grid, provides the basis for a market breakthrough, for air-cooled proton exchange membrane fuel cells, both in the current market applications, and opening up for new markets. The turbulence inducing device enables manufacturers to produce

- Air-cooled proton exchange membrane fuel cells, with much higher rating, and/or
- Smaller foot print fuel cells, with at least same rating as current products, opening up for uses, where space/weight is highly restricted.

TECHNOLOGY SUMMARY

Air-cooled low temperature proton exchange membrane fuel cells (Fig. 1) suffer from low limiting current density, resulting in low power density. A detailed computational fluid dynamics analysis (Fig. 2), has revealed that the underlying reason for the low current density is membrane overheating (Fig. 3). The electrolyte membrane in the center of the fuel cell can not withstand temperatures above 90 °C, which is encountered already at very low current density (around 0.4 A/cm²), severely limiting efficiency and scalability.
The TurbuGrid (Fig. 4) was placed in front of the fuel cell, mixing the air stream passing through the fuel cell (Fig. 5). Thereby eliminating the temperature hot spot inside the fuel cell, and reducing fuel cell temperature, so the current density, power density and fuel cell efficiency could be significantly improved (Fig. 6), thus enabling significant cost savings on new Air-cooled proton exchange membrane fuel cells.

CURRENT STATE OF DEVELOPMENT

Proof of Concept has been made in the laboratory on standard, air-cooled stacks from Ballard Power Systems, optimizing the effect of turbulence generating grids, placed at varying distances from the fuel cell stack.

THE INVENTORS

- Torsten Berning
  tbe@et.aau.dk

CONTACT INFORMATION

Lars Halkjær
Technology Transfer Manager
lah@adm.aau.dk

SEEKING

- Licensee
- IPR sale
- Research collaboration

PATENT: Pending