

Recent Development of Portable DMFC Influenced by Simplo-ITRI Cooperation

W. Ling, L. Tsai, C.-C. Lai, M.-H. Wang

This document appeared in

Detlef Stolten, Thomas Grube (Eds.):

18th World Hydrogen Energy Conference 2010 - WHEC 2010

Parallel Sessions Book 5: Strategic Analyses / Safety Issues / Existing and Emerging Markets

Proceedings of the WHEC, May 16.-21. 2010, Essen

Schriften des Forschungszentrums Jülich / Energy & Environment, Vol. 78-5

Institute of Energy Research - Fuel Cells (IEF-3)

Forschungszentrum Jülich GmbH, Zentralbibliothek, Verlag, 2010

ISBN: 978-3-89336-655-2

Recent Development of Portable DMFC Influenced by Simplo-ITRI Cooperation

Welkin Ling, Li-duan Tsai, Chiou-Chu Lai, Industrial Technology Research Institute, Taiwan

Mei-Hui Wang, Simplo Technology, Ltd.

1 Who Are Simplo and ITRI?

The main business of Simplo Technology Ltd. is providing ODM battery packs for notebook computer manufacturers. Its global market share in this segment is 22.3% in 2008 for 29 million pieces battery packs. It has about 5000 employees worldwide and generated 976 million USD revenue in 2008.



Figure 1

ITRI (the Industrial Technology Research Institute) is a non-profit research institute located in Taiwan under the supervision of the Republic of China Ministry of Economic Affairs, with over 6000 employees and an operating budget of about US\$ 510 million (half from the MOEA and half from private sources). ITRI has been working on FC R&D since 2001 mainly focused on PEMFC and DMFC, currently with about 70 people and 4M Euro combined.



Figure 2

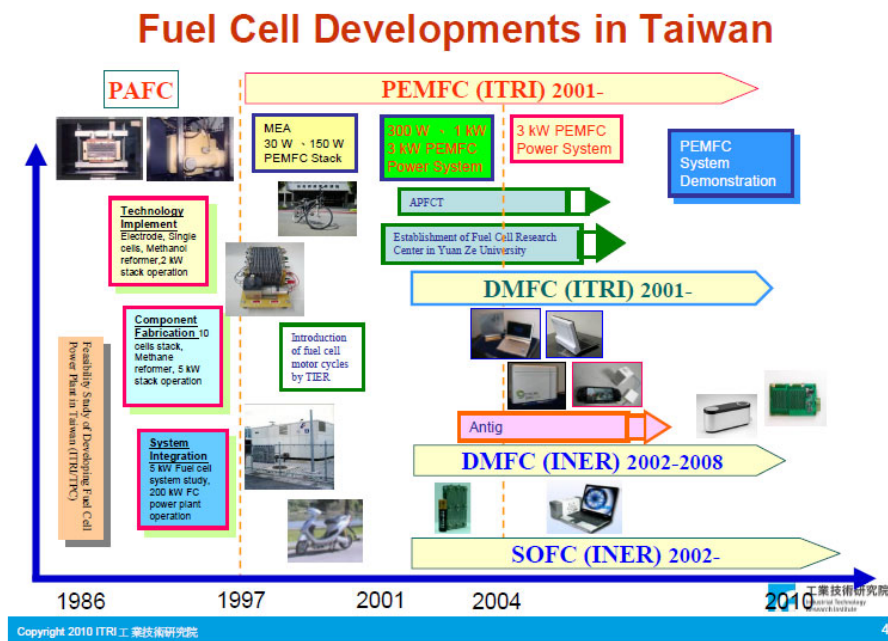


Figure 3

In this poster, the emphasis will be on the “DMFC MEA (Membrane Electrode Assembly)” and “DMFC/Li-ion Battery hybrid power supply controller”.

2 DMFC/Li-ion Battery Hybrid Power Supply Controller

With the consideration as an add-on FC power supply for Li-ion battery powered portable electronics, a patented “Dual Tracking hybrid controller” is developed. The core control strategy is to measure the secondary battery voltage to determine Fuel cell operation mode.

When battery voltage is below the setting value, the FC operation will be controlled at a constant voltage. In this case, each FC cell will run at a pre-determined voltage. This voltage value is based on the optimum condition that was determined for a specific fuel cell system. The converter output voltage will follow the voltage of the battery. It means FC will run at constant power (voltage) stage and battery will discharge when extra power is required and recharge when FC output power is higher than load.

When battery voltage is higher than the setting value, the controller will change its control mode. In this mode converter output voltage will be set at battery charging voltage. The FC will run at a high voltage to get higher conversion efficiency or higher fuel efficiency depending on the application requirement. In this case the fuel supply needs to be controlled to avoid the waste of fuel.

Compared to the Dual Tracking hybrid controller, fuel cell equipped with traditional fuel cell controller has to frequently change their operating voltage according to the load. The FC system's durability and fuel efficiency may be adversely affected under this condition.

Hybrid Power control system

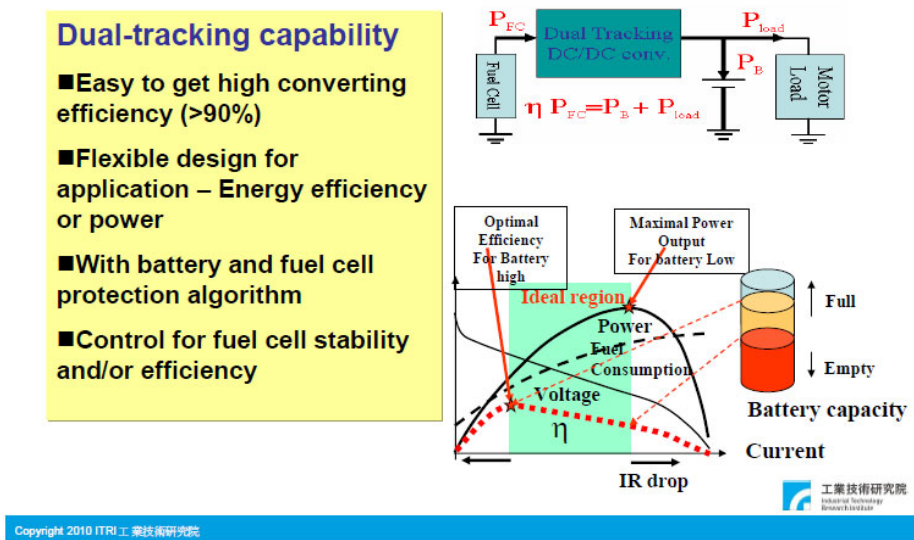


Figure 4

3 DMFC MEA development in ITRI

When the DMFC MEA is used in a passive/semi-passive system which lacks sophisticate fuel/air supply devices, the material design and manufacturing process development of MEA become very important. ITRI's current DMFC MEA, when tested in performance/characteristics verification setup, is shown to have both good power density (120mW/cm²) and durability (10% decay after 1500 hrs discharging).

Long-term Durability Test (study on modified MEA design)

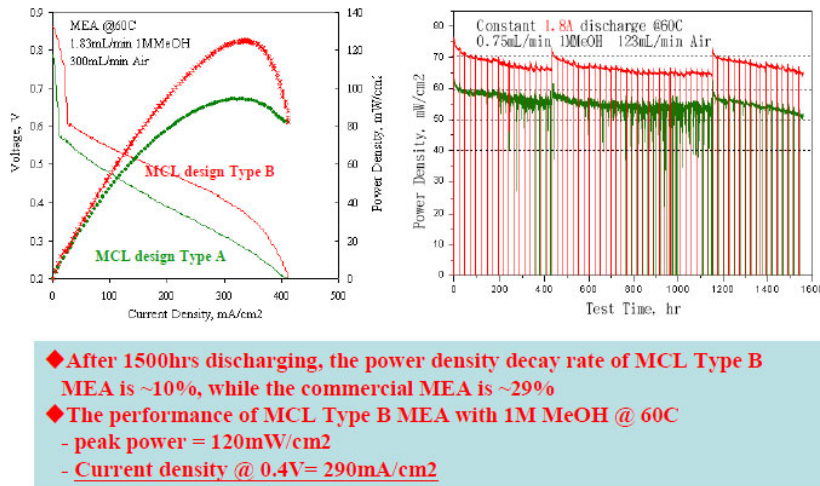


Figure 5

The above progress mainly comes from better Pt/C dispersion technique and improved catalyst coating process to the MEA.

DMFC Catalyst Development

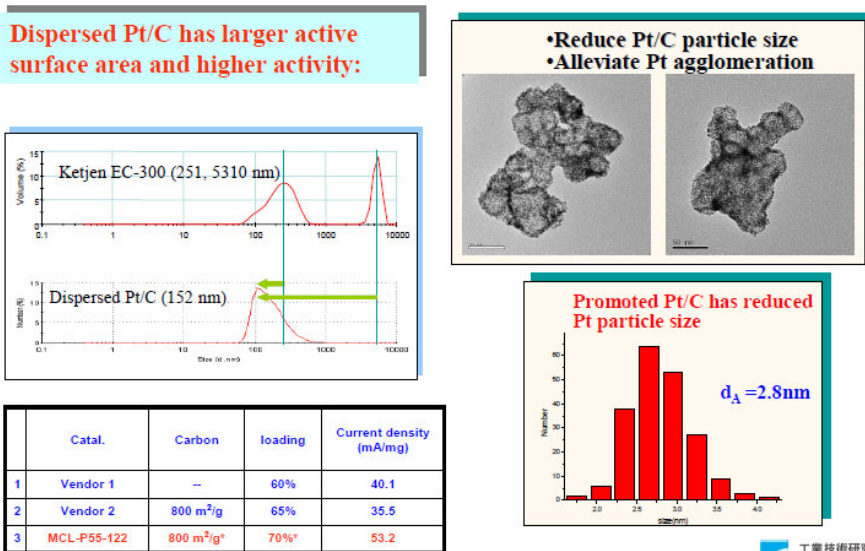


Figure 6

4 Summary

By working toward the design requirements from notebook battery pack market leader, e.g. Simplo Technology Ltd., both active and passive portable electronics DMFC prototypes have been developed in recent years. Those DMFC prototypes are also good proving ground to show the effectiveness of tailor-made MEAs and DMFC/Li-ion battery hybrid power supply controller.

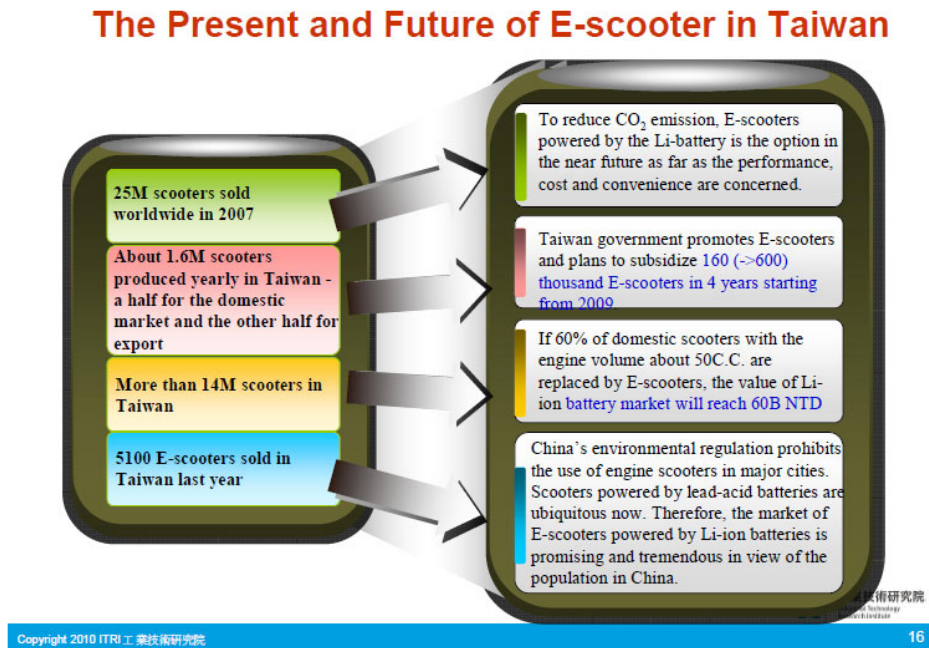


Figure 7

In ITRI we consider multi-lateral cooperation, such as demonstration or R&D projects under EU-FP7, is a good way to facilitate the commercialization of fuel cell technologies. Simplo and ITRI, a long time partners in portable DMFC R&D, welcome the opportunity to establish a cross-linking project between existing demonstration projects in Germany (EU) and Taiwan (e.g., the e-scooter project).