# 中低溫型固態氧化物燃料電池機組開發

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- 本計畫為進行中溫型1 kW級SOFC燃料電池堆開發，著重於電池堆之製程及最佳化，評估燃料電池的耐久性及其失效機制並回饋改良SOFC電池堆材料、設計及製程。研發主要分為中低溫型SOFC電池堆製作與測試的研究及氣體供應系統與熱管理系統模擬評估。

專利申請：

1. 適於一固態氧化物燃料電池的模組化平板型互連裝置及含有其的固態氧化物燃料電池/中華民國(2017)。
2. 固態氧化物燃料電池新型陰極材料/中華民國、美國(2017)。
3. 燃料電池堆單元/中華民國(2016)。
4. 於固態燃料電池的模組化平面互連裝置/美國(2016)
5. 固態燃料電池及其製備方法/中華民國(2016)。
6. 用於固態電解質的陶瓷材料及製備方法/美國(2016)。
7. 陶瓷陰極材料及其製備方法/中華民國(2015)。
8. 陶瓷電池結構/中華民國、美國(2015)。

中溫型SOFC單元電池

1KW SOFC電池堆

- 開發新型電解質材料：利用固態合成法製備鑭矽氧基中溫型SOFC電解質材料。
- 開發新型陰極材料:利用固態合成法製備釩鈷氧基中溫型SOFC陰極材料。
- 設計月生產5000片SOFC單元電池之生產線設計規劃，包含：製漿、製帶、積層、均壓、脫脂、燒結。
- 中溫型SOFC電池堆開發製作，發電量大於1kW，燃料利用率>70%，單元電池發電效率>38%。
- 設計連續生產SOFC電池堆連接板衝壓模具，可直接衝壓成型，大幅降低電池堆製作成本。
- 以化工模擬軟體Aspen Plus軟體建立1 kW電池堆氣體供應系統及其熱管理模型。
- 建立5種不同模式之純氫陽極回流系統發電模型及2種不同模式之天然氣陽極回流系統設計。

# The development of intermediate-temperature solid oxide fuel cell power generating units

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| Project Director | Wang,Sea-Fue |

- **Content:** This project focuses on the fabrication and optimization of IT-SOFC stacks in order to develop stacks of 1 kW intermediate-temperature solid oxide fuel cell (IT-SOFC). To improve the performance of IT-SOFC stacks, we have evaluated the lifetime and the failure mechanism of IT-SOFC stacks. According to the evaluation results, we have designed new materials, process and structures of IT-SOFC stacks. IT-SOFC power generation systems and simulated thermal management of those systems were also designed in this project.

**PATENT APPLICATIONS**

1. CATHODE MATERIAL FOR A SOLID OXIDE FUEL CELL AND METHOD FOR MAKING THE SAME/TW(2017).
2. MODULAR PLANAR INTERCONNECT DEVICE FOR A SOLID OXIDE FUEL CELL AND THE SOLID OXIDE FUEL CELL CONTAINING THE SAME/US、TW(2017).
3. FUEL CELL STACK UNIT /TW (2016).
4. MODULAR PLANAR INTERCONNECT DEVICE FOR A SOLID OXIDE FUEL CELL /US(2016).
5. A SOLID OXIDE FUEL CELL AND METHOD /TW(2016).
6. CERAMIC CATHODE MATERIAL OF SOLID OXIDE FUEL CELL AND MANUFACTURING METHOD THEREOF /US(2016).
7. CERAMIC CATHODE MATERIAL AND ITS PREPARATION METHOD/TW(2015).
8. CERAMIC CELL STRUCTURE /TW、US(2015).

IT-SOFC Unit Cell

1kW SOFC Stack

- Development of novel electrolyte material: synthesize of lanthanum silicate through the solid-state synthesis method as IT-SOFC electrolyte materials.
- Development of novel cathode material: synthesize of gadolinium cobaltate through the solid-state synthesis method as IT-SOFC cathode materials.
- Designing the mass production line (5000 cells per month) of the IT-SOFC unit cell including tape casting, lamination, hot isostatic pressing, de-binder and sintering.
- The power and the fuel utilization of the IT-SOFC stacks are more than 1 kW and 70%, respectively. The electrical efficiency of the IT-SOFC unit cells is more than 38%.
- To minimize the cost of IT-SOFC stacks, we have designed punch process and punch dies to continually fabricate the SOFC interconnect boards.
- 1 kW IT-SOFC generation system and its thermal management model has been built with Aspen Plus software.
- Designed and simulated 5 kinds of pure hydrogen anode recycle system models and 2 kinds of natural gas anode recycle system models.