

# 燃燒後二氧化碳捕獲及再利用技術之開發及應用

執行單位

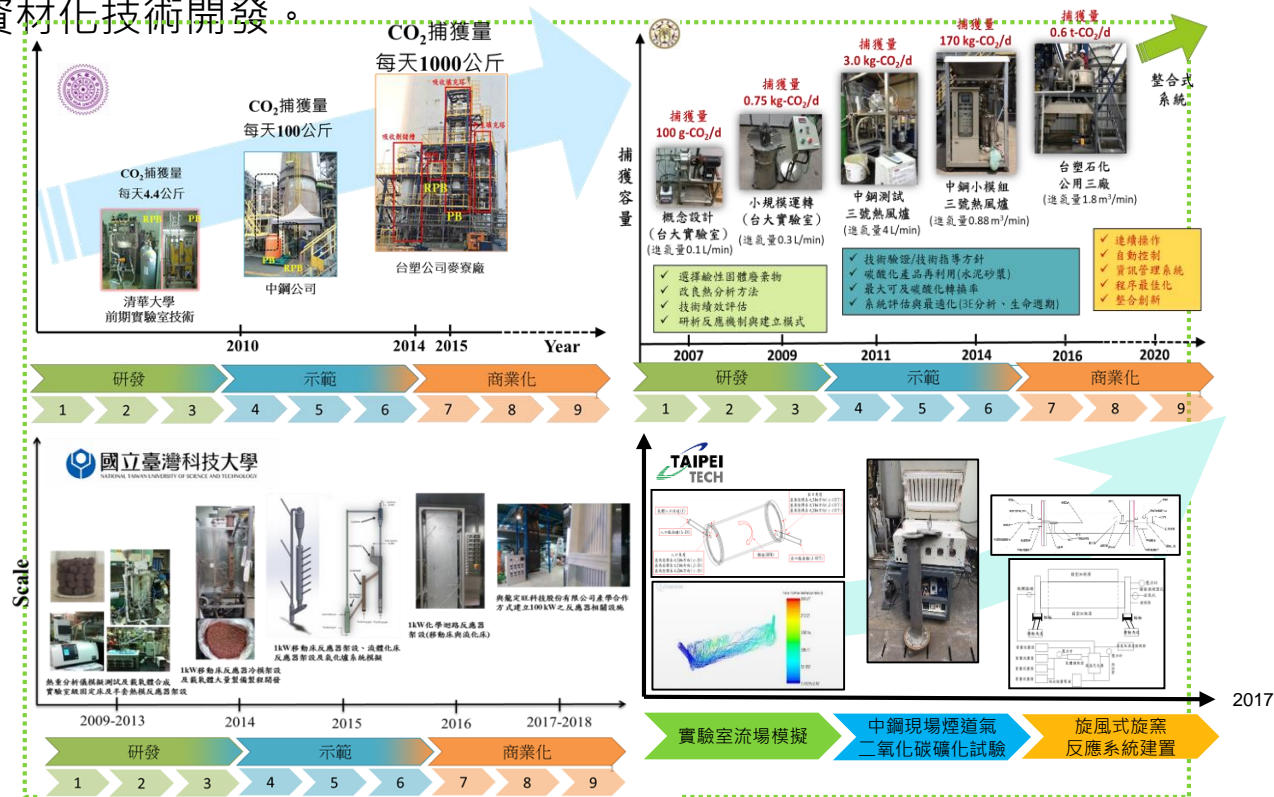
國立清華大學  
化學工程學系

計畫主持人

鄭西顯

- 以化學吸收法捕獲CO<sub>2</sub>應用在火力發電廠、鋼廠及化工廠廢氣淨化排放技術。
- 以超重力碳酸化技術捕獲CO<sub>2</sub>，發展石化廠及造紙廠空氣污染物淨化減量技術，並以碳酸化產物再利用為水泥砂漿，發展綠色水泥材料。
- 以化學迴路程序技術處理光電產業衍生廢溶液。已完成100kW<sub>th</sub>示範場建構。
- 轉爐石二氧化碳礦化及資材化技術開發。

- 二氧化碳捕捉系統與方法/(台/陸/美)/3件
- 利用廢氣改質轉爐石之反應器/(台)/1件
- 超重力碳酸化裝置/(台)/1件
- 不同粒徑爐渣安定化之方法及系統/(台)/1件
- 提升鹼性固體廢棄物碳酸化轉化率之方法
- 鹼性固體廢棄物改質作為綠色建材之方法
- 化學迴路反應器設計/(台)/2件
- 載氧體製備與方法/(台/美)/3件



- 本計畫共包含四項子計畫：「化學吸收法捕獲CO<sub>2</sub>」、「以超重力碳酸化鹼性廢棄物進行碳捕獲與再利用應用與示範」、「化學迴路程序技術的研發」及「CO<sub>2</sub>循環再利用」。總體目標：(1)結合產學研界的研究能量，建立CO<sub>2</sub>捕獲再利用研發平台，開發自主性技術(2)於產業排放源建立示範工廠，實地測試自行開發之CO<sub>2</sub>捕獲及再利用各項技術(3)培養CO<sub>2</sub>捕獲再利用技術的研發人才，提升國內節能減碳技術能量，並協助國內建立新興產業(4)建立國際合作關係，宣示我國CO<sub>2</sub>減量決心及能力。
- 化學吸收法-在台塑石化之示範工廠已完成場域先導示範建置，其捕獲量/捕獲效率/能耗都符合設計預期，達到技術成熟度TRL7;
- 超重力碳酸化技術-在中鋼、正隆及台塑石化之示範廠建置，每日最大碳捕獲量達0.6 噸，達到技術成熟度TRL 7);
- 化學迴路程序技術-已完成實驗室之原型系統在模擬環境測試，達到技術成熟度TRL 6;目前正協助龍定旺公司籌建100kW實廠系統;
- CO<sub>2</sub>循環再利用-在中鋼建立實驗室級轉爐石礦化改質之旋轉式反應器，完成最適化操作分析;建立基因穩定之琥珀酸生產藍綠菌株可達到最高產量5.7 g/L。

# Development and Applications of CO<sub>2</sub> Capture and Utilization Technologies for Post-Combustion

Execution Unit

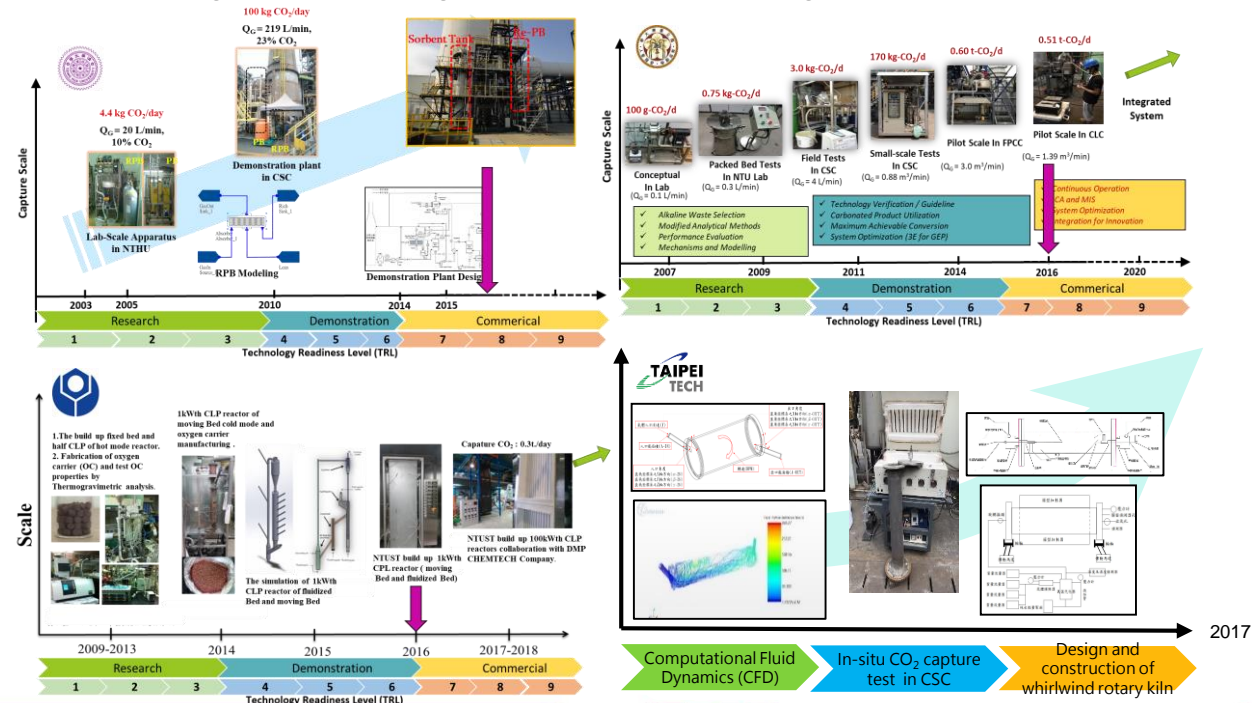
National Tsing Hua University, Department of Ch.E.

Project Director

Professor Shi-Shang Jang

- The chemical adsorption captured CO<sub>2</sub> applied on power, steel and chemical engineering plant.
- Treatment of actual waste solvent of optoelectronics industry in 100kWth fluidized bed pilot.
- Building scale-up demonstration for CO<sub>2</sub> fixation and waste treatment in an incinerator plant. Developing the green construction materials by utilizing the carbonated products. Establishing the waste to resource supply chain for waste and CO<sub>2</sub> emission management toward a circular economy.
- Development of carbonation and recycling of basic oxygen furnace (BOF) slag.

- System and method of CO<sub>2</sub> captured /3 items
- A reactor for property modification of basic oxygen furnace using exhaust gas/1 item
- High gravity carbonation equipment
- A method of slag stabilization with various particle sizes
- Enhancement of carbonation conversion for solid wastes
- Utilization of alkaline wastes for green construction materials
- Design reactor of chemical looping process /2 items
- Fabrication and method of oxygen carrier /3 items



- There are four sub-projects in this integrated project including “CO<sub>2</sub> capture by chemical absorption method”, “Application and demonstration of high-gravity carbonation using alkaline wastes for carbon capture and utilization”, “Development of chemical looping process technology”, and “CO<sub>2</sub> recycle and reutilization”. CO<sub>2</sub> reduction project contain: (1) Establishment of a platform for research and development on post-combustion CO<sub>2</sub> capture and reuse in Taiwan from which local industries, academia, and research institutes can be linked; (2) Construction and operation of pilot plants at the CO<sub>2</sub> emission sites to test our own developed CO<sub>2</sub> capture and reuse technologies; (3) Education and training of professionals that specialize in CO<sub>2</sub> emission reduction for both academia and industry; (4) Participation in international network on CO<sub>2</sub> reduction cooperation with foreign institutions to demonstrate the resolve and capabilities of Taiwan on reducing CO<sub>2</sub> emission.
- **Chemical Absorption Method: The pilot plant was built on FPC, CO<sub>2</sub> capture rate, amount and energy consumption are meet the process design, the TRL reach 7.**
- **High-Gravity Carbonation Technology:** Demonstrations of pilot-scale were carried out in CSC, FPC and CLC. With the maximum achievable capture capacity of 0.6 CO<sub>2</sub>-tons/day, the TRL has grown to 7.
- **Chemical Looping Process:** We are already establish 1kWth reactor of chemical looping process at National Taiwan University Science Technology (NTUST), Technological readiness level was reached six levels. 100kWth reactor was establish with DMP CHEMTECH Company for treatment waste solvent in A.D. 2017.
- **CO<sub>2</sub> recycle and reutilization:** Establishment of laboratory-scale whirlwind rotary kiln converter of stone mineralization and modification, to complete the operation of the most appropriate analysis in CSC.