【低碳能資循環科技】

- **純氧/富氧燃燒、生物質/化石燃料混燒**

結合化石燃料與生質物混燒，可減少使用化石燃料，同時有助於生物質/廢棄物去化與再利用，本團隊利用 280kW$_{th}$ 準工業級燃燒試驗爐進行包括粉煤、生質料、各式燃油、乳化燃油等各種固態與液態燃料之空氣、富氧與純氧單燒與混燒試驗，搭配氣體分析儀進行排放分析，純氧燃燒實驗煙道氣中乾基二氧化碳濃度皆可超過 90%，純氧燃煤煙道氣二氧化碳濃度最高可達 94%，與國際間最頂尖研究機構實驗爐相當，成功展現煙道氣迴流與以微正壓技術開發成果。

圖 1 280kW 準工業級燃燒試驗系統平台

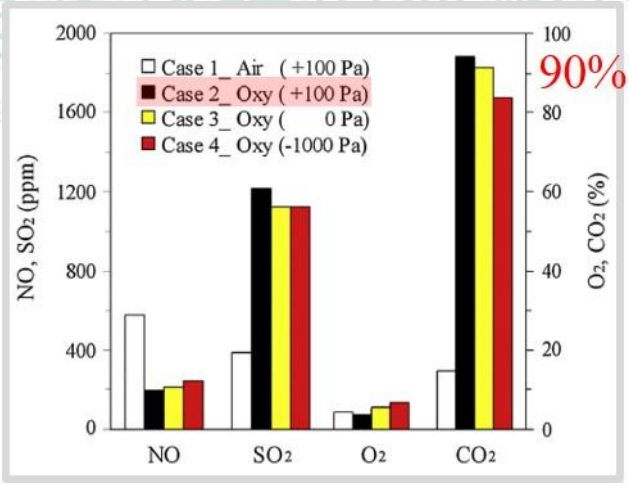

圖 2 純氧燃燒之煙道氣迴流技術，其 CO_2 濃度可達 90%以上

- **氣化爐開發、生物質廢棄物氣化技術**

本團隊與中科院、台灣正久機械公司合作，開發國內首座雙流體化床生質氣化爐，以生質廢棄物氣化技術及共燒節能減排兩條應用路徑逐步落實研發成果。雙流化床氣化爐由一個 600 kW$_{th}$ 氣化爐與一個 200 kW$_{th}$ 燃燒爐所組成，並於成功大學歸仁校區建置國內首座準工業級氣化爐試驗平台，同時以此設備進行先進內循環流化床氣化系統與技術開發，產出較潔淨的合成氣，減少直接燃燒固態燃料，達到排放汙染減少之目的。

圖 3 600kW$_{th}$ 雙流體化床生質氣化爐

圖 4 600kW$_{th}$ 雙流體化床生質氣化爐示範平台

- **爐渣再利用**

  利用不銹鋼廠煉鋼爐碴與副產品進行高性能建材開發，以相對低耗能、低製程成本及搭配改質劑之方式完成不銹鋼爐碴的安定化，及較佳的資源化耐燃摻劑配比，有效降低整體資源化產品製程成本，並大幅提升產品強度與隔熱性能。

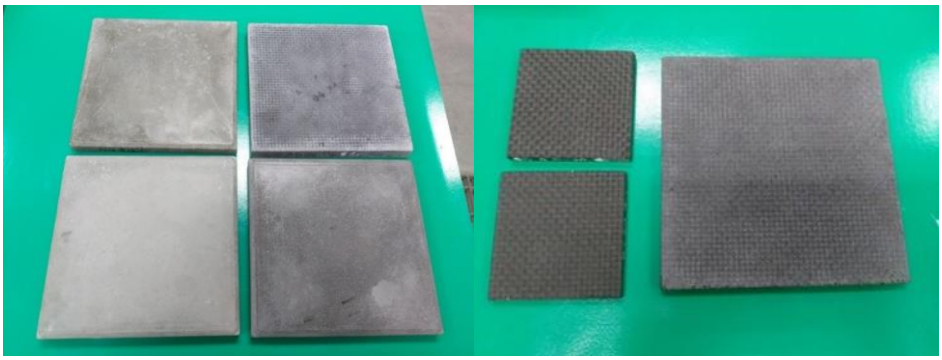

圖 5 資源化產品實作成果

【Flexi-fuel and Recycling materials】

- **Oxy-feul / oxygen-enriched combustion, biomass/fossil fuel co-firing:**

Co-firing of fossil fuel and biomass can reduce the consumption of fossil fuels, and help reuse biomass/waste. A 280kW_{th} furnace system is used to carry out the combustion of pur air, oxygen-enriched or oxy-fuel combustion of single or the blens of various solid and liquid fuels. A gas analyzer is used for emission analysis and the concentration of CO_2 on the dry basis in the flue gas of oxy-combustion can exceed 90%. The CO_2 concentration of oxy-coal combustion in flue gas can reach up to 94%.

- **Gasifier development, biomass/waste gasification:**

RCETS cooperated with National Chung Shan Institute of Science and Technology and Taiwan Masahisa Machinery CO., LTD. to develop the first domestic dual fluidized bed gasifier, which includes a 600kW_{th} steam gasifier and a 200kW_{th} air burner. The first quasi-industrial scale gasifier test platform was built on the Guiren campus of National Cheng Kung University. This internal circulating fluidized bed gasification system could produce clean syngas and help reduce the direct combustion of solid fuel, and reduce emissions.

- **Slag utilization:**

The slag of stainless steelmaking furnaces and by-products were used for the development of high-performance building materials. With the relatively low energy consumption and low process cost, modifiers were used for the stabilization of stainless steel slag. The blending ratio was optimized to effectively reduce the overall process cost of building materials, and greatly improve their strength and thermal insulation performance.