

# 碳基能源永續潔淨利用技術發展

執行單位

核能研究所

計畫主持人

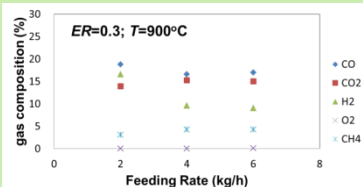
邱耀平

- 建構自主性氣化關鍵技術整合中高溫氣體淨化技術之驗證設施。
- 產業推動以生質/廢棄物電熱應用(發電業、環保業)、廢棄物能源化(鋼鐵業)與煤炭潔淨利用(能源服務業)等為重點領域。產業應用規模在  $MW_{th}$  等級以上。

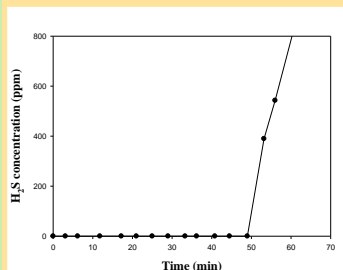
- ✓ 至106年底
- ✓ 申請：8案
  - 中華民國：3案
  - 美國：5案
- ✓ 獲得：14案(含前期)
  - 中華民國：8案
  - 美國：6案
- ✓ 「多段式流動顆粒床過濾裝置」專利獲得2015年台北國際發明暨技術交易展競賽區銀牌獎
- ✓ 專利應用：2案



氣化爐



不同進料速率之生成氣體 (合成氣) 組成



商用脫硫劑(CF-01)貫穿曲線



中高溫合成氣淨化系統

- 本計畫目標為，建構具前瞻性的自主化氣化系統工程技術，推動MW級系統建置以及低碳能源技術產業化應用。
- 建立100 kW<sub>th</sub> 級流體化床氣化系統，結合中高溫氣體淨化程序，並進行發電應用示範。
  - ◆ 完成空氣條件下，變動操作溫度、當量比、進料量等參數對於氣化合成氣的影響分析；並進行加入蒸汽輔助氣化之試驗。
  - ◆ 完成富氧狀態 (氧氣濃度為35%與50%) 下之氣化性能試驗，結果顯示熱值隨著氧氣濃度增加而提升。
  - ◆ 合成氣之中高溫淨化程序可提高系統熱效率。本計畫已利用小型固定床反應器建立脫硫劑特性料庫，並以Aspen plus模擬雙流體化床反應系統；利用CF-01鐵系脫硫劑於30kW<sub>th</sub> 系統測試實驗結果顯示，入口硫化氫濃度1000ppm之反應氣體歷經180分鐘測試後，硫化氫出口濃度皆低於2ppm。

# Technology Development of Clean Carbon as Sustainable Energy (CaSE)

Execution Unit

Institute of Nuclear Energy Research

Project Director

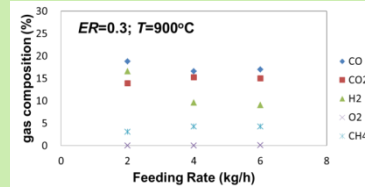
Yau-Pin Chyou

- This work focuses on clean carbon-based energy technologies, and completes the commissioning of an integrated test facility for clean carbon system, consisted of gasification and warm/hot gas clean-up platforms.
- Industrial applications: MW<sub>th</sub>-scale facility for electricity, heat, chemical, and so on.

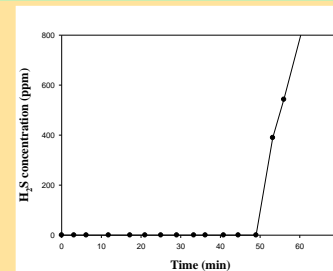
- ✓ Patent (till 2017)
- ✓ Application: 8
  - Taiwan : 3
  - US : 5
- ✓ Granted: 14 (incl. former cases)
  - Taiwan : 8
  - US : 6
- ✓ Silver metal award: 2015 Taipei Int'l Invention Show & Technomart
- ✓ Utilization: 2



Gasifier



Syngas Composition with Various Feeding Rate



Breakthrough Curve of Sorbent (CF-01)



Warm/Hot Gas Cleaning

- The 100 kW<sub>th</sub>-class fluidized-bed gasifier integrates the warm/hot gas clean-up reactor and electricity generator into an integrated test facility for clean carbon utilization.
  - ◆ The effects of operating temperature, equivalence ratio, feeding flow rate, and partial steam condition on the syngas composition and heating value, with air as gasifying agent, were investigated to identify proper operation conditions.
  - ◆ Gasification tests under oxygen-rich condition (35% and 50%, respectively) were performed, and the results show that heating value increases as the oxygen content increases.
  - ◆ The physical and chemical properties of the sulfur sorbents were evaluated by a fixed-bed reactor. Using the Aspen Plus tool, a 30 kW dual fluidized-bed adsorption-regeneration system was simulated this year. The CF-01, the ionic desulfurization agent, was tested with the commissioned 30 kW<sub>th</sub> fluidized-bed reactor. The results show that the outlet hydrogen sulfide concentration is less than 2 ppm, as the inlet hydrogen sulfide concentration around 1000 ppm, during the experimental period of 180 minutes.