INER-F0887 **INER-F0887**

出國報告（出國類別：其他）

赴韓國出席 ASCON 會議發表論文及參訪出國報告

服務機關：核能研究所
姓名職稱：邱耀平　研究員
派赴國家：韓國
出國期間：103 年 11 月 9 日~103 年 11 月 18 日
報告日期：104 年 1 月 15 日

摘　要

本次公差主要係赴韓國麗水參加 ASCON-IEEChE (The 4th Asian Conference on Innovative Energy and Environmental Chemical Engineering) 研討會，並發表論文。另順道赴首爾地區參訪 Konkuk University 及 Sungkyunkwan University，就流體化床、化學迴路技術等議題進行交流。

ASCON-IEEChE 是兩年一度之能源及環境化工技術領域國際盛會，由亞洲各國輪流主辦，為掌握低碳能源發展最新研發現況之重要場合。本所訪員另參訪大學，就可能之雙邊合作計畫內容進行討論，推動國際合作。ASCON 大會議題涵蓋**核研所科專計畫的主要內容**，如氣化、碳轉換、流體化床技術等，具備未來性與競爭力；顯示**本所淨碳技術開發計畫符合國際主流趨勢**，值得持續推動。韓國能源研究所 (KIER) 為韓國能源科技研究之主要推動機構，而所拜訪教授之領域與本所淨碳計畫相當契合，未來或可**形成國際合作之重點技術研究團隊**。

目　　　次

摘　要

（頁碼）

一、目　的 · · · · · · · · · · · · · · · · · · 1

二、過　程 · · · · · · · · · · · · · · · · · · 3

三、心　得 · · · · · · · · · · · · · · · · · ·12

四、建　議　事　項 · · · · · · · · · · · · · · ·57

五、附　錄 · · · · · · · · · · · · · · · · · ·59

一、目　的

為推動國家減碳政策，政府積極建構低碳能源發展藍圖；同時，透過國際共同研發，引進淨煤技術及發展碳捕捉與封存，降低國內能源系統的碳排放。核能研究所（以下稱本所）目前亦積極進行能源國家型科技計畫領域之「淨碳技術發展」研究計畫，並配合能源局能專計畫項下之「潔淨低碳多元應用暨氣體處理技術發展」計畫，冀望從永續發展觀點推動自主性潔淨能源技術之建立。有鑑於為有效掌握國際潔淨能源議題，本次公差主要係赴韓國麗水參加第四屆亞洲創新能源及環境化工國際研討會議 (The 4th Asian Conference on Innovative Energy and Environmental Chemical Engineering, ASCON-IEEChE 2014)，並發表會議論文。會議結束後，順道赴首爾地區參訪建國大學 (Konkuk University) 與成均館大學 (Sungkyunkwan University)，就流體化床技術與化學迴路技術等議題進行交流，就雙方國際合作進行洽談工作。

ASCON-IEEChE 是兩年一度之能源及環境化工技術領域國際盛會，由亞洲各國輪流主辦；第四屆大會於 2014 年 11 月 9 日至 12 日於韓國麗水 (Yeosu) 舉行；會議主題涵蓋生質物、生物燃料及生化程序、流體力學、氣體熱裂解及氣化、程序管理創新、合成技術等議題，為掌握低碳能源發展最新研發現況之重要場合。依據大會資料，參與今年 ASCON-IEEChE 大會共計有來自亞洲各國家在低碳潔淨能源、淨煤技術等重點研究領域之學者、專家超過 200 人，顯見會議之國際參與性。

本所目前正積極進行「淨碳技術發展」相關研究計畫，本年度計畫成果論文 "**CHARACTERISTICS COMPARISON OF METAL-BASED OXYGEN CARRIERS FOR CHEMICAL LOOPING COMBUSTION**" 已被 ASCON-IEEChE 2014 大會接受。故派員參與會議，發表論文，並與國際學者專家討論、分享核研所近年來在淨碳技術的研究成果；藉以掌握國際間化石燃料之使用、燃燒與氣化、氣體淨化以及煤炭轉化技術之發展與趨勢，拓展與國際學者專家之關係及國際合作。

其次，建國大學與成均館大學為韓國知名高等教育學府，具有悠久的歷史，分別座落在韓國首都首爾 (Seoul) 市區與郊區京畿道水原市 (Suwon)。今年 ASCON-IEEChE 大會由韓國化工學會主辦，並召集多所大學相關領域教授組成籌備委員會，負責推動會務；大會秘書長由建國大學化工系 Jeong-Hoo Choi 教授擔任，另成均館大學 Dong Hyun Lee 教授亦列名籌備委員。筆者此行趁赴韓國出席第四屆亞洲能源及環境化工國際研討會議公差之便，應邀請順道於會後自麗水前往首爾地區參訪該兩所大學；就可能之雙邊

合作計畫內容進行討論，包含化學迴路、流體化床實驗技術研究等，推動國際合作。藉此機會，亦可深入瞭解目前國際上之 CLP 技術研究重點及最新發展趨勢。另外，經由與相關研究人員交流，可望拓展與亞洲能源學者專家之人脈及國際合作。故本所此次派員赴韓國公差乃為拓展國際人脈、推動國際合作及實務驗證專業工程技術之甚佳機會。

二、過　程

（一）公差行程

本次公差自民國 103 年 11 月 09 日至 11 月 18 日止，共計 10 天 (圖 II-0)。

11 月 09 日(星期日)　自台灣松山機場 (TSA) 出發，抵達韓國金浦 (GMP) 國際機場，轉往國內機場航廈換機，抵達麗水市 (RSU) 機場

11 月 09 日(星期日) ～ 11 月 12 日(星期三)　停留麗水
辦理會議註冊，出席 ASCON-IEEChE 2014 (The 4th Asian Conference on Innovative Energy and Environmental Chemical Engineering) 國際會議，發表論文

11 月 13 日(星期四)　麗水市 (RSU) 搭機，抵達金浦 (GMP) 機場，前往首爾

11 月 14 日(星期五)　參訪 Sungkyunkwan University

11 月 15 日(星期六) ～ 11 月 16 日(星期日)　停留首爾
準備會議及參訪資料

11 月 17 日(星期一)　參訪 Konkuk University，進行研究交流討論

11 月 18 日(星期二)　仁川 (ICN) 國際機場搭機，返回台灣桃園 (TPE) 國際機場，返抵台北

（二）第四屆亞洲能源及環境化工國際研討會議 (The 4th Asian Conference on Innovative Energy and Environmental Chemical Engineering, ASCON-IEEChE 2014)

ASCON-IEEChE 是由亞洲各國化工學會輪流主辦，為兩年一度之能源及環境化工技術領域國際盛會，第四屆大會於 2014 年 11 月 9 日至 12 日於韓國麗水 (Yeosu) 舉行 (圖 II-1 ~ II-6)；會議主題涵蓋生質物、生物燃料及生化程序、流體力學、氣體熱裂解及氣化、程序管理創新、合成技術等議題。今年 ASCON-IEEChE 2014 大會者共計有來自亞洲各國家在相關重點研究領域之學者、專家、研究生等超過 200 人參與。

ASCON-IEEChE 2014 之議程如表 II-1 所示，會議自 11 月 9 日（星期日）開始註

冊，並於當天晚上舉行歡迎茶會。星期一早上開始進行兩天之會議議程，安排上、下午各分為兩個時段，同時各有兩個平行場次之口頭論文發表。壁報論文則在星期一下午在會場大廳展示，從 15:00 開始到傍晚 - 18:00。而在星期三當天則安排前往 GS Caltex 進行技術參訪行程。

大會口頭論文發表場次的領域列舉如下：

1. BIO- Biomass, Biofuel, and Biochemical Processes;
2. CMB- Combustion;
3. FLD- Fluid Dynamics;
4. GAS- Pyrolysis and Gasification;
5. PM- Program Management for Promoting Innovation;
6. SIM- Process Simulation;
7. SYN- Syntheses;
8. CCU-CO2 Capture and Utilization;
9. ECN- Energy Conversion;
10. EPR- Environmental Protection.

（三）參訪成均館大學

筆者此行趁赴韓國出席 ASCON-IEEChE 2014 會議公差之便，順道轉往首爾 (Seoul) 地區 (圖 II-7 ~ II-12)，參訪成均館大學 (Sungkyunkwan University)。成均館大學擁有著兩座美麗的校園：人文與社會科學校區以及自然科學校區。其中，自然科學校區建於 1978 年，位於首爾南郊 45 公里之京畿道水原市 (Suwon) ，占地 250 英畝 (圖 II-13 ~ II-14)。筆者此行主要係參訪化工系教授，討論包含未來能源技術、氣化、氣體淨化、流體化床實驗技術研究現況等。

（四）參訪建國大學

筆者此行赴韓國公差行程之終點為首爾，在此順道參訪建國大學 (Konkuk University)。建國大學創立於 1946 年，總校位於首爾，另在忠州市設有分校。大學校園裡寬敞明亮，環境優美宜人，綠樹蔥蔥，湖光燦爛，大學氣氛和美麗的景色淡然混為一體 (圖 II-15)。筆者此行主要係參訪化工系教授，討論包含未來能源技術、氣化、流體

化床實驗技術、化學迴路程序 (Chemical Looping Process, CLP) 技術相關計畫研究現況進行交流 (圖 II-16)。

筆者在韓國的公差行程於 11 月 17 日告一段落，次日即自仁川 (ICN) 國際機場搭機，返回台灣桃園 (TPE) 國際機場，於 11 月 18 日（星期三）返抵台北，結束本次公差行程。

§II　有關 2014 KR 公差行程之圖表

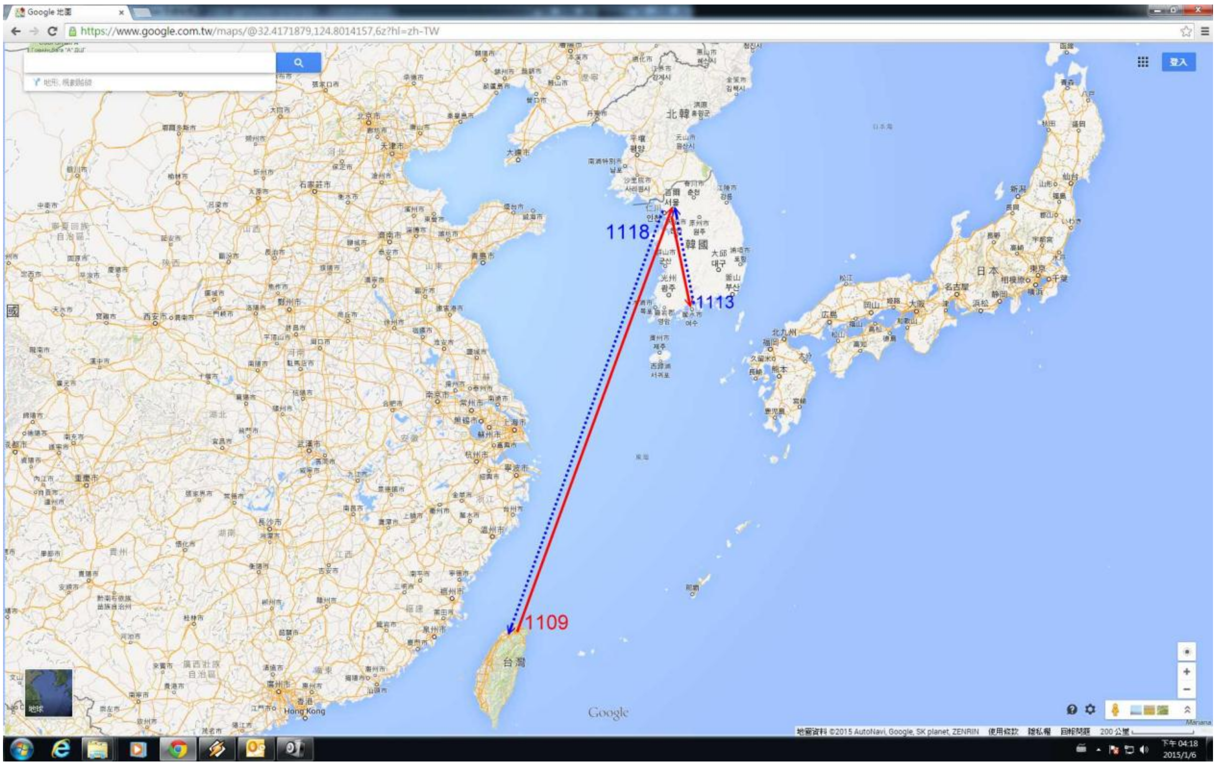
表 II-1：ASCON-IEEChE 2014 之議程

OVERALL SCHEDULE (FINAL)

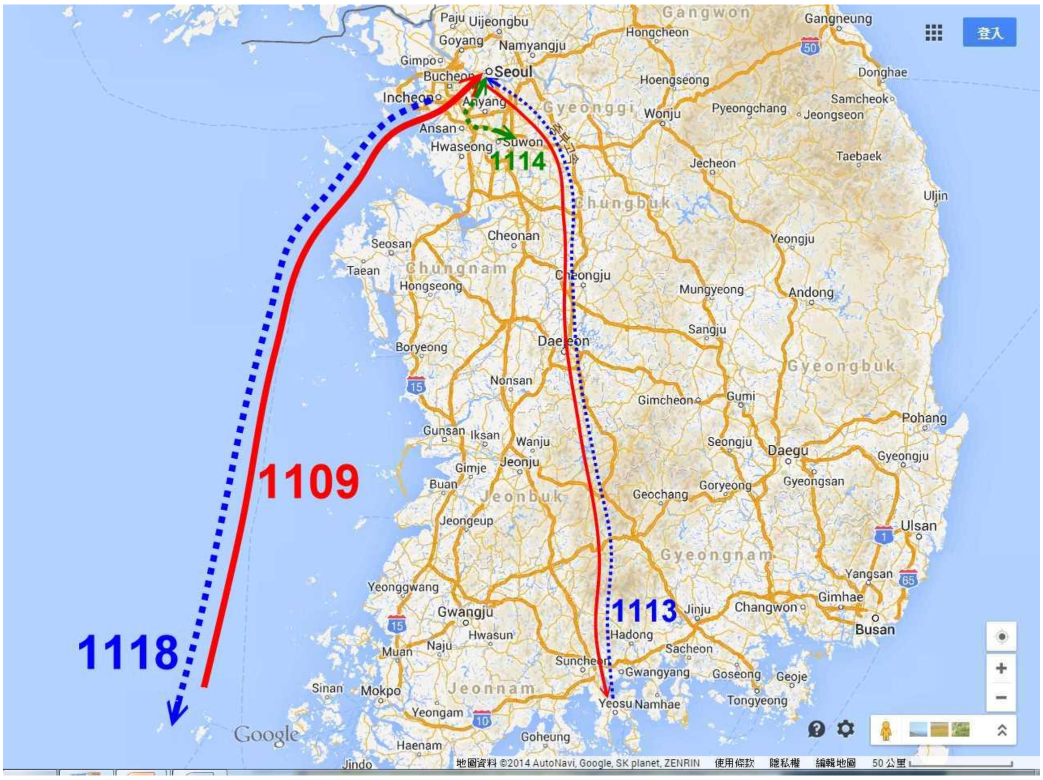
Time		November 9 (1st day: Sun.)	November 10 (2nd day: Mon.)		November 11 (3rd day: Tue.)		November 12 (4th day: Wed.)
			Room 1	Room 2	Room 1	Room 2	
8:30	9:00		Registration		Registration		Technical Tour: GS Caltex & Sightseeing with Lunch & Dinner
9:00	9:20		CMB-1	GAS-1	GAS-5	PM-1	
9:20	9:40		CMB-2	GAS-2	GAS-6	PM-2	
9:40	10:00		CMB-3	GAS-3	GAS-7	PM-3	
10:00	10:20		CMB-4	GAS-4	GAS-8	PM-4	
10:20	10:40		Coffee break		Coffee break	PM-5	
10:40	11:00		SYN-1	FLD-1	BIO-1	PM-6	
11:00	11:20		SYN-2	FLD-2	BIO-2	PM-7	
11:20	11:40		SYN-3	FLD-3	BIO-3	PM-8	
11:40	12:00		SYN-4	FLD-4	BIO-4	PM-9	
12:00	12:20		SYN-5	FLD-5	BIO-5		
12:20	13:40		Lunch		Lunch		
13:40	14:00		SYN-6	SIM-1	CMB-5	GAS-9	
14:00	14:20	Registration	SYN-7	SIM-2	CMB-6	GAS-10	
14:20	14:40		SYN-8	SIM-3	CMB-7	GAS-11	
14:40	15:00		SYN-9	SIM-4	CMB-8	GAS-12	
15:00	15:20				Coffee break		
15:20	15:40		IC Meeting* (15:30-16:30) Poster session (Coffee served)		SYN-10	FLD-6	
15:40	16:00				SYN-11	FLD-7	
16:00	16:20				SYN-12	FLD-8	
16:20	16:40				SYN-13	FLD-9	
16:40	17:00						
17:00	18:00						
18:00	20:00	Welcome Reception	Banquet		Farewell Party		

* The International Coordinators Meeting will be held in the Organizing Committee Room (1st Floor) at 15:30-16:30, November 10, 2014 (Monday).

BIO- Biomass, Biofuel, and Biochemical Processes; CMB- Combustion; FLD- Fluid Dynamics; GAS- Pyrolysis and Gasification; PM- Program Management for Promoting Innovation; SIM- Process Simulation; SYN- Syntheses; CCU-CO_2 Capture and Utilization; ECN- Energy Conversion; EPR- Environmental Protection



A. 亞洲—台韓全程（2014.11. 09. ~ 18）



B. 韓國境內轉機與地面交通

圖 II-0：　公差行程示意圖

圖 II-1：ASCON-IEEChE 2014 會場地點

圖 II-2：韓國麗水（Yeosu）市區周邊景象之一 (Photo @ ASCON 2014 website)

圖 II-3：韓國麗水（Yeosu）市區周邊景象之二（空中鳥瞰）

圖 II-4：韓國麗水（Yeosu）市區周邊景象之三 (Photo @ ASCON 2014 website)

圖 II-5：ASCON 2014 會場日出景象

圖 II-6：韓國麗水（Yeosu）市區地標景象 (Photo @ ASCON 2014 website)

圖 II-7：首爾（Seoul）市區夜間景象之一

圖 II-8：首爾（Seoul）市區夜間景象之二

圖 II-9：首爾（Seoul）市區景象之一

圖 II-10：首爾（Seoul）市區景象之二

圖 II-11：首爾（Seoul）市區活動景象之一

圖 II-12：首爾（Seoul）市區活動景象之二

圖 II-13： 成均館大學 (Sungkyunkwan University) 人文與社會科學校區以及自然科學校區資訊

圖 II-14： 成均館大學 (Sungkyunkwan University) 自然科學校區三星學術情報館景象

圖 II-15：　建國大學 (Konkuk University) 校園地圖資訊

圖 II-16：　筆者與建國大學 (Konkuk University) 化工系 Jeong-Hoo Choi 教授合影

三、心　得

本次公差主要係前往韓國麗水參加第四屆亞洲創新能源及環境化工國際研討會議 (The 4th Asian Conference on Innovative Energy and Environmental Chemical Engineering, ASCON-IEEChE 2014)，並發表會議論文。會議結束後，順道赴首爾地區參訪建國大學 (Konkuk University) 與成均館大學 (Sungkyunkwan University)，就流體化床技術與化學迴路技術等議題進行交流，就雙方國際合作進行洽談工作。本報告將依序分別選擇重點摘要於下文中。

（一）ASCON-IEEChE 2014 大會

第四屆亞洲創新能源及環境化工國際研討會議 (The 4th Asian Conference on Innovative Energy and Environmental Chemical Engineering, ASCON-IEEChE 2014) 起源於 1988 年開始在東京舉辦之流體化床與三相反應器亞洲會議，此一系列的會議至今已舉行 14 屆。經歷十屆成功的會議後，該會議更名為 ASCON-IEEChE，提供亞洲國家間一個在創新能源和環境領域以及流體化床和多相反應器的論壇，以促進學術和工業部門的技術和科學資訊交流。今年的 ASCON-IEEChE 會議於 2014 年 11 月 9 日至 12 日在韓國麗水 (Yeosu) 舉行，由韓國化工學會主辦 (圖 III-1)；並聯合亞洲各國化工學會協助舉辦，包含日本、臺灣、泰國等，另新加坡則有代表參與。這個聯合活動的目的是提供工程師、研究人員、教授、學生和其他人的平台，展示他們的最新成果、交換想法、建立新的聯繫、建立新的合作關係等。大會議題涵蓋能源、環境、化工領域的技術和工程實務，包括目前的發展趨勢和未來的規畫與需求。

ASCON-IEEChE 2014 會議排程自 11 月 9 日（星期日）揭開序幕，與會者於當天開始報到 (圖 III -2)；晚上並進行歡迎酒會 (圖 III-3 ~ III-4)，類同於開幕典禮。大會的晚宴於 11 月 10 日（星期一）晚上舉行，首先由大會主席致詞歡迎各國與會嘉賓 (圖 III-5 ~ III-6)；隨後，各國化工學會代表輪流上台答謝，並贈送紀念品予主辦單位 (圖 III-7 ~ III-8)。麗水 (Yeosu) 為 2012 年世博 (2012 Expo) 舉辦城市，主辦單位特別準備了世博紀念酒，供與會嘉賓酌飲並相互祈福 (圖 III-9)；席間，並備有卡拉 OK，供與會唱歌助興 (圖 III-10)。其次，下屆大會預定於兩年後移師日本舉辦，大會主席並於會議結束前進行交接 (圖 III-11 ~ III-12)。

本屆大會的技術議程自 11 月 10 日（星期一）早上開始舉行，分為論文口頭發表

及壁報論文展示兩部分，將分章節依序描述於本報告中。

1. Oral Paper Sessions

ASCON 口頭論文發表議程每天上、下午各分為兩個時段，同時各有兩個平行場次之口頭論文發表。各場次排定四至五場專題演講 (Lecture)，另外上、下午各有一段中場休息以為區隔 (圖 III.1.1-1 ~ III.1.1-3)。技術議題涵蓋七項領域，其口頭論文篇數計 60 篇。基於篇幅考量，本報告中摘錄了數場相關的代表性論文加以陳述之。

大會口頭論文發表場次的領域與篇數列舉如下：

(1) BIO: 5 篇;

(2) CMB: 8 篇;

(3) FLD: 9 篇;

(4) GAS: 12 篇;

(5) PM: 9 篇;

(6) SIM: 4 篇;

(7) SYN: 13 篇.

本所淨碳團隊在此次 ASCON 大會中投稿之論文係以口頭宣讀方式發表，被安排在 11 月 10 日(星期一)下午，屬於 Syntheses II 的場次 (圖 III.1.1-4 ~ III.1.1-6)。論文編號為 SYN-6，其簡報演講內容摘要如圖 III.1.1-7 ~ III.1.1-24 所示。筆者之簡報亦獲得在場韓國、日本等與會者之回應討論。

論文＃SYN-8：本論文由 Korea Institute of Energy Research (KIER) [Korea] 的研究人員發表 (圖 III.1.1-25)，演講主題為 “**Operation of Sorption Enhanced Water Gas Shift System Integrated with Coal Gasifier and Hot Gas Cleanup Process for Pre-combustion CO_2 Capture**”，屬於 Fluidized-bed gasification 後端之高溫氣體處理領域。演講內容摘要如圖 III.1.1-26 ~ III.1.1-48 所示。於 Syntheses II 的場次結束後，筆者與演講者 Dr. Ho-Jung Ryu 交換名片；他主動向筆者致意，表示之前曾在國際研討會場合聆聽過筆者發表本所之研發成果。事實上，KIER 的領域與本所淨碳計畫相當契合，相信未來應有可能合作之議題。

論文＃FLD-1：本論文由 Konkuk University [Korea] 的研究人員發表，演講

主題為 “**Correlation on Transport Velocity in an Inclined Fluidized Bed**”，屬於 Fluid Dynamics 領域。演講內容摘要如圖 III.1.1-49 ~ III.1.1-66 所示。

論文＃FLD-3：本論文由 Sungkyunkwan University [Korea] 的研究人員發表，演講主題為 “**Flow Regime Transition of Wide PSD Particle according to Superficial Gas Velocity in the Gas-Solid CFB Riser**”，屬於 Fluid Dynamics 領域。演講內容摘要如圖 III.1.1-67 ~ III.1.1-84 所示。

論文＃GAS-7：本論文由 University of Science and Technology [Korea] 的研究人員發表，演講主題為 “**Comparison between Simulation and Experimental Hydrodynamic Characteristics in a Gasifier with Semi-Dual Fluidized Bed Reactor**”，屬於 Pyrolysis and Gasification 領域。演講內容摘要如圖 III.1.1-85 ~ III.1.1-96 所示。

論文＃GAS-10：本論文由 National Institute of Advanced Industrial Science and Technology (AIST) [Japan] 的研究人員發表，演講主題為 **“Utilizing Volatiles-char Interaction to Improve Tar Cracking in Circulating Fluidized Bed Gasification Reactor”**，屬於 Pyrolysis and Gasification 領域。演講內容摘要如圖 III.1.1-97 ~ III.1.1-114 所示。

2. Poster Session

大會壁報論文發表議程安排在第一天下午，即從 15:20 開始展示到傍晚 - 17:00。在本屆 ASCON 大會中，壁報論文總數達 58 篇，幾乎與口頭發表論文分庭抗禮。大會壁報論文所屬的領域與篇數列舉如下：

(1) BIO: 9 篇;

(2) CCU: 5 篇;

(3) CMB: 1 篇;

(4) ECN: 4 篇;

(5) EPR: 5 篇;

(6) FLD: 7 篇;

(7) GAS: 9 篇;

(8) SIM: 1 篇;

(7) SYN: 17 篇.

筆者抽空參閱了壁報論文發表，以瞭解彼等在未來之研發努力及現況成果。本報告中摘錄了數篇較具相關性的論文與現場盛況展示於後 (圖 III.1.2-1 ~ III.1.2-8)。

3. Technical Tours

今年 ASCON 大會於論文發表研討議程結束後，在 11 月 12 日（星期三）當天則安排前往 GS Caltex 進行技術參訪行程。該煉油廠目前隸屬於韓國大型企業集團 LG 麾下，位於麗水半島北側之工業區內，距離大會地點約二十公里，車程約半小時 (圖 III.1.3-1 ~ III.1.3-2)。當天參訪團抵達後，煉油廠首先安排了簡報議程，進行公司現況簡介 (圖 III.1.3-3 ~ III.1.3-4)；隨後，再驅車前往實廠參觀 (圖 III.1.3-5 ~ III.1.3-10)。

GS Caltex（中文譯名：GS 加德士）成立於 1967 年，為與 Chevron 合資之企業，體認到該國的石油產品不斷增長的需求，形成與 GS 控股的夥伴關係。GS Caltex 建造和經營韓國麗水煉油廠鉅型綜合設施 (Yeosu complex)，為世界第四大和 Chevron 公司的最大單場區煉油廠。今天，GS Caltex 已成長為韓國第二大的能源公司，提供穩定的能源，有助於燃料供應韓國經濟的發展；2010 年，GS Caltex 出口 $ 180 億美金全球範圍內的石油和石化產品。麗水鉅型綜合煉油設施廠區擁有員工 1600 多人，占地近 2.3 平方英里 （6 平方公里）。在典型的一天中，麗水煉油廠處理超過 850,000 桶原油和石腦油原料，並生產符合最高環境標準的運輸燃料。Chevron 提供一半的原油（包括一些抵押股權產能），並使用約一半的出口產品供應在亞太區的客戶。汽油和其他石油產品則運到 20 多個國家。

秉持成為工作的地方社區一個良好的作夥伴的傳統，GS Caltex 基金會成立於 2006 年。到目前為止，該基金已貢獻大約每年度 $ 1000 萬來支援在韓國南部的社會福利專案、教育專案和文化藝術活動。GS Caltex 基金會在麗水市建立了一座價值 $ 9000 萬的文化複合館。這個創新、環保高效的建築坐落在生態友善公園，包括音樂廳、會展中心、能源博物館和天文臺。該計畫成為 2012 年韓國麗水世博會的一部份，在當年 5 月的國際慶祝活動節慶吸引了約 800 萬觀光客。有別於一般產業之運轉實廠，GS Caltex 煉油廠採取相對開放之策略；除了接待一般國際技術研討會與會者之專業參訪團外，亦開放公眾團體之預約參訪。由此可見該公司對公眾關係之著墨頗深，或可供國內業界參考。

（二）參訪成均館大學 (SKKU)

透過 ASCON-IEEChE 2014 大會秘書長 Jeong-Hoo Choi 教授之安排，筆者本次赴韓國公差於回程順道前往首爾 (Seoul) 地區，參訪成均館大學 (SKKU) 與建國大學 (KU)；就可能之雙邊合作計畫內容進行討論，包含化學迴路、流體化床實驗技術研究等，推動國際合作。

筆者於 ASCON-IEEChE 2014 會議結束後次日，即搭機轉往首爾地區，先參訪成均館大學 (圖 III.2-1 ~ III.2-6)。該校 Dong Hyun Lee 教授之研究團隊在第四屆亞洲能源及環境化工國際研討會議中發表數篇論文，多屬 Fluid Dynamics 領域。茲列舉其題目與摘要如下：

(1) **FLD-3: Flow Regime Transition of Wide PSD Particle according to Superficial Gas Velocity in the Gas-Solid CFB Riser**

Abstract

Flow regime transition of wide particle size distribution (PSD) powder was investigated in the circulating fluidized beds of 0.1 m-ID x 3.7 m-high. Iron ore and limestone particles were used as wide PSD powder. To study effect of particle size distribution on flow regime transition, 5 types of mono size glass bead are used. Binary and ternary mixtures have been compounded of mono size glass beads. Bubbling to turbulent regime transition of wide PSD powder has been studied by means of pressure fluctuation analysis. As the superficial gas velocity gradually increases, bubbling to turbulent regime transition occurred in complete fluidized bed. And, effect of fine particle concentration and particle size distribution on bubbling to turbulent regime transition velocity (Uc) has been studied. To predict transition velocity (Uc), the correlation expressed in terms of Rec, Ar and standard deviation of particle size distribution (σp) is proposed. Calculated Uc is in excellent agreement with the experimental data of mono, binary and ternary mixtures.

(2) **FLD-5: Hydrodynamic Characteristics of Bubbles in a Bubbling Fluidized Bed with Internals**

Abstract

Hydrodynamic characteristics of bubble in bubbling fluidized beds with internals were studied. Optical fiber probe was calibrated voltage range from 0.5 V (bubble phase) to 4.5 V (emulsion phase) and the experiment was

progressed with optical probe condition of 903 Hz, 725 s. To obtain improved bubble data, it has been considered data analysis through three processes (threshold determination process, bubble analysis process, erroneous bubble elimination process). The data was compared and analyzed with bed height (0.2 ~ 0.7 m), superficial gas velocity (3 ~ 7 Umf), radial position (r/R = 0.22 ~ 0.95), distributor nozzle numbers (2, 3, 7), and internals with different hydraulic diameter (Deq = 0.19, 0.17, 0.15 m). After, the experimental data were compared with several researchers' empirical correlation. Bubble rise velocity was increased with decreasing distributor's nozzle number, and bubble frequency was increased with decreasing distributor's nozzle number. And when internals were existed, bubble rise velocity was decreased and bubble frequency was increased with decreasing hydraulic diameter because of bubble breaking effect.

(3) **FLD-7: Hydrodynamic Characteristics of Multi-Walled Carbon Nanotube Agglomerates in the Fluidized Beds**

Abstract

Hydrodynamic characteristics of multi-walled carbon nanotube (MWCNT) agglomerates were investigated in the gas-solid fluidized beds of 0.14 m-ID x 2.4 m-high. The average particle size and bulk density of MWCNTs agglomerates were 242 μm and 64 kg/m3, respectively. The particle density of agglomerates was 151 kg/m3 by mercury porosimeter. The MWCNTs agglomerate was fluidized like the Group A particles with increasing the superficial gas velocity. And minimum fluidizing velocity and minimum bubbling velocity were determined by the experimental results. The maximum value of bed expansion ratio was the 2.56 due to very lower bulk and particle density than Group A particles. For particulate fluidization, the MWCNT agglomerate size was predicted using the Zhu model. MWCNT agglomerates belong to group AC boundary. Solid fraction in the dense region was decreased with increasing the axial height. For bubbling fluidization, solid fraction in the freeboard was highly increased with increasing the superficial gas velocity.

(4) **FLD-9: CPFD Simulation of Bubbling Fluidized Beds with Shroud Nozzle Distributor and Vertical Internal: Effect for Bubble Flow**

Abstract

Bubbling fluidized beds with shroud nozzles and vertical internal was simulated using CPFD (Computational Particle-Fluid Dynamics). Fluidized bed which has the size of 0.3 m-ID × 2.4 m-high was modeled by commercial CPFD BARRACUDA® 15. Metal-grade silicon particles (MG-Si) were used to bed

material which have dp = 150 μm, ρp = 2,330 kg/m3, Umf = 0.02 m/s. Total bed inventory was 75 kg and static bed height was 0.8 m. Effect of vertical internal to bubble size and rising velocity were investigated. Bubble was split by internal when z=0.45m. Bed pressure drop and axial solid holdup was not affected by internal. However, when the internal was too close to jet, bubble was not separated and rose bypassing internal, and faster than without internal or z=0.45m.

(5) **FLD-P2: Hydrodynamic Characteristics at Layer Inversion Point in Three-Phase Fluidized Beds with Binary Solids**

Abstract

Layer inversion velocity and liquid holdup at layer inversion point with the superficial gas velocity and the volumetric ratio of binary solids were investigated. Liquid holdup at layer inversion point has been measured in a 0.210 m diameter semi-cylindrical acryl column with the binary solid mixture of polymer beads (dp=3.3 mm, ρs=1,280 kg/m3) and glass beads (dp=0.385 mm, ρs=2,500 kg/m3). Layer inversion point decreased with increasing superficial gas velocity and volume fraction of GB. Liquid holdup at layer inversion point decreases with increasing the volume fraction of PB. In lower gas velocity, layer inversion velocity fit well with the gas perturbed liquid model. However, there is a wide deviation with the gas perturbed liquid model when the gas velocity is increased.

從上述論文之內容可略窺得知，Dong Hyun Lee 教授在流體化床技術 Fluid Dynamics 領域之研究著墨頗深，亦著有成就。本所目前正致力於流體化床實驗技術與系統設計分析研究，所謂「他山之石，可以攻錯」，筆者相信，雙方未來應有聚焦於前述研究主題共同合作之議題，以推動進一步更密切之合作。

（三）參訪建國大學 (KU)

建國大學 (KU) 化工系 Jeong-Hoo Choi 教授曾任職於韓國能源研究所 (Korea Institute of Energy Research, KIER)，一九九零年代後期才轉任教職；從事流體化床、化學迴路程序 (Chemical Looping Process, CLP) 等領域之研究已逾二十年，韓國諸多該領域之研究學者師承其門下，如前述之 Dr. Ho-Jung Ryu 便是。筆者於 ASCON 會議結束

後，轉赴首爾參訪建國大學，就流體化床技術與化學迴路程序技術相關現況進行交流。筆者此行參觀了流體化床實驗室，亦會晤了相關研究人員 (圖 III.3-1 ~ III.3-6)；雙方廣泛交換意見，期望未來能建立合作關係，推動進一步更密切之合作。

依據 Jeong-Hoo Choi 教授之解說，KIER 為韓國能源科技研究之主要推動機構，近年來在學術、技術層面頗為活躍；例如， Dr. Ho-Jung Ryu 之研究團隊在 ASCON 2014 研討會議中發表數篇論文，涵蓋 Fluid Dynamics (FLD-P1, P5, P12)、Pyrolysis and Gasification (GAS-5, 12)、Syntheses (SYN-2, 8) 等領域。筆者此行先於 ASCON 2014 研討會議中結識 KIER 之 Dr. Ho-Jung Ryu，復參訪 KU 與 Jeong-Hoo Choi 教授就未來能源技術、CLP 技術等研究現況與合作可能性進行討論；藉此機會，可深入瞭解目前韓國之技術研究重點及最新發展趨勢，預期未來應能建立合作關係。

§III.1　有關 2014 KR 公差 ASCON 之圖像

Registration

Since 1988
ASCON
ENERGY & ENVIRONMENT
Yeosu, Korea 2014

圖 III-1 ASCON 2014 大會標章

圖 III-2 ASCON 2014 大會報到櫃臺

Welcome Reception

圖 III-3 歡迎晚會場內景象之一

圖 III-4 歡迎晚會場內景象之二

ASCON 2014 Banquet

圖 III-5 大會主席晚宴致詞

圖 III-6 大會晚宴會場內景象

圖 III-7 大會晚宴會場內景象

圖 III-8 大會晚宴會場內景象

圖 III-9 大會晚宴會場內景象

圖 III-10 大會晚宴會場內景象

圖 III-11 下屆大會舉辦資訊

圖 III-12 大會主席交接景象

1. Oral Paper Sessions

圖 III.1.1-1 中場休息景象之一

圖 III.1.1-2 中場休息景象之二

圖 III.1.1-4 Syntheses II 場次的會場內景象

圖 III.1.1-3 中場休息景象之三

圖 III.1.1-4 Syntheses II 場次的會場內景象

圖 III.1.1-5 筆者於 ASCON 2014 大會口頭發表論文景象之一

圖 III.1.1-6 筆者於 ASCON 2014 大會口頭發表論文景象之二

SYN-6: INER 發表論文之口頭簡報摘錄

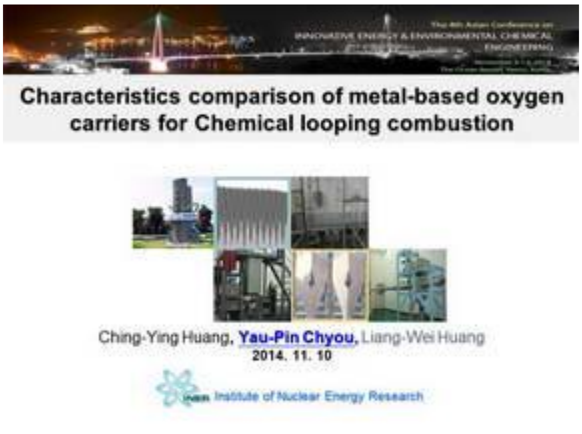


圖 III.1.1-7

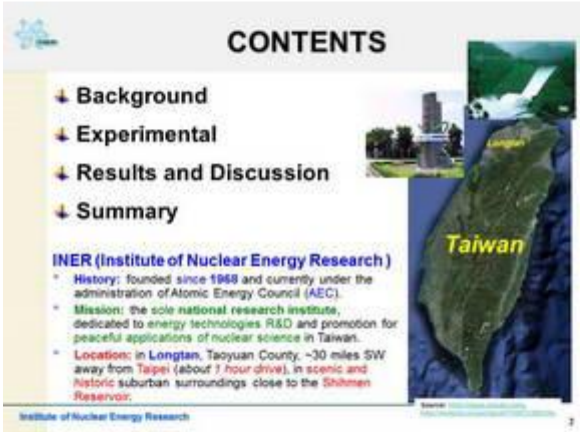


圖 III.1.1-8

圖 III.1.1-9

圖 III.1.1-10

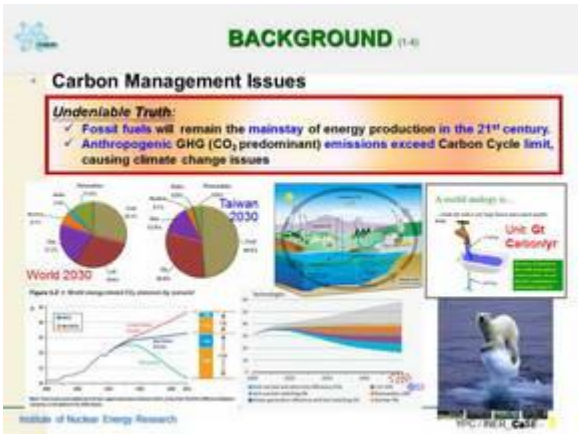


圖 III.1.1-11

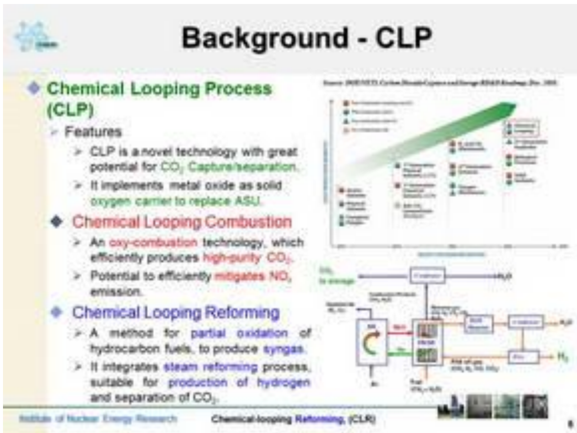


圖 III.1.1-12

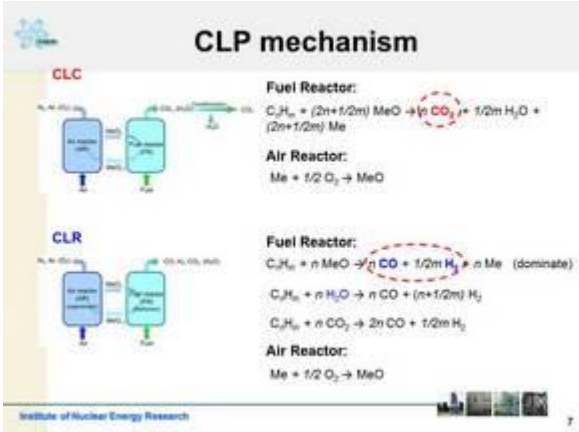


圖 III.1.1-13

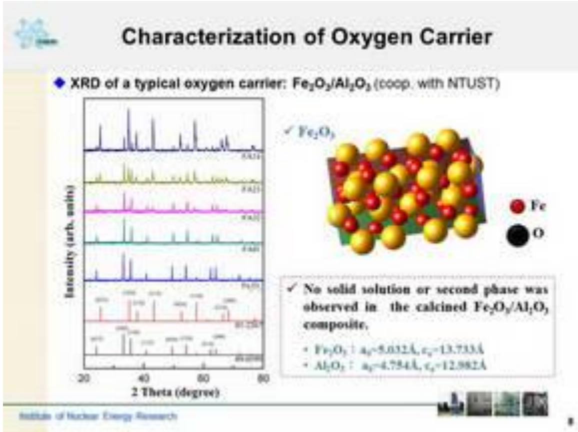


圖 III.1.1-14

圖 III.1.1-15

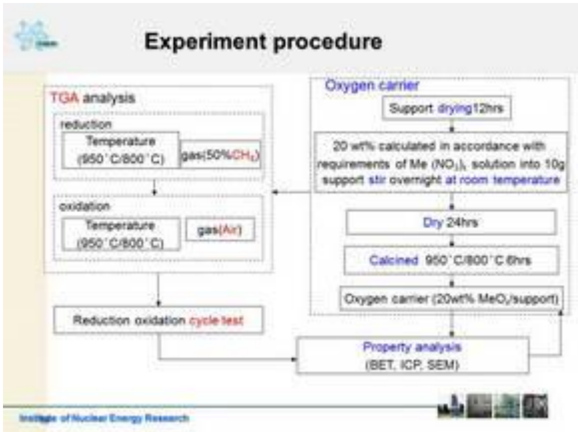


圖 III.1.1-16

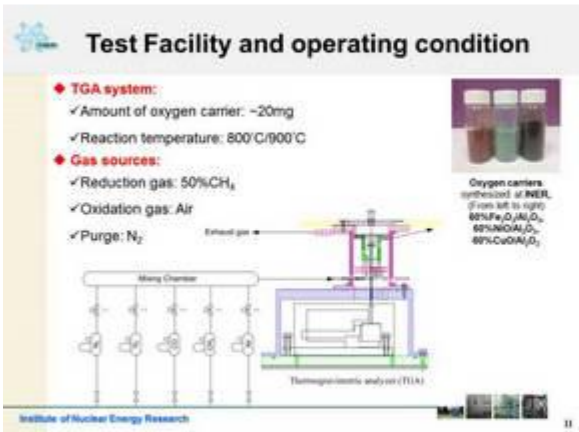


圖 III.1.1-17

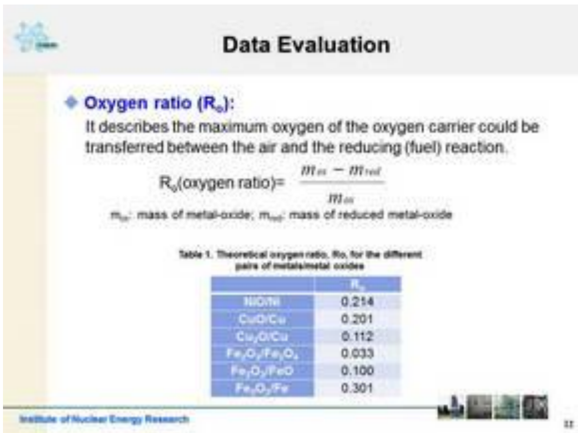


圖 III.1.1-18

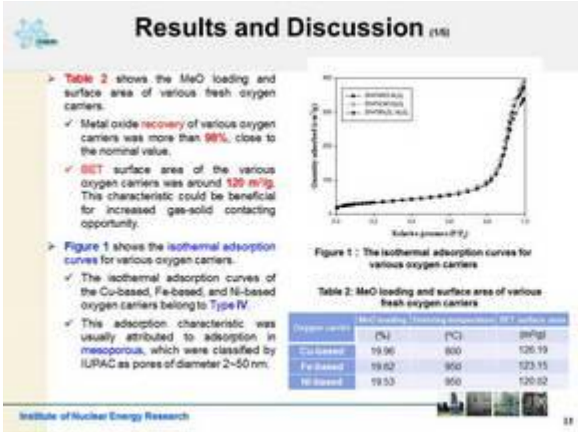


圖 III.1.1-19

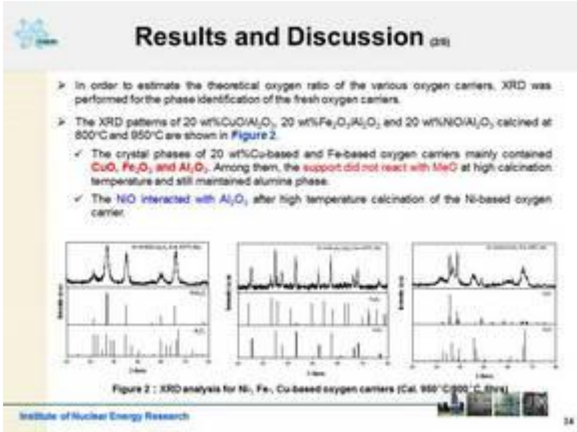


圖 III.1.1-20

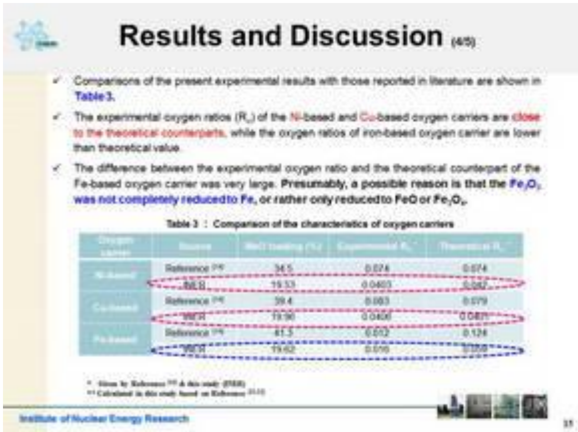


圖 III.1.1-21

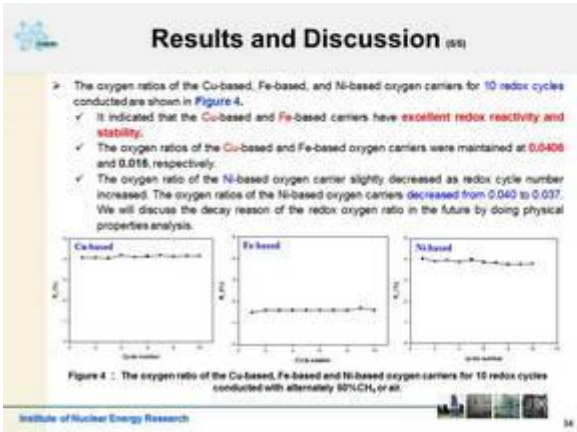


圖 III.1.1-22

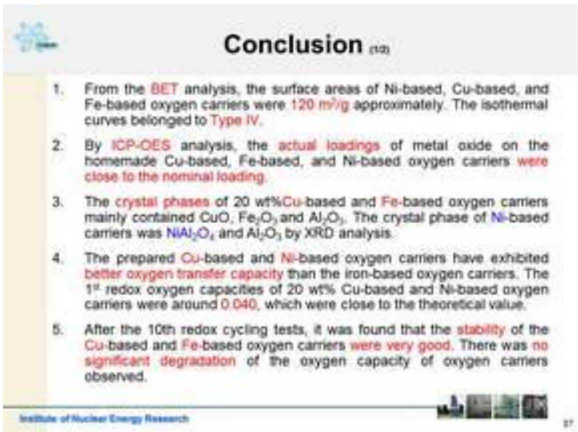


圖 III.1.1-23

圖 III.1.1-24

SYN-8:

圖 III.1.1-25

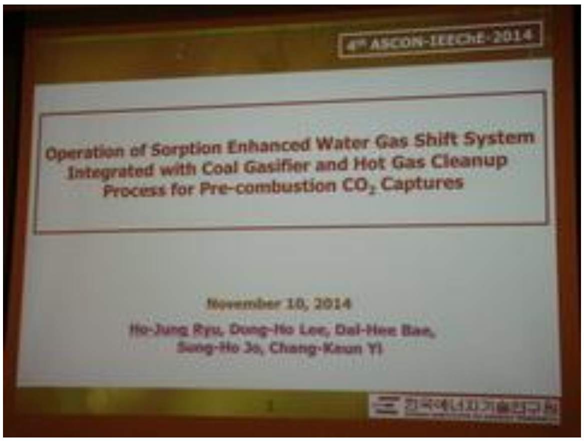


圖 III.1.1-26

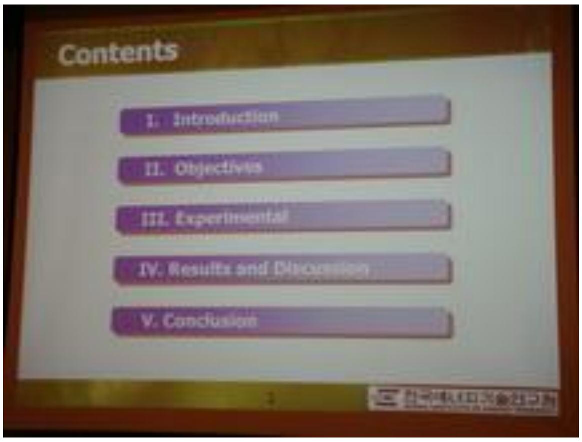


圖 III.1.1-27

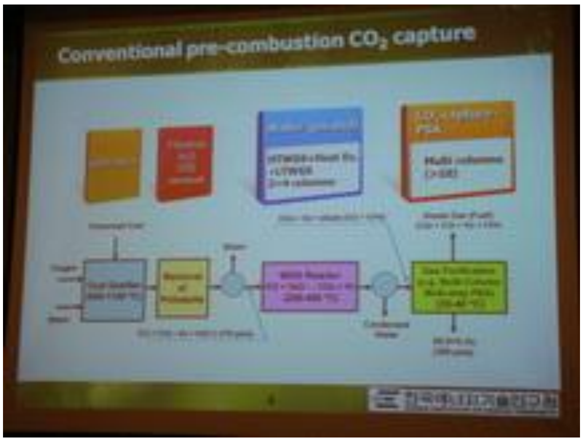


圖 III.1.1-28

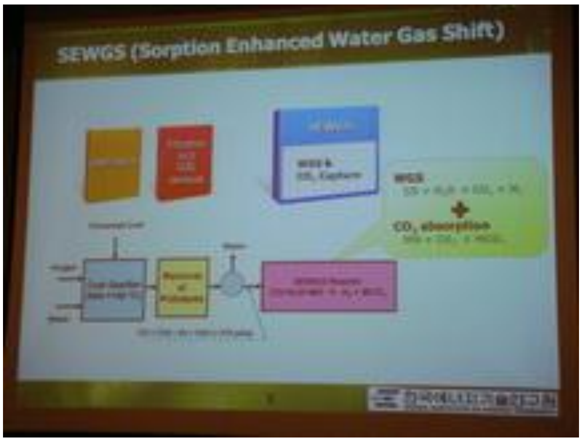


圖 III.1.1-29

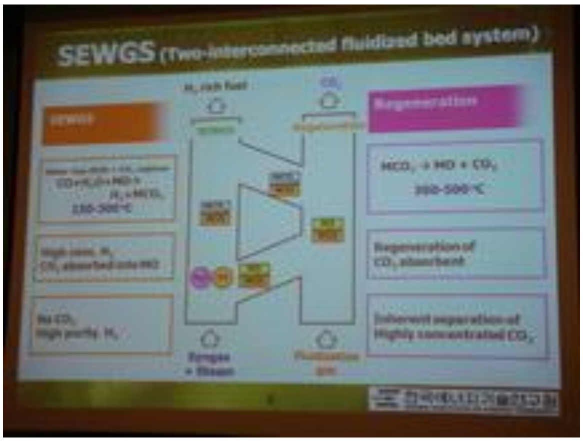


圖 III.1.1-30

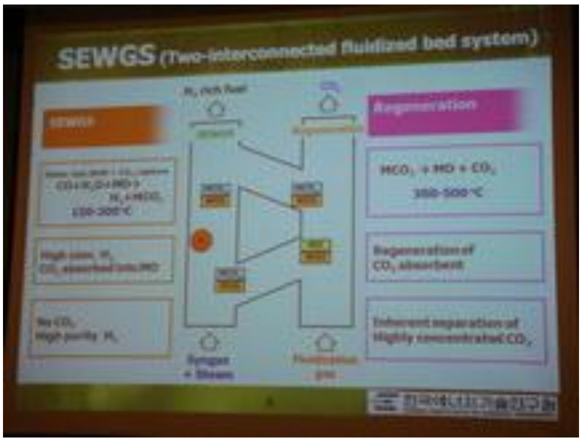


圖 III.1.1-31

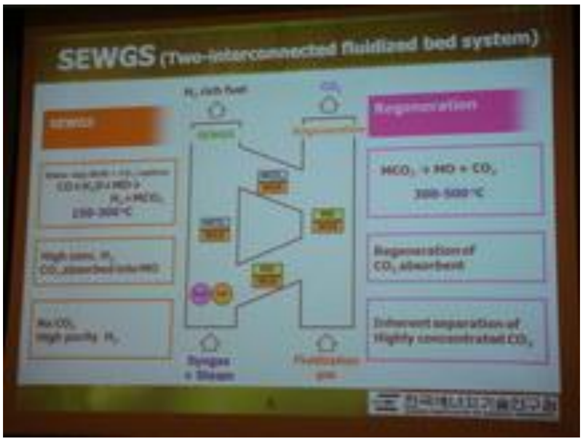


圖 III.1.1-32

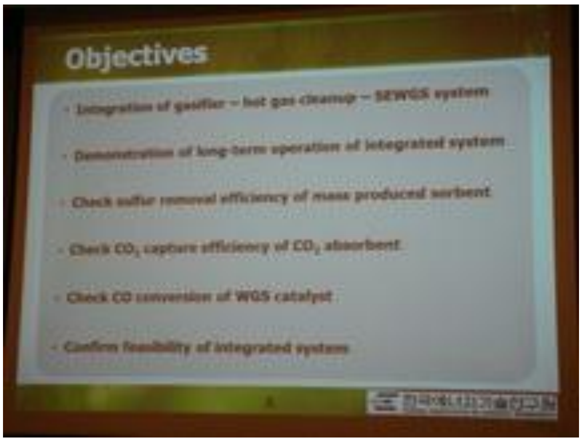


圖 III.1.1-33

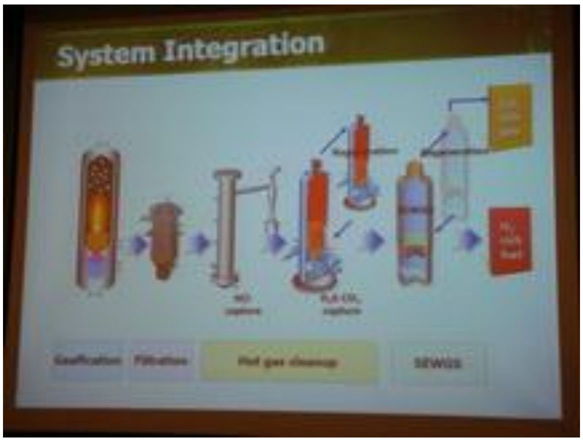


圖 III.1.1-34

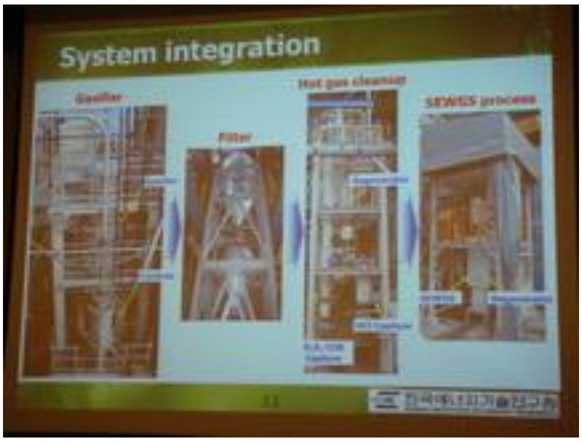


圖 III.1.1-35

圖 III.1.1-36

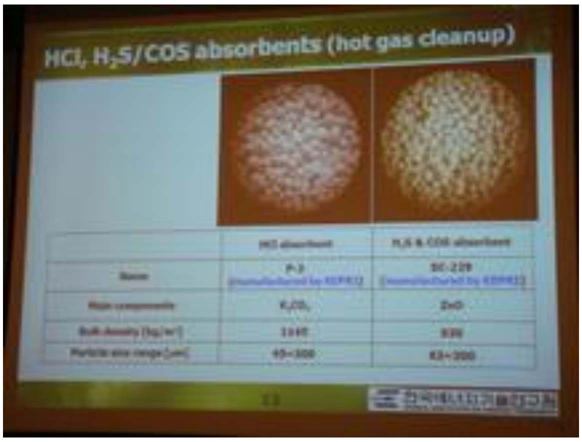


圖 III.1.1-37

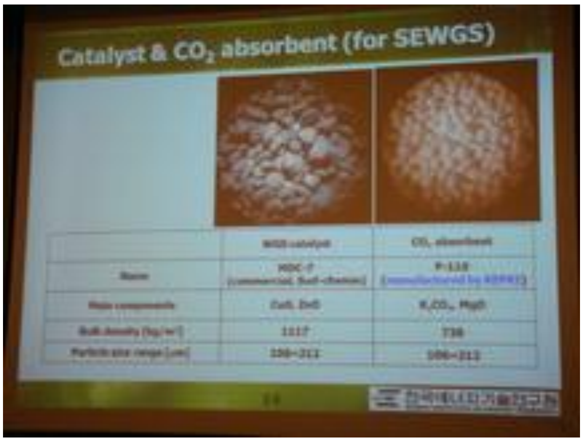


圖 III.1.1-38

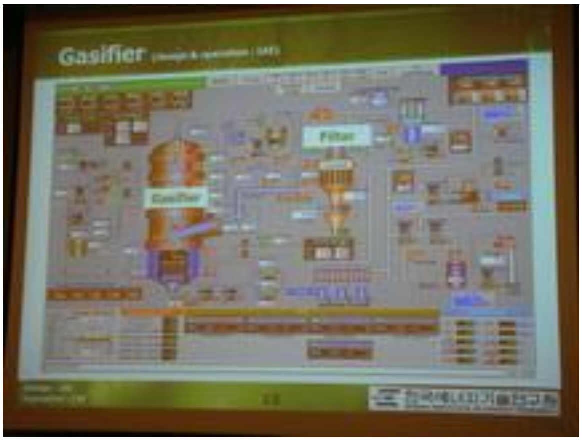


圖 III.1.1-39

圖 III.1.1-40

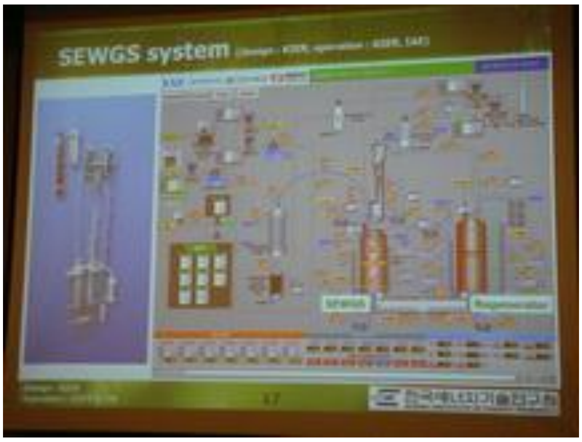


圖 III.1.1-41

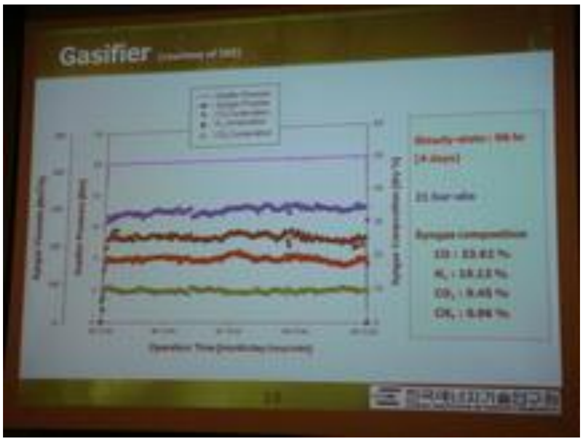


圖 III.1.1-42

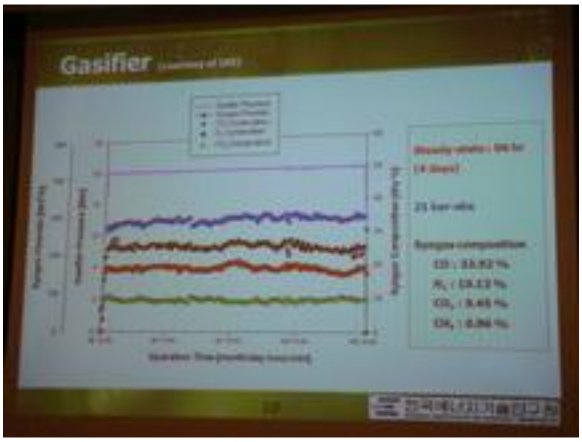


圖 III.1.1-43

圖 III.1.1-44

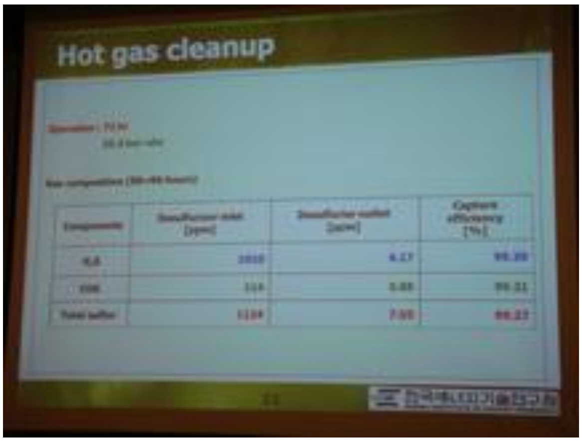


圖 III.1.1-45

圖 III.1.1-46

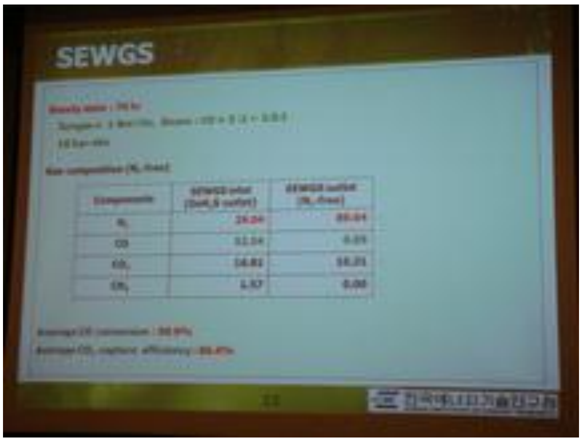


圖 III.1.1-47

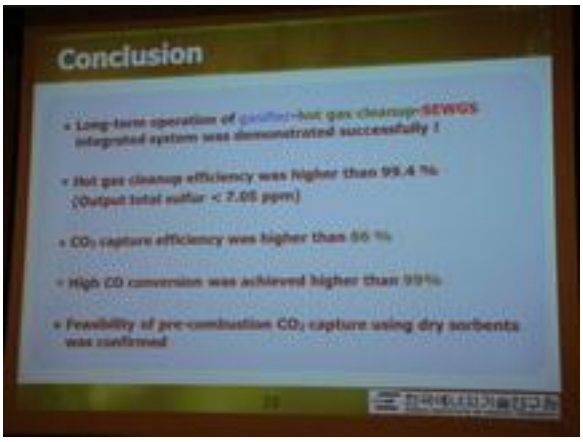


圖 III.1.1-48

FLD-1:

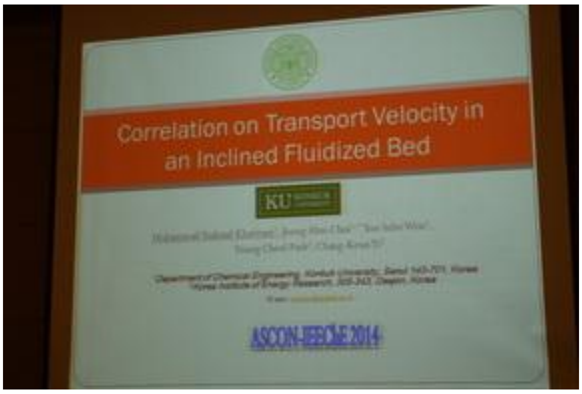


圖 III.1.1-49

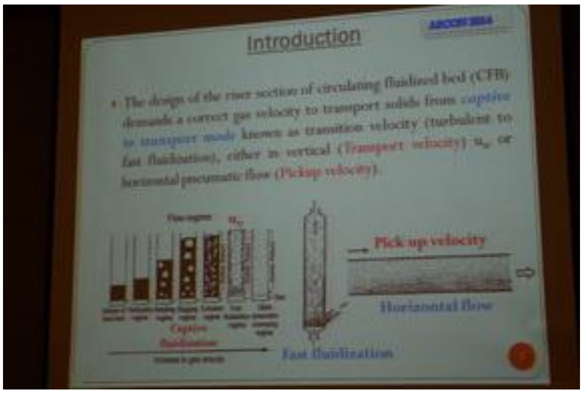


圖 III.1.1-50

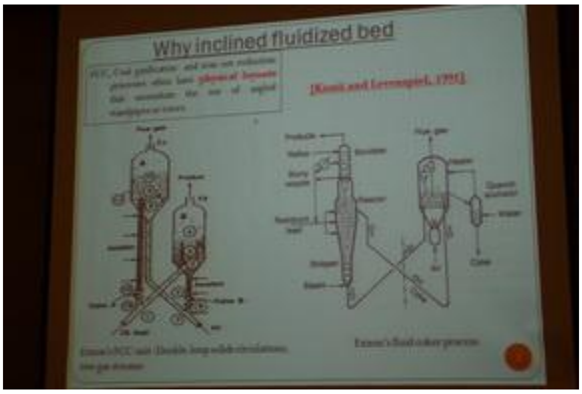


圖 III.1.1-51

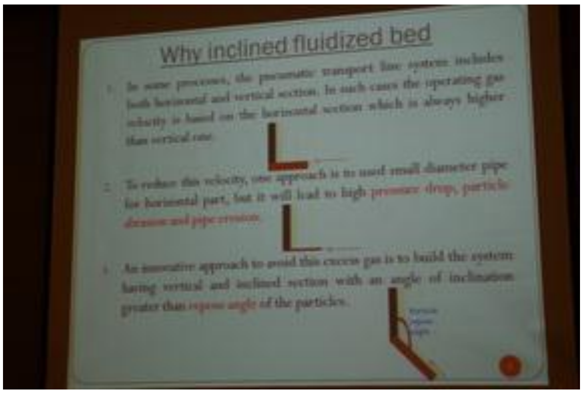


圖 III.1.1-52

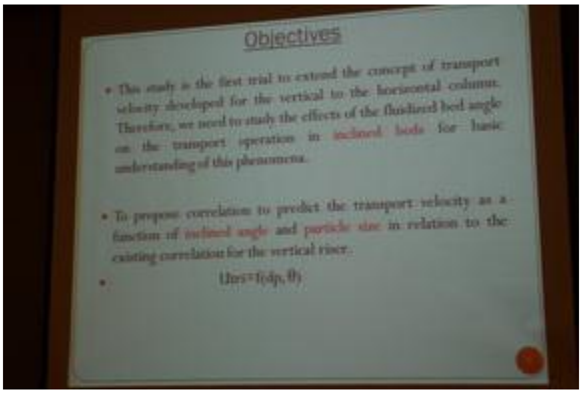


圖 III.1.1-53

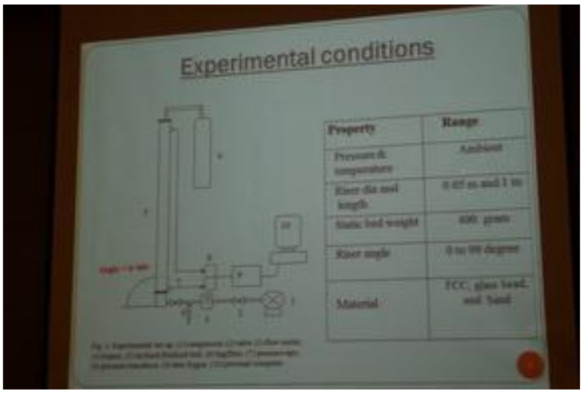
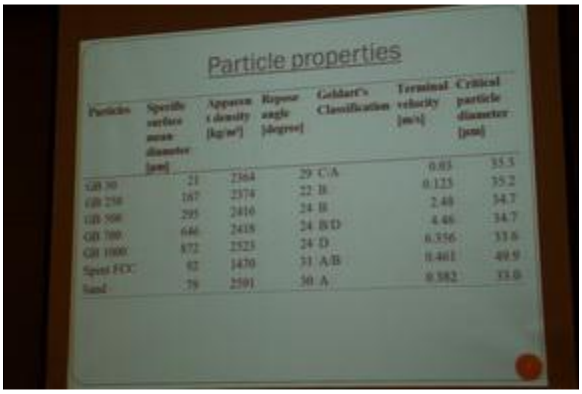


圖 III.1.1-54



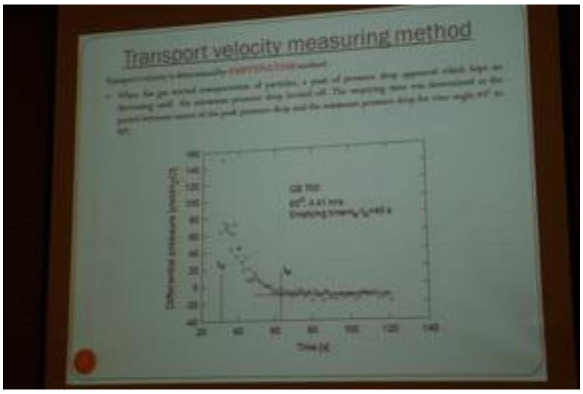
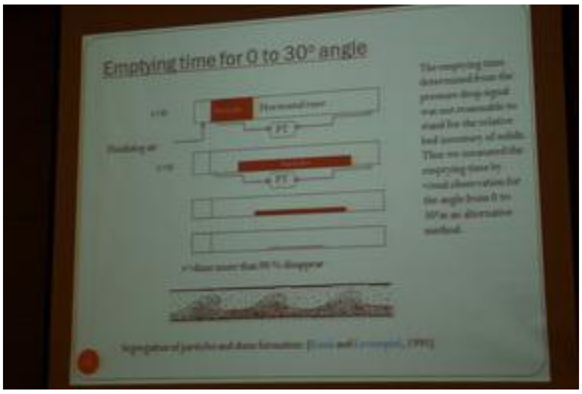


圖 III.1.1-55

圖 III.1.1-56



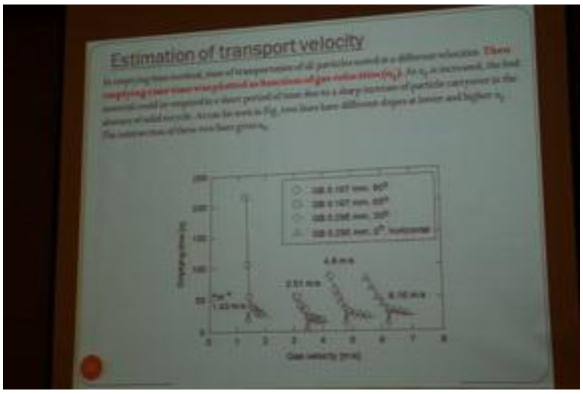
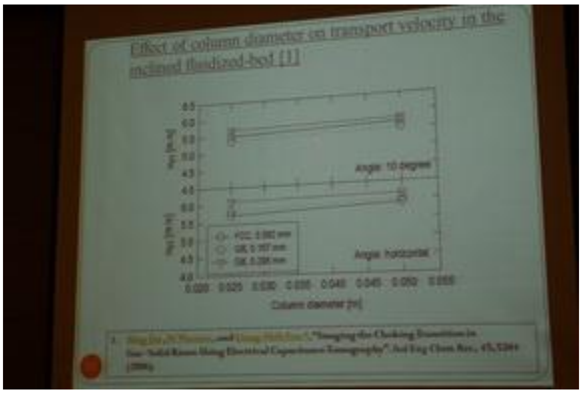


圖 III.1.1-57

圖 III.1.1-58



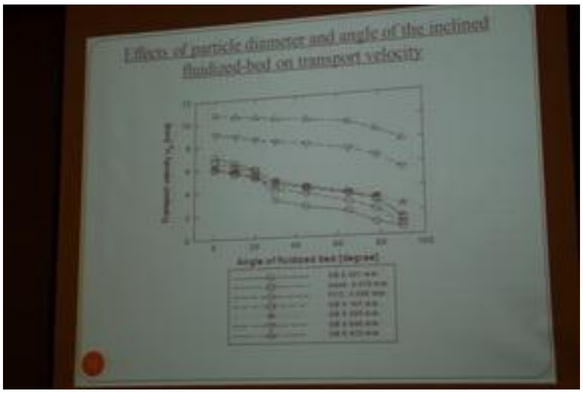


圖 III.1.1-59

圖 III.1.1-60

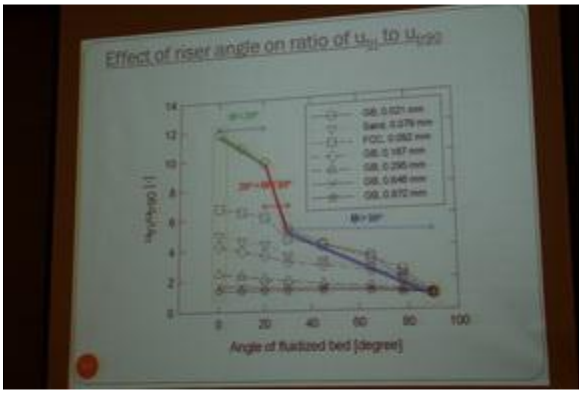


圖 III.1.1-61

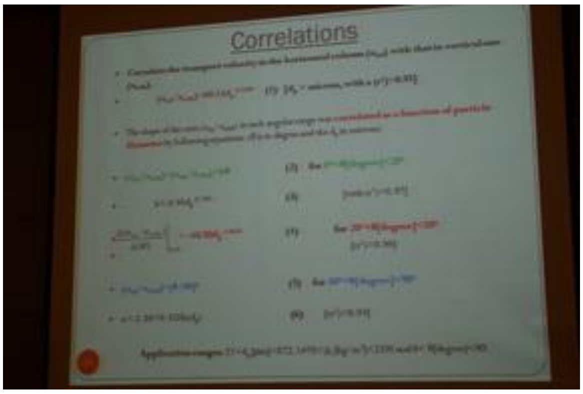


圖 III.1.1-62

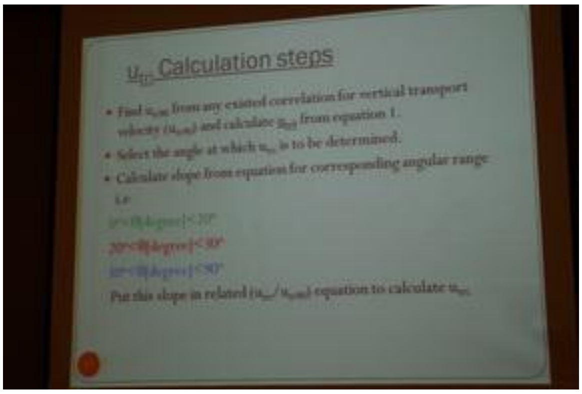


圖 III.1.1-63

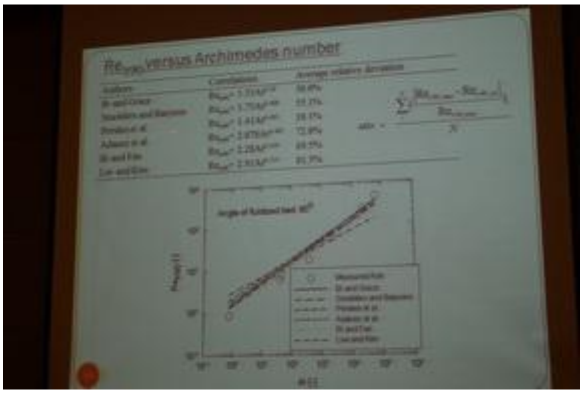


圖 III.1.1-64

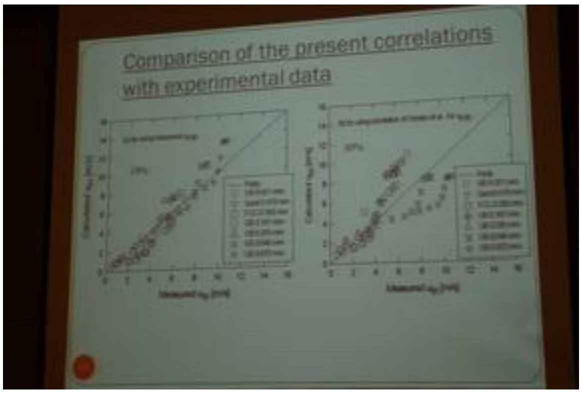


圖 III.1.1-65

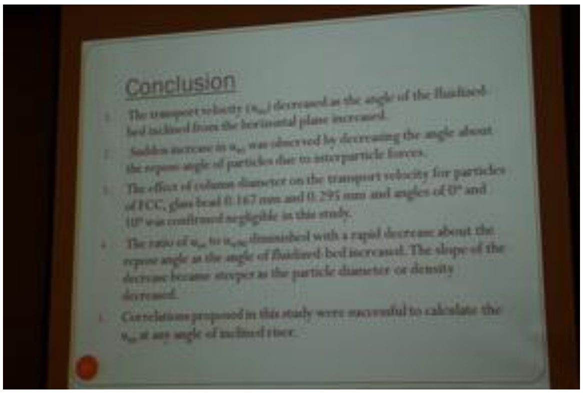


圖 III.1.1-66

FLD-3:

圖 III.1.1-67

圖 III.1.1-68

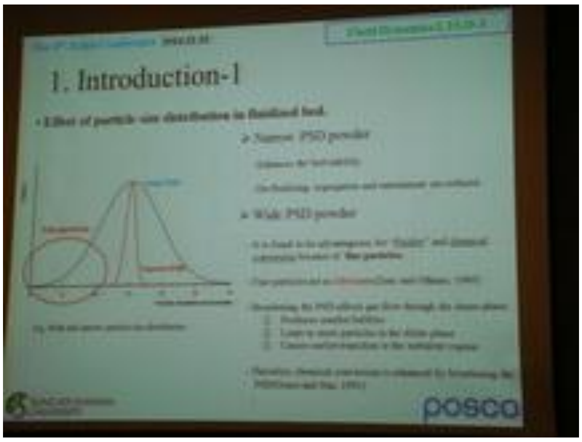


圖 III.1.1-69

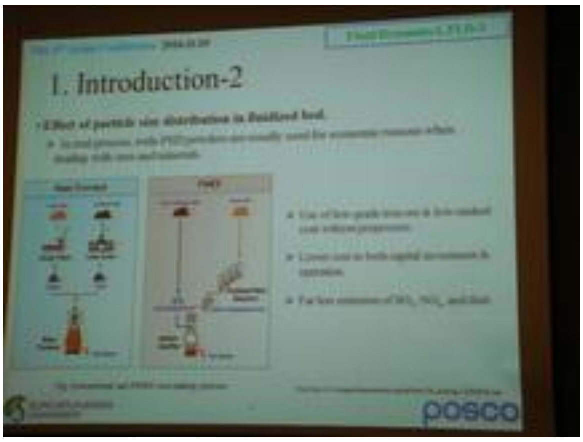


圖 III.1.1-70

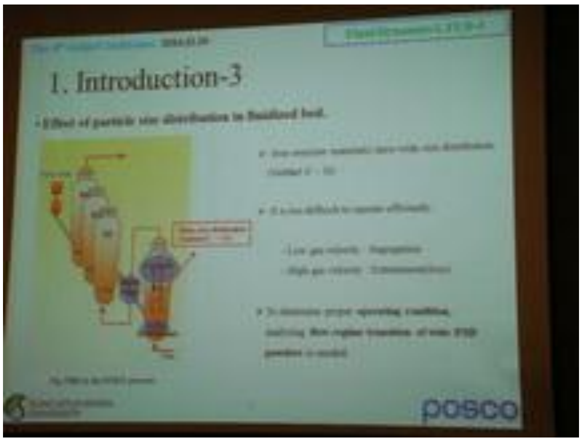


圖 III.1.1-71

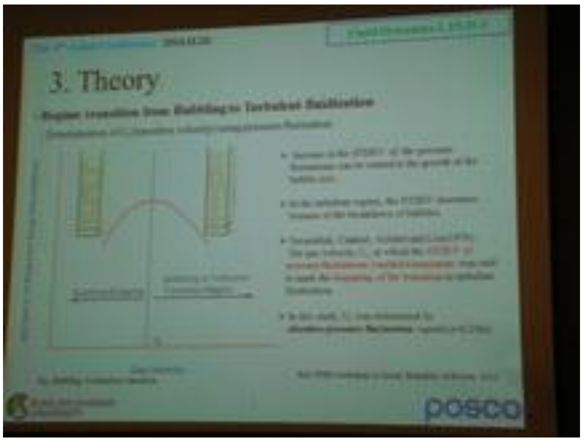
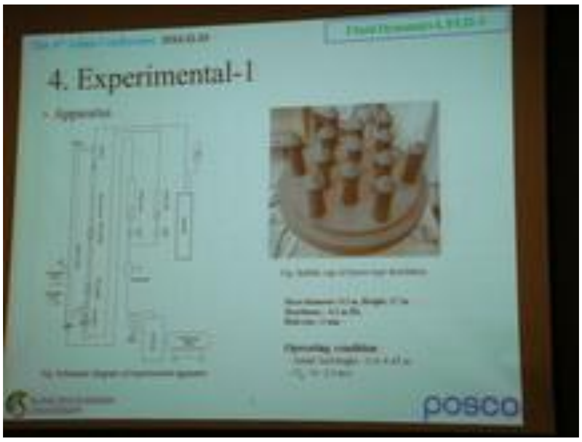


圖 III.1.1-72



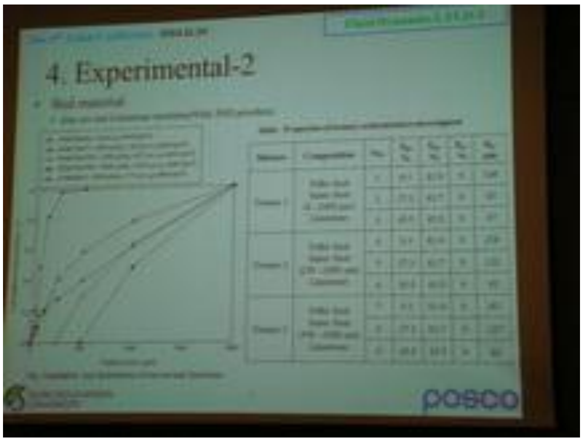
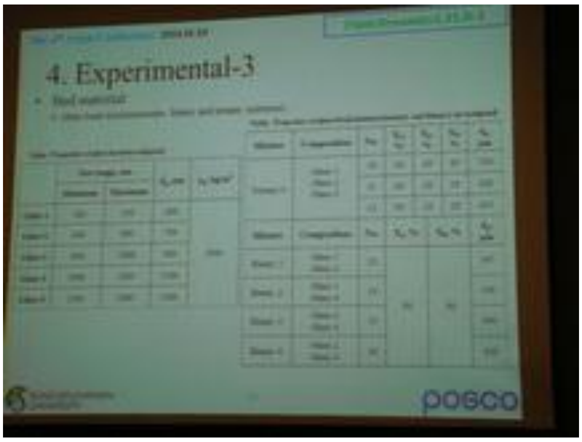


圖 III.1.1-73

圖 III.1.1-74



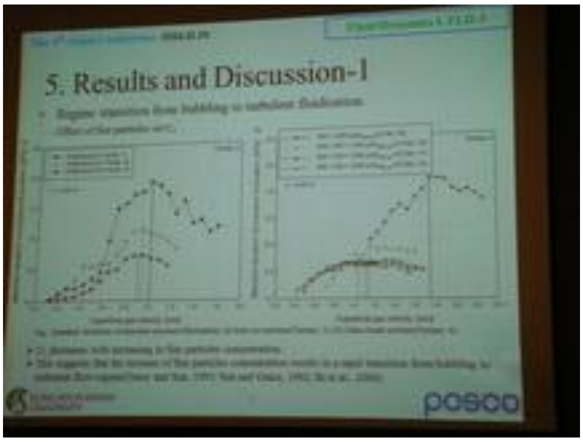
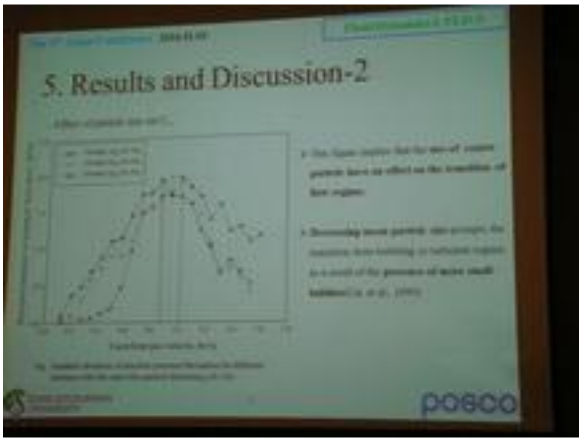


圖 III.1.1-75

圖 III.1.1-76



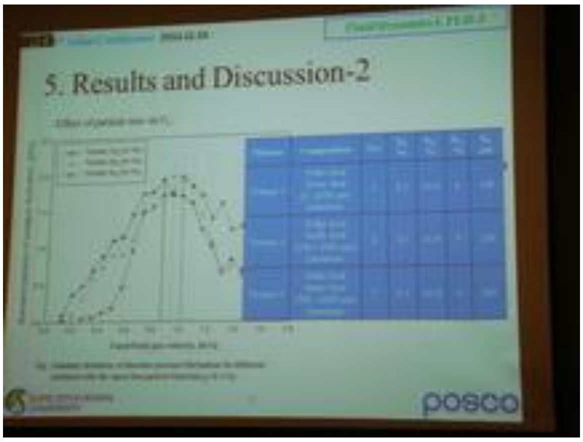
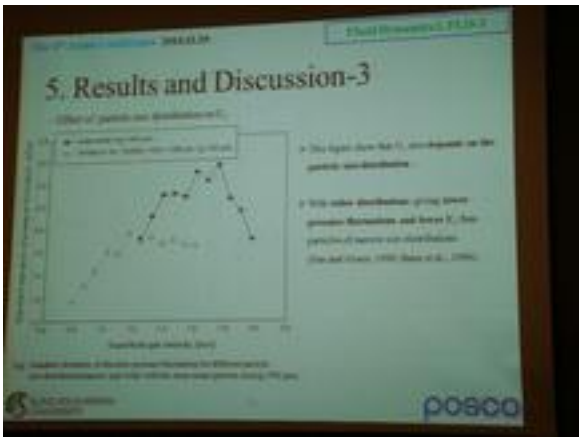


圖 III.1. 1-77

圖 III.1. 1-78



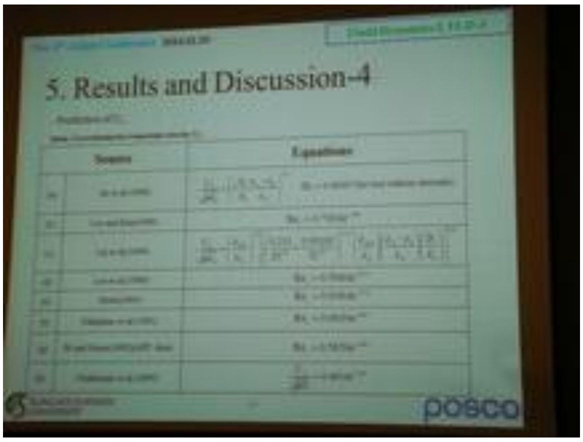
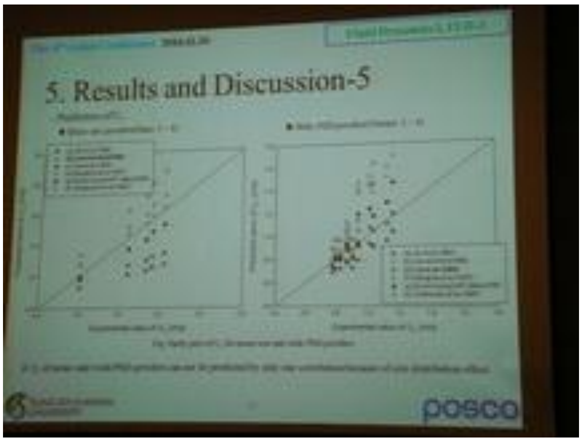


圖 III.1. 1-79

圖 III.1.1-80



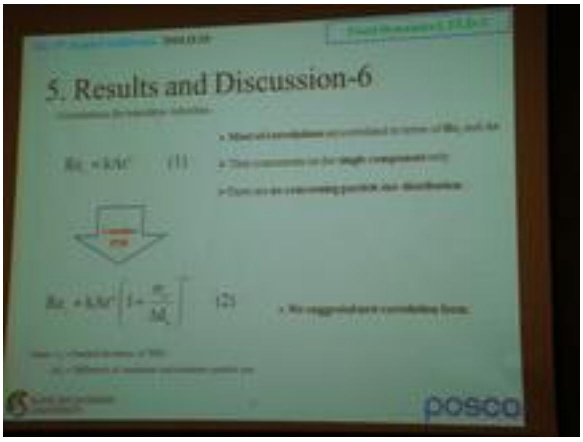
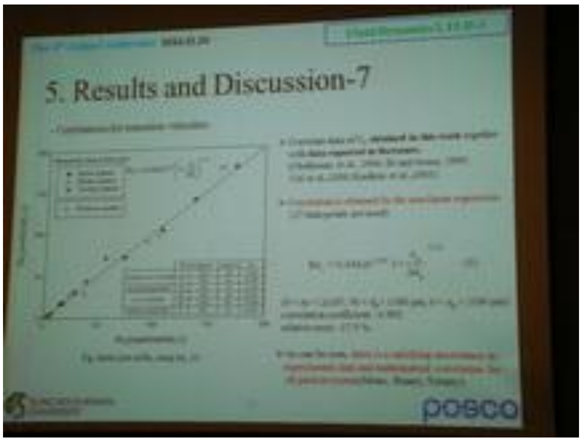


圖 III.1.1-81

圖 III.1.1-82



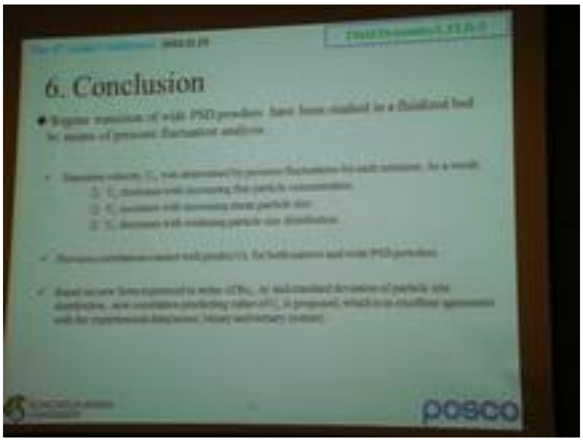


圖 III.1.1-83

圖 III.1.1-84

GAS-7:

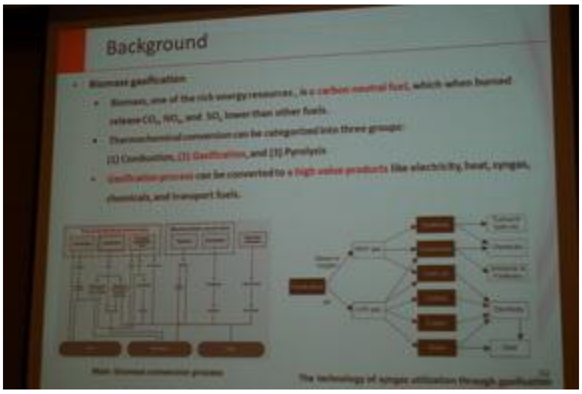


圖 III.1.1-85

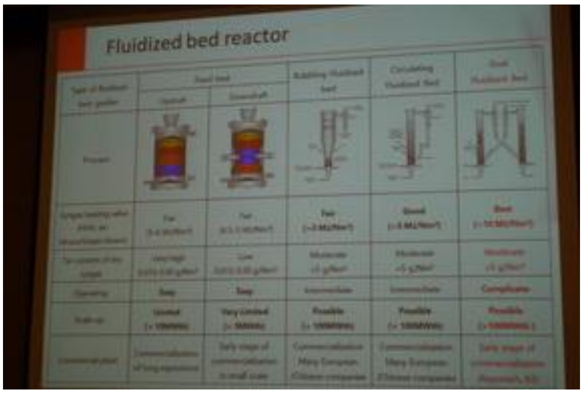


圖 III.1.1-86

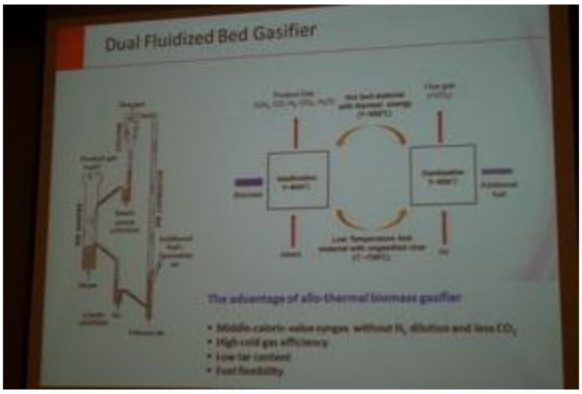


圖 III.1.1-87

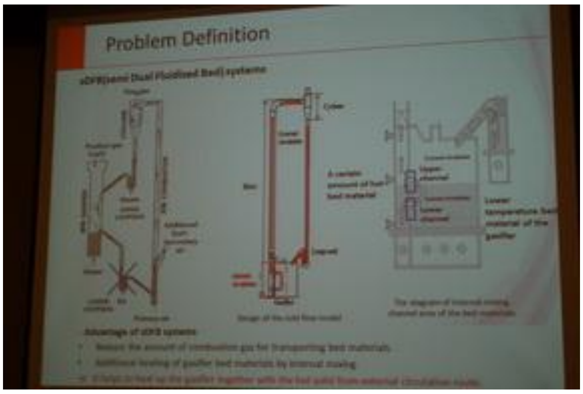


圖 III.1.1-88

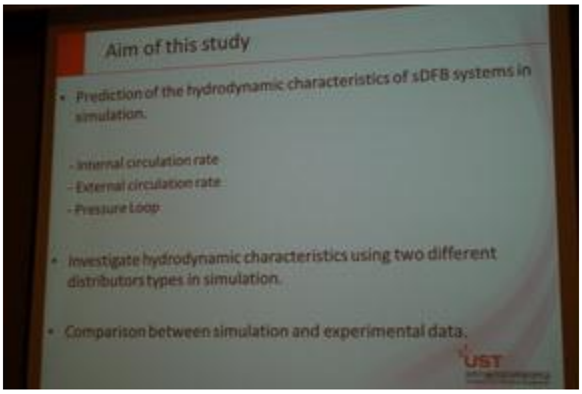


圖 III.1.1-89

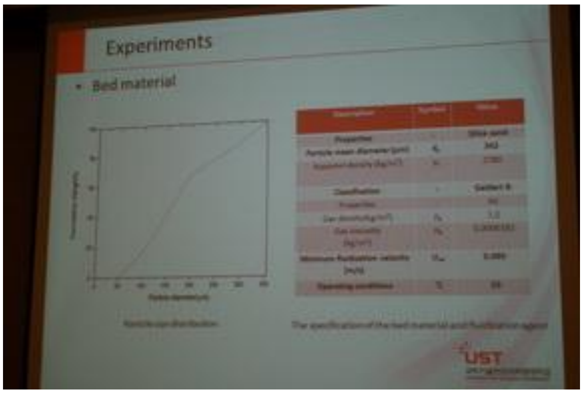


圖 III.1.1-90

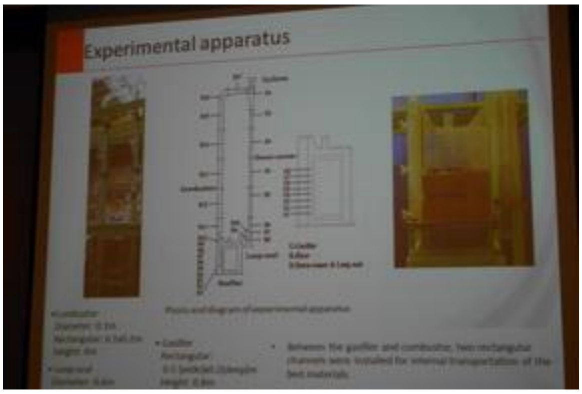


圖 III.1.1-91

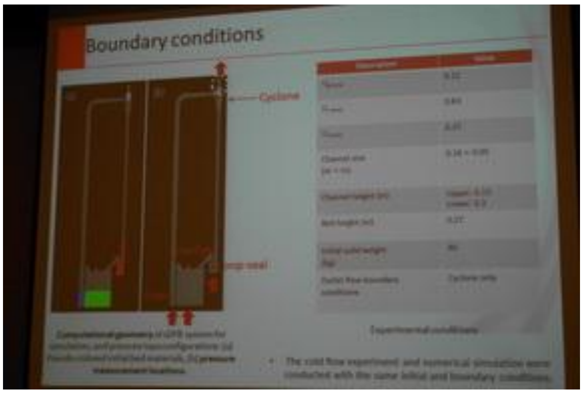


圖 III.1.1-92

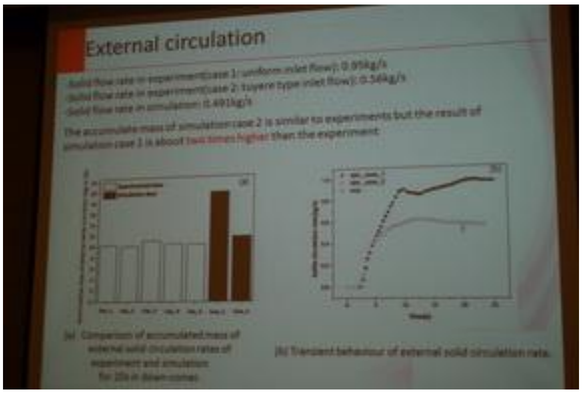


圖 III.1.1-93

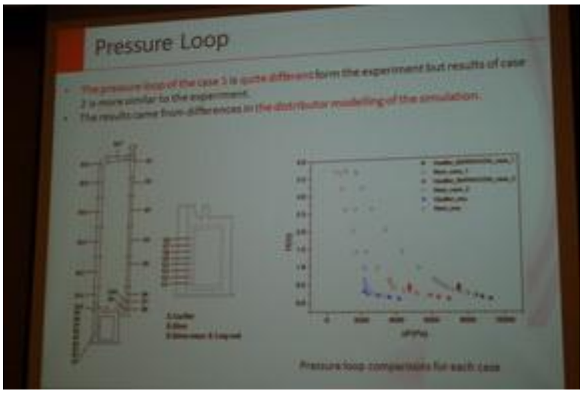


圖 III.1.1-94

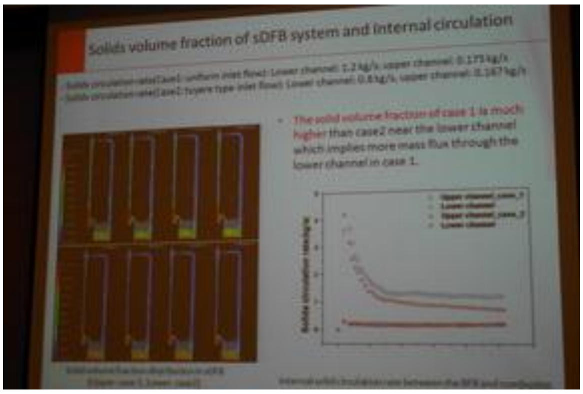


圖 III.1.1-95

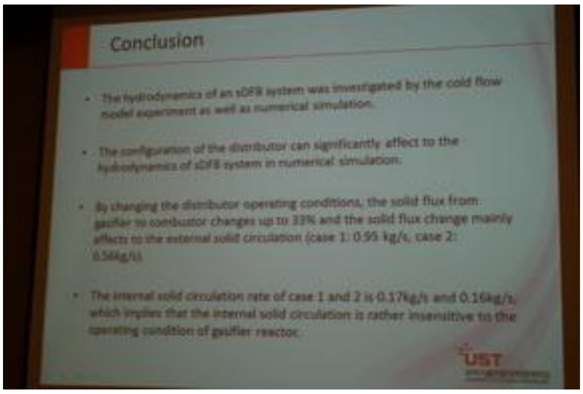


圖 III.1.1-96

GAS-10:

圖 III.1.1-97

圖 III.1.1-98

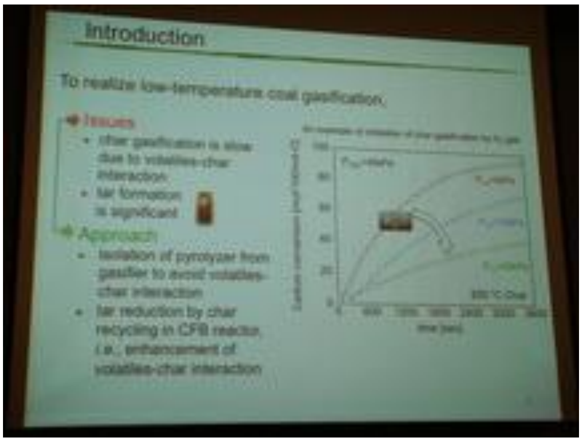


圖 III.1.1-99

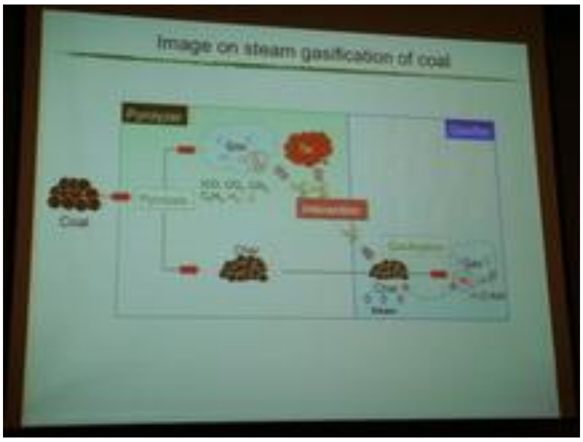


圖 III.1.1-100

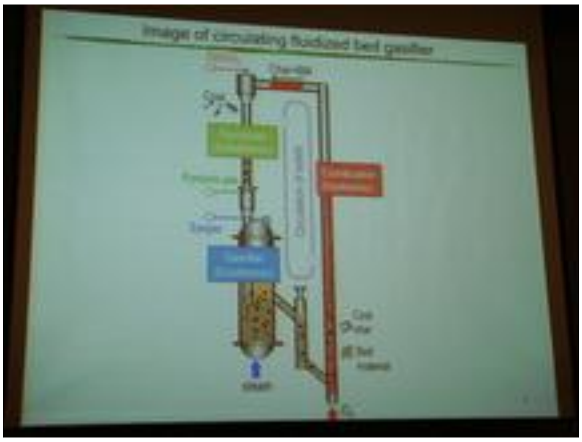


圖 III.1.1-101

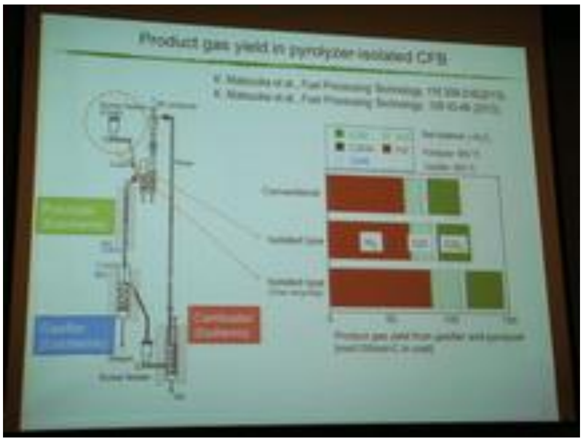


圖 III.1.1-102

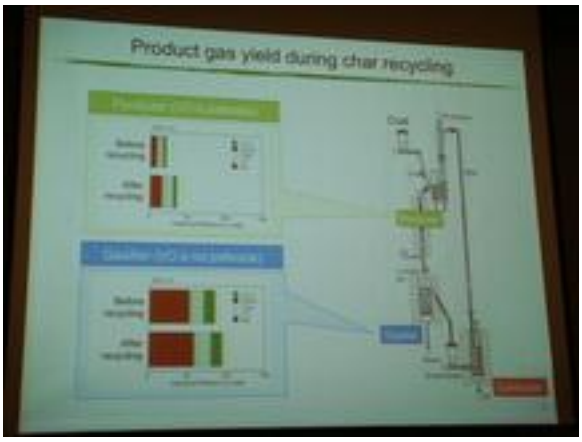


圖 III.1.1-103

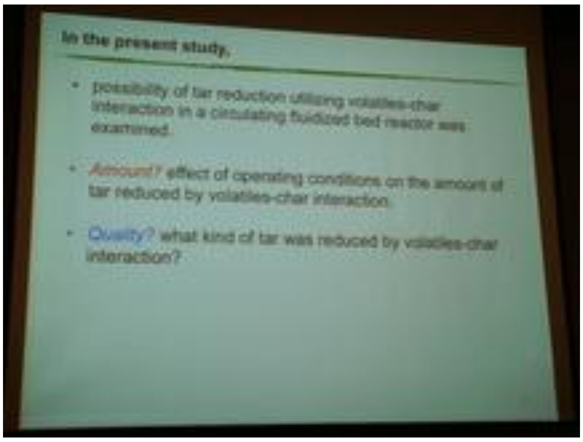


圖 III.1.2-32

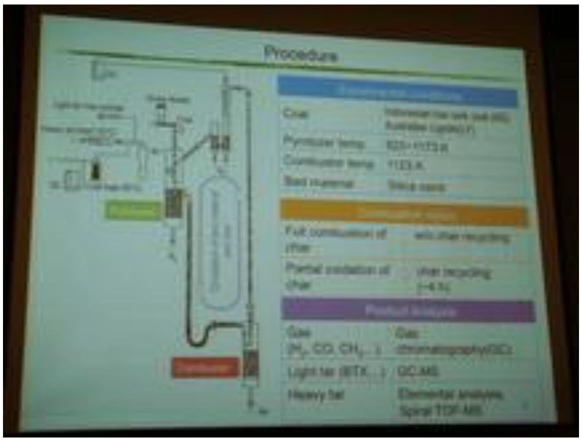


圖 III.1.2-33

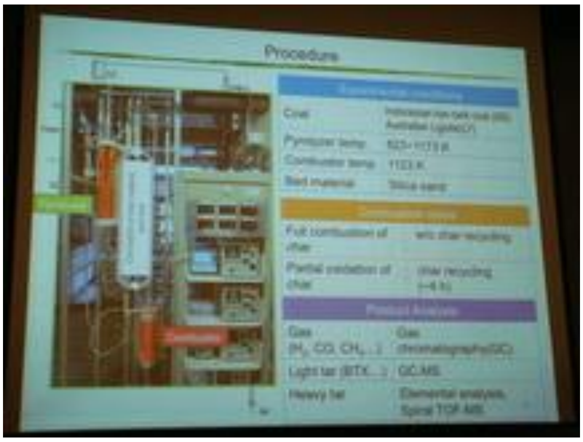


圖 III.1.2-34

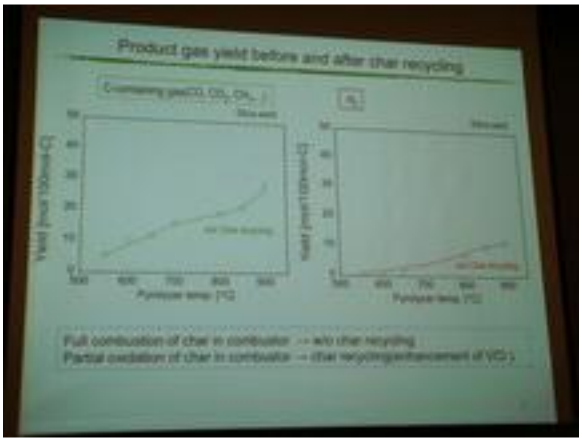


圖 III.1.2-35

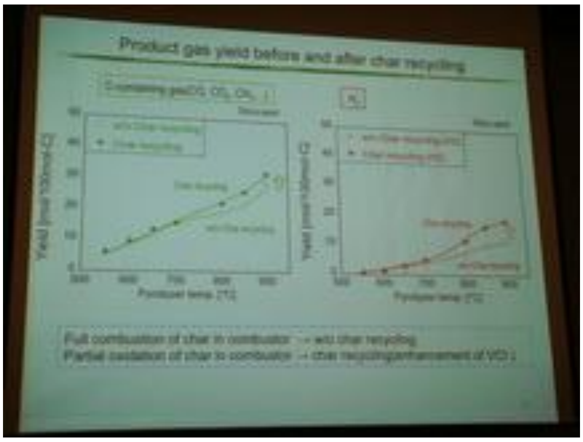


圖 III.1.2-36

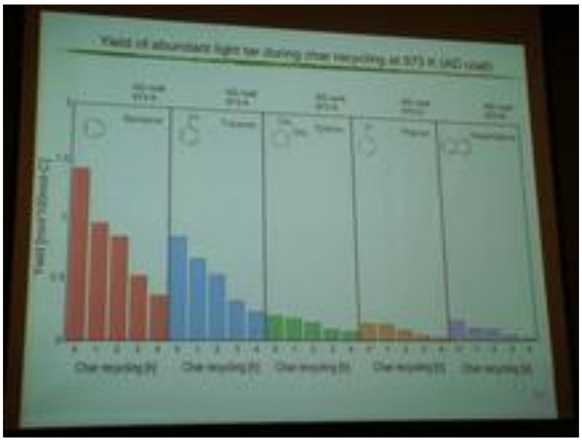


圖 III.1.2-37

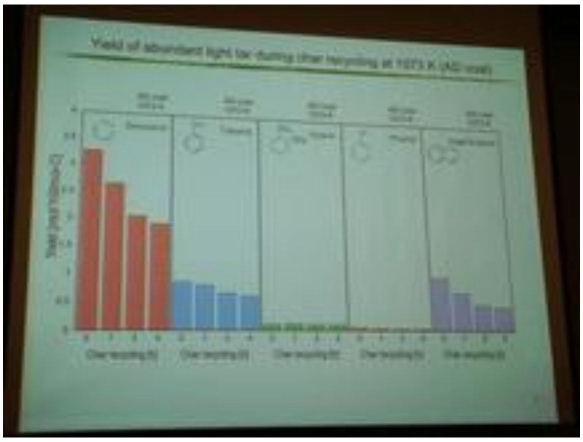


圖 III.1.2-38

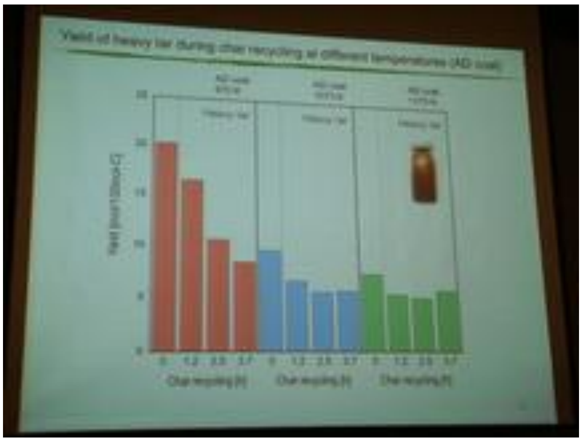


圖 III.1.2-39

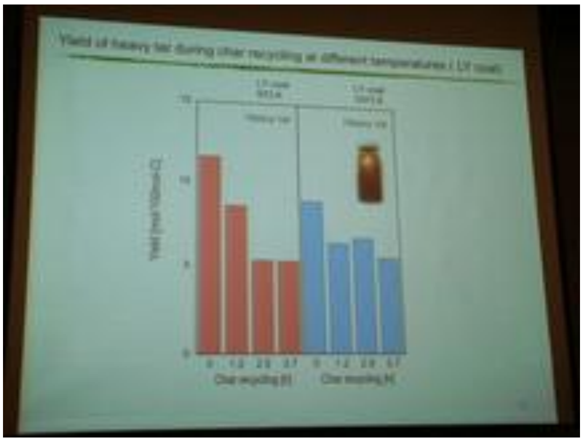


圖 III.1.2-40

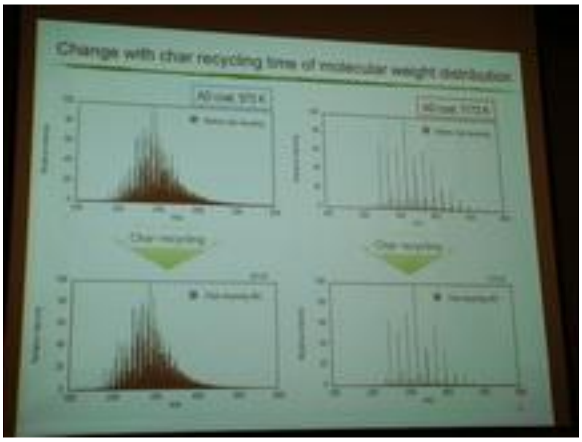


圖 III.1.2-41

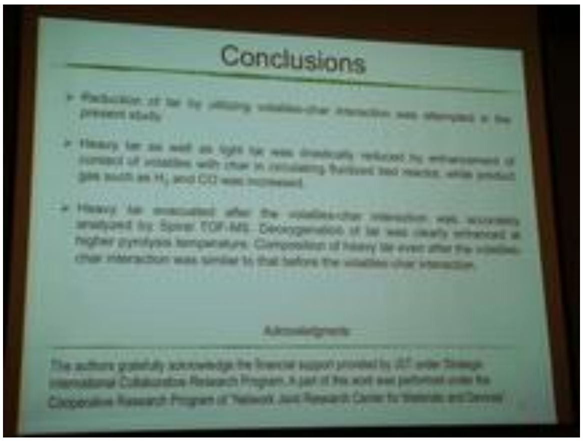


圖 III.1.2-42

2. Poster Session

圖 III.1.3-1：

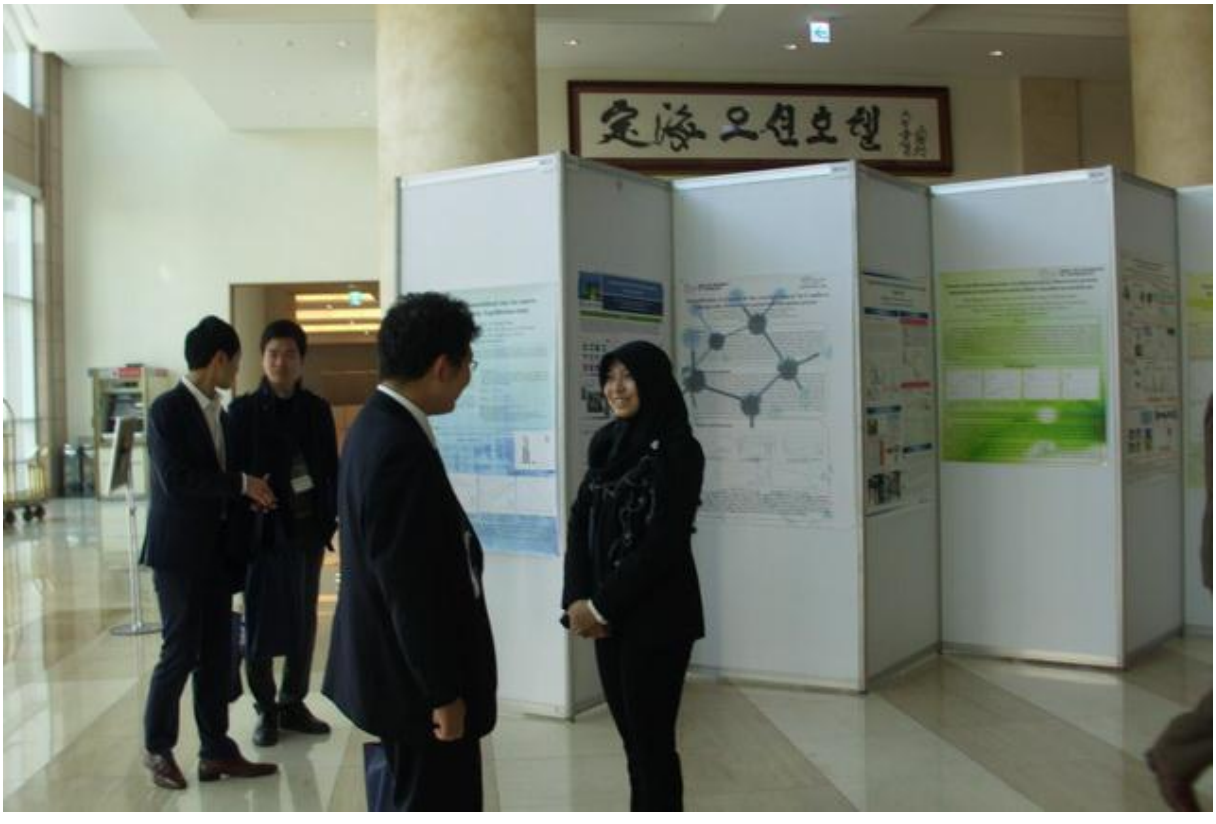


圖 III.1.3-2：

圖 III.1.3-3：

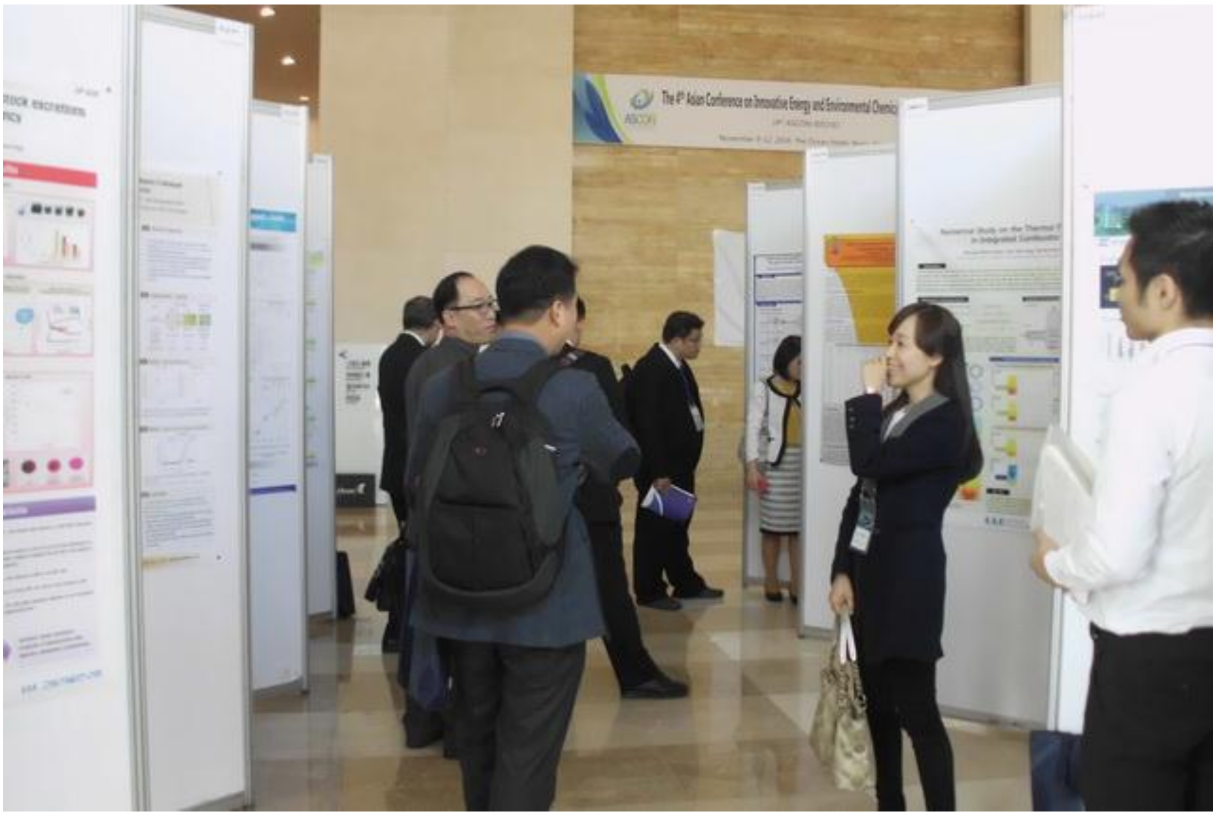


圖 III.1.3-4：

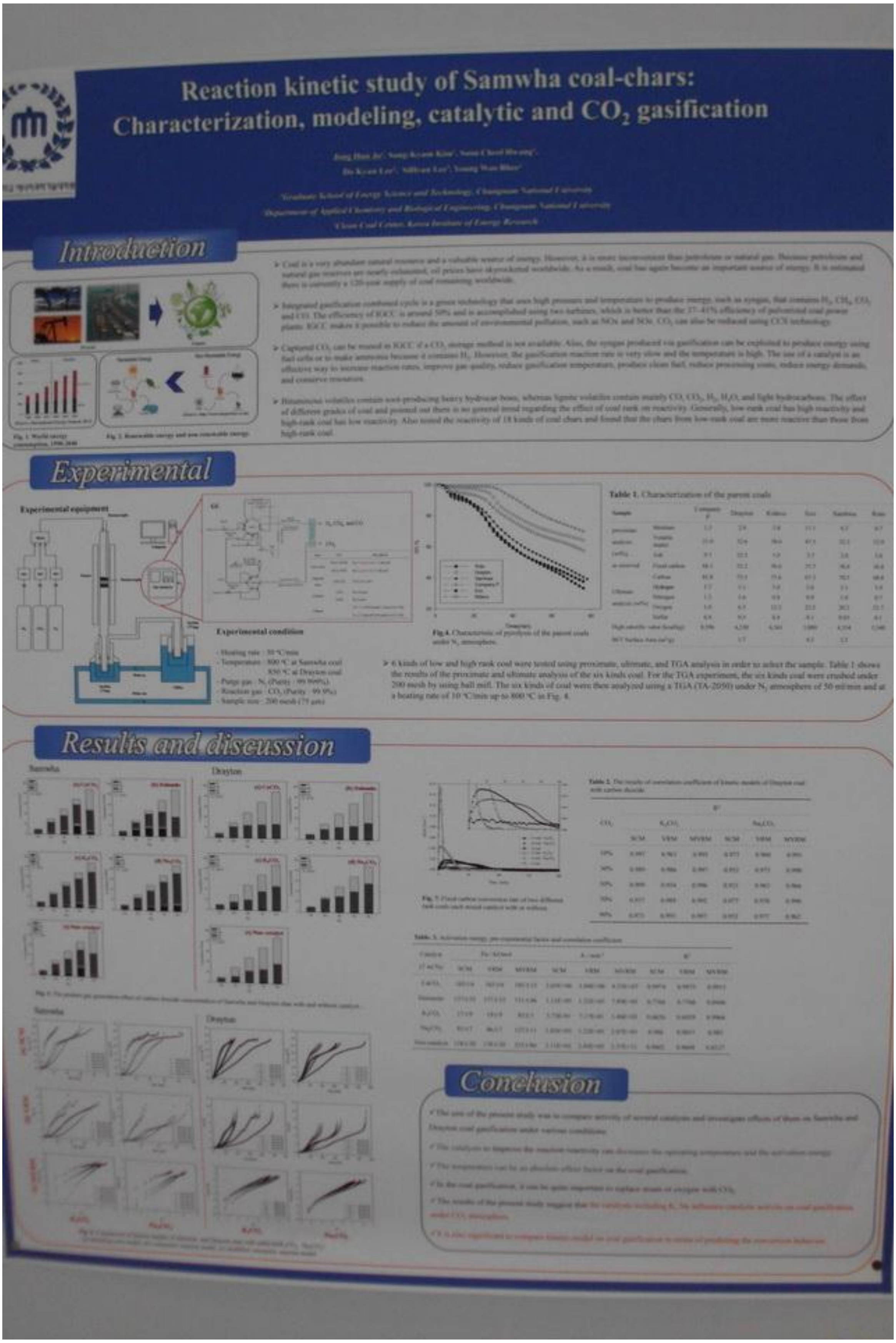
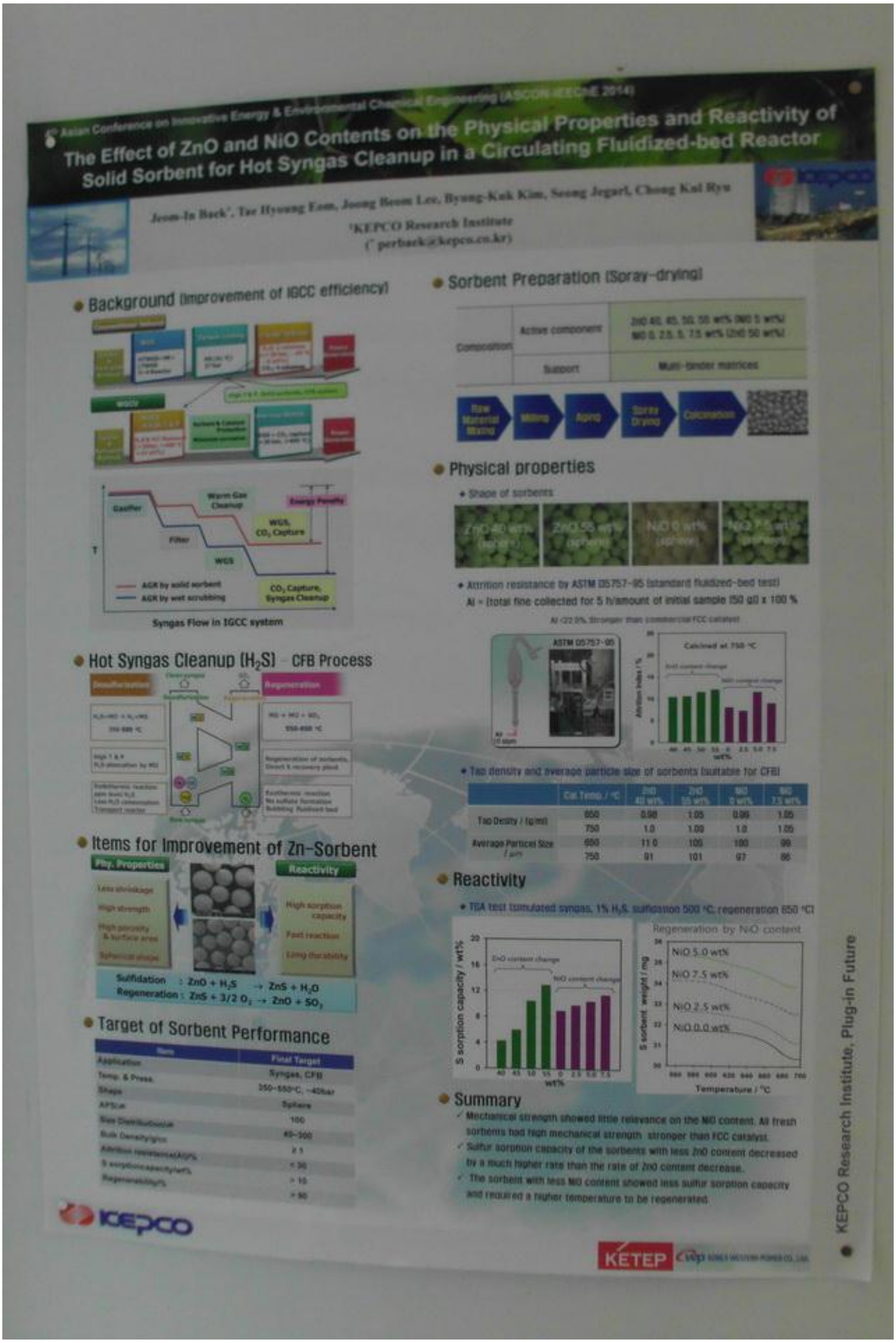

Reaction kinetic study of Samwha coal-chars:
Characterization, modeling, catalytic and CO2 gasification
Introduction
Experimental
Experimental equipment
Experimental condition
Table 1. Characterization of the parent coals
Results and discussion
Conclusion

圖 III.1.3-5：



The Effect of ZnO and NiO Contents on the Physical Properties and Reactivity of Solid Sorbent for Hot Syngas Cleanup in a Circulating Fluidized-bed Reactor
KEPCO Research Institute
Background (Improvement of IGCC efficiency)
Syngas Flow in IGCC system
Hot Syngas Cleanup (H2S) - CFB Process
Items for Improvement of Zn-Sorbent
Sulfidation : ZnO + H2S → ZnS + H2O
Regeneration : ZnS + 3/2 O2 → ZnO + SO2
Target of Sorbent Performance
Sorbent Preparation (Spray-drying)
Physical properties
Reactivity
Summary
KEPCO
KETEP
KEPCO Research Institute, Plug-in Future

圖 III.1.3-6：


The 4th Asian Conference on Innovative Energy & Environmental Chemical Engineering, Nov. 9-12, 2014 The Ocean Resort, Yeosu, Korea
Development of the Performance Evaluation Technology for the Dry-Sorbent CO2 Capture Process
Young Cheol Park, Jae-Young Kim., Jong-Ho Moon, Seung-Yong Lee, Sung-Ho Jo, Chang-Keun Yi, Jong-Seop Lee, and Byoung-Moo Min*
Korea Institute of Energy Research
KOREA INSTITUTE OF ENERGY RESEARCH
Abstract
Carbon Capture and Storage (CCS) has been regarded as one of the promising technologies to mitigate the global warming in near future. ISO/TC 265 has been created in 2011 in order to develop international standards for carbon dioxide capture, transportation, and geological storage. Catching up with it, the government project for the standardization and certification of CCS technology has begun in late 2012 in Korea. In this project, the dry-sorbent CO2 capture process, which is one of the post-combustion CO2 capture technologies, has been set to develop the performance evaluation technology of the CO2 capture part using dry sorbents. By several experiments, the main factors for the standards for dry-sorbent CO2 capture process have been derived.
Background - CCUS
CO2 Capture by Dry Regenerable Sorbent
Principles of the Proposed Technology
Apparatus
Calibration
Performance Evaluation
Performance Tests
Performance Analysis
Performance Analysis Methodology
Factors related with the Performance
Performance Calculation
KIERDRY (Process Development)
Acknowledgements
This work was supported by the Energy Efficiency & Resources Core Technology Program of the Korea Institute of Energy Technology Evaluation and Planning (KETEP), granted financial resource from the Ministry of Trade, Industry & Energy, Republic of Korea. (No. 2012T100201687)
KIER
KOREA INSTITUTE OF ENERGY RESEARCH
MOTIE

圖 III.1.3-7：

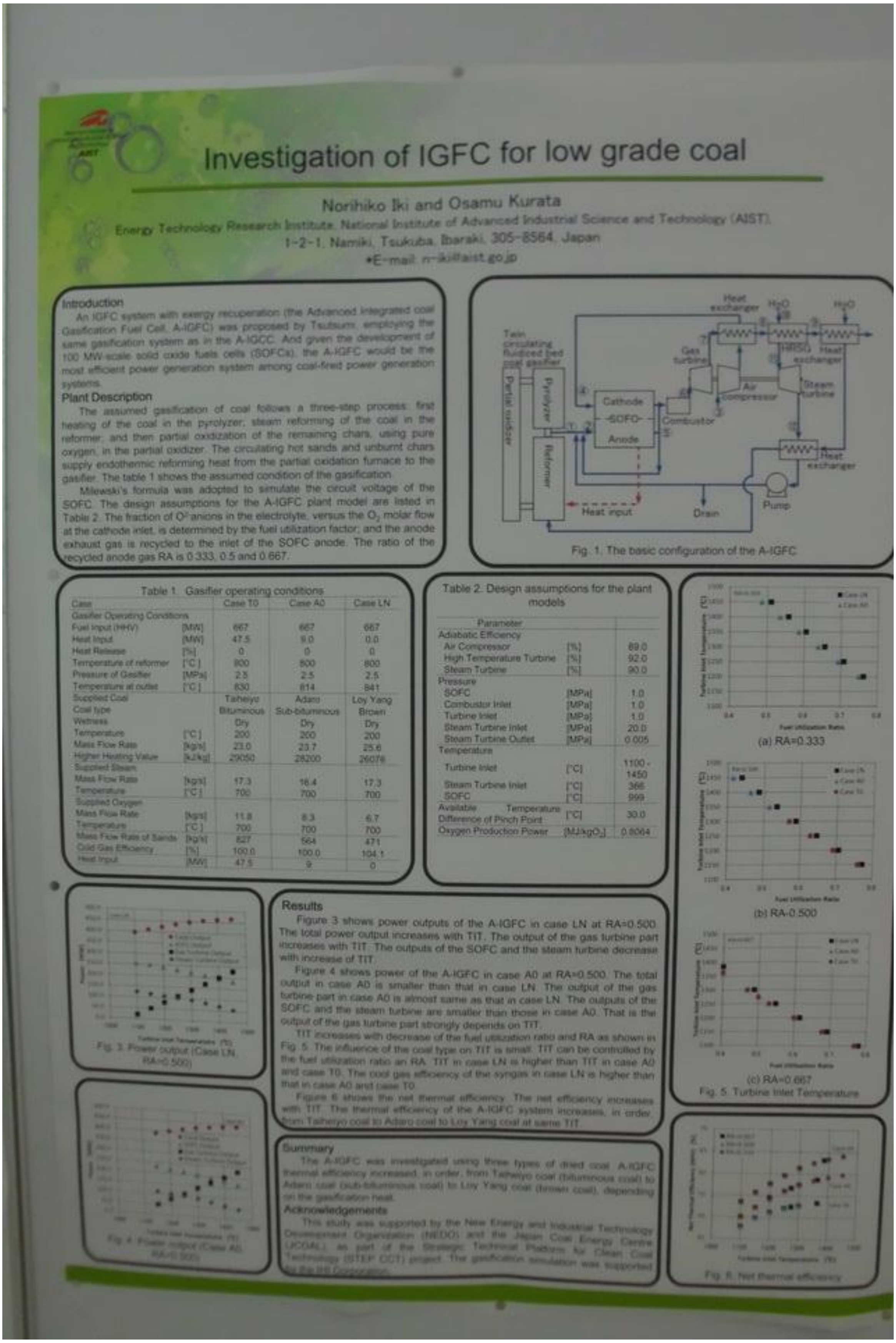

Investigation of IGFC for low grade coal
Norihiko Iki and Osamu Kurata
Energy Technology Research Institute, National Institute of Advanced Industrial Science and Technology (AIST)
1-2-1, Namiki, Tsukuba, Ibaraki, 305-8564, Japan
*E-mail: n-iki@aist.go.jp
Introduction
An IGFC system with exergy recuperation (the Advanced Integrated coal Gasification Fuel Cell, A-IGFC) was proposed by Tsutsumi, employing the same gasification system as in the A-IGCC. And given the development of 100 MW-scale solid oxide fuels cells (SOFCs), the A-IGFC would be the most efficient power generation system among coal-fired power generation systems.
Plant Description
The assumed gasification of coal follows a three-step process: first heating of the coal in the pyrolyzer; steam reforming of the coal in the reformer; and then partial oxidization of the remaining chars, using pure oxygen, in the partial oxidizer. The circulating hot sands and unburnt chars supply endothermic reforming heat from the partial oxidation furnace to the gasifier. The table 1 shows the assumed condition of the gasification.
Milewski's formula was adopted to simulate the circuit voltage of the SOFC. The design assumptions for the A-IGFC plant model are listed in Table 2.
Fig. 1. The basic configuration of the A-IGFC
Table 1. Gasifier operating conditions
Table 2. Design assumptions for the plant models
Results
Summary
Acknowledgements
Fig. 3 Power output (Case LN, RA=0.500)
Fig. 4 Power output (Case A0, RA=0.500)
(a) RA=0.333
(b) RA=0.500
(c) RA=0.667
Fig. 5 Turbine Inlet Temperature
Fig. 6 Net thermal efficiency

圖 III.1.3-8：

3. Technical Tours

圖 III.1.3-1：

圖 III.1.3-2：

圖 III.1.3-3：

圖 III.1.3-4：


圖 III.1.3-5


圖 III.1.3-6


圖 III.1.3-7


圖 III.1.3-8


圖 III.1.3-9


圖 III.1.3-10

§III.2　有關 2014 KR 公差 SKKU 之圖像

圖 III.2-1　**SKKU** 校園

圖 III.2-2　**SKKU** 校園

圖 III.2-3　**SKKU** 校園

圖 III.2-4　**SKKU** 校園

圖 III.2-5　**SKKU** 校園

圖 III.2-6　**SKKU** 校園

§III.3　有關 2014 KR 公差 KU 之圖像

圖 III.3-1　建國大學 (KU) 化學工程研究所之實驗室照片

圖 III.3-2　建國大學 (KU) 化學工程研究所之實驗室照片

圖 III.2-1　KU 實驗室照片

圖 III.2-2　KU 實驗室照片

圖 III.2-3　**KU 實驗室照片**

圖 III.2-4　**KU 實驗室照片**

四、建　議　事　項

聯合國 IPCC 之 AR5 已自 2013 年底起開始逐步發佈，持續警示氣候變遷之相關影響，為減緩全球氣候變化，政府必須儘速明確揭櫫策略方向，投資於科技知識來支持人類活動全方位的必要改變，以確保邁向一個永續之未來。為推動國家減碳政策，政府自 2008 年發佈「永續能源政策綱領」以來積極建構低碳能源發展藍圖；因此，核能研究所積極進行**能源國家型科技計畫**領域之**「淨碳技術發展」**研究計畫，冀望能為我國減碳情景略盡綿薄之力。此外，該計畫亦從永續發展觀點推動**自主性潔淨能源技術之建立**，研發淨煤、多元氣化與應用、碳捕捉與分離等技術，藉以**提升能源自主性、降低國內的碳排放**。

此次公差行程之建議事項可分為數個面向分述如下：

(一) 技術研發領域

1. ASCON 大會議題涵蓋生質物燃料及生化程序、流體力學、熱裂解及氣化、程序管理創新、合成技術等議題，**亦是核研所科專計畫的主要內容，**具備未來性與競爭力，值得參與。
2. **氣化技術**與**煤轉換技術**議題可謂是 ASCON 大會的重點項目，**有望成為未來永續能源轉換的重要技術平台**，顯示**本所淨碳技術開發計畫之推動符合國際主流趨勢**，值得持續推動**。**
3. **流體化床與異相反應器技術，**包含裂解、氣化、轉化等，亦為大會議題的重要支柱；代表未來在永續發展過程的可能途徑，提供能源、環境與經濟的整合解決方案之平台。
4. **流體力學技術之應用**日趨廣泛，在流體化床反應器系統設計領域扮演重要角色，於石化、環保、能源等各領域皆或有其角色，亦是核研所計畫未來推動的主要內容之一。

(二) 國際交流合作領域

1. 韓國能源研究所 (KIER) 為韓國能源科技研究之主要推動機構，近年來在學術、技術層面頗為活躍；其領域與本所淨碳計畫相當契合，相信未來應有可能合作之議題。

2. 韓國建國大學(KU)化工系 Jeong-Hoo Choi 教授為該國流體化床、化學迴路程序研究等領域之先驅，**本所**應進一步**與之串連，形成國際合作之重點技術研究團隊**。
3. 韓國成均館大學 (SKKU) Dong Hyun Lee 教授在流體化床技術**流體力學**領域之研究著墨頗深，本所可藉助其專長致力於流體化床實驗技術與系統設計分析研究。

五、附　錄

（一） 第四屆亞洲創新能源及環境化工國際研討會議 **(The 4th Asian Conference on Innovative Energy and Environmental Chemical Engineering, ASCON-IEEChE 2014)** 之 Scientific program

ASCON-IEEChE 2014 Conference programme/agenda: all

PROGRAM (FINAL)

November 9, 2014 (Sunday)
14:00 Registration
18:00 Welcome Reception
November 10, 2014 (Monday)
Emerald A Combustion I
Session Co-Chairs: Prof. Chaiyan Chaiya (Rajamangala University of Technology Krungthep),
Prof. Hang Seok Choi (Yonsei University)
9:00
CMB-1
Novel Hypercross-linked Polymers as a Sorbent for CO2 Adsorption Rajangam Vinodh
9:20 1,2, Mani Ganesh1,2, Mei Mei Peng1,2, Aziz Abidov1,2, Muthiahpillai Palanichamy1,2, Hyun Tae Jang1,2* 1Hanseo University, Korea 2Korea Carbon Capture and Sequestration R and D Centre, Korea
CMB-2
Energy Saving CO2 Capture Process by Effective Reaction and Evaporation Heat Recuperation―A Parametric Study Chunfeng Song
9:40 , Yasuki Kansha, Masanori Ishizuka, Qian Fu, Atsushi Tsutsumi * Collaborative Research Center for Energy Engineering, The University of Tokyo, Japan
CMB-3
Numerical Study for Hydrodynamic Characteristics of an Oxy-Fuel Circulating Fluidized Bed Combustor Hoon Chae Park
10:00 , Hang Seok Choi* Yonsei University, Korea
CMB-4
Cyanuric Chloride Cross Linked Isolated Aromatics for CO2 Adsorption Mani Ganesh, Mei Mei Peng, Rajangam Vinodh, Abidov Aziz, Ung Jin Jeon, Wang Seog Cha2, Hyun Tae Jang* Hanseo University, Korea 2Kunsan National University
10:20 Coffee break
Emerald A Syntheses I
Session Co-Chairs: Prof. Shwu-Jer Chiu (Ming Chi University of Technology),
Prof. Noritatsu Tsubaki (University of Toyama)
10:40
SYN-1
Fischer-Tropsch Synthesis over Cobalt Catalyst Supported on SiO2-Fiber Modification by ZSM-5 Kanthana Klaigaew
11:00 1, Chanatip Samart2, Chaiyan Chaiya3, Yoshiharu Yoneyama4, Noritatsu Tsubaki4, Prasert Reubroycharoen1,* 1 Chulalongkorn University, Thailand 2 Thammasat University, Thailand 3 Rajamangala University of Technology Krungthep, Thailand 4 University of Toyama, Japan
SYN-2
Metal-Oxide Hollow Nano-Structures for Catalytic Applications Ji Bong Joo

1Korea Institute of Energy Research, Korea 2University of California Riverside, USA 1*, Yadong Yin2, Dowon Shun1, Jaehyeon Park1, Ho-Jung Ryu1, Dong-Ho Lee1
11:20
SYN-3
Observation of Chemical Degradation Behavior Of SOFC Anode Caused by Trace Contaminants in Coal-Derived Fuel Gas Koji Kuramoto
2Graduate School of Engineering, Nagoya University, Japan 1,*, Toshiyo Fukushima1, Sou Hosokai1 Koichi Matsuoka1, Yoshizo Suzuki1, Haruo Kishimoto1, Katsuhiko yamaji1, Yasuaki Ueki3, Ryo Yoshiie2, Ichiro Naruse3 1National Institute of Adv. Ind. Sci. Tech, Japan
3EcoTopia Science institute, Nagoya University, Japan
11:40
SYN-4
Application of Waste Scallop Shell as Catalyst for Tar Removal Guoqing Guan
12:00 *, Malinee Kaewpanha, Jenny Rizkiana, Patchiya Phathong, Xiumin Li, Ji Cao, Abuliti Abudula Hirosaki University, Japan
SYN-5
Low Temperature Synthesis of DME as a Clean Fuel over CuZnO/AlPO4 Nanocatalysts Akapong Kongjaroen1 , Suwattana Thongkam2, Banjong Boonchom1,3, Montree Thongkam1,3 * 1*Department of Chemistry, Faculty of Science, King Mongkut's Institute of Technology Ladkrabang, Thailand 2Scienctific Instruments Centre, Faculty of Science, King Mongkut's Institute of Technology Ladkrabang, Thailand 3Functional Phosphate Materials and Alternative Fuel Energies Research Unite (FPM-AFE), King Mongkut's Institute of Technology Ladkrabang, Thailand

12:20 Lunch

Emerald A **Syntheses II**

Session Co-Chairs: Prof. Tzong-Horng Liou (Ming Chi University of Technology),
Dr. Ho-Jung Ryu (Korea Institute of Energy Research)

13:40	SYN-6	Characteristics Comparison of Metal-Based Oxygen Carriers for Chemical Looping Combustion Ching-Ying Huang, Yau-Pin Chyou *, Liang-Wei Huang Institute of Nuclear Energy Research, Taiwan
14:00	SYN-7	Water Gas Shift Reaction and Sorption Enhanced Water Gas Shift Reaction of the Syngas from Oxy Gasification-Melting System Seon-Ah Roh *, Sang-In Keel Korea Institute of Machinery and Materials, Korea
14:20	SYN-8	Operation of Sorption Enhanced Water Gas Shift System Integrated with Coal Gasifier and Hot Gas Cleanup Process for Pre-combustion CO2 Capture Ho-Jung Ryu*, Dong-Ho Lee, Dal-Hee Bae, Sung-Ho Jo, Chang-Keun Yi Korea Institute of Energy Research, Korea
14:40	SYN-9	Synthesis of ZSM-5/Silica Fibrous Catalyst by Hydrothermal Method Wittawat Ratanathavorn 1,2 , Prasert Reubroycharoen 1,* 1 Chulalongkorn University, Thailand 2 Center of Excellence on Petrochemical and Materials Technology,

Thailand

Emerald B Pyrolysis and Gasification I
Session Co-Chairs: Prof. Wang Seog Cha (Kunsan National University),
Prof. Montree Thongkam (King Mongkut's Institute of Technology Ladkrabang)
9:00
GAS-1
Energy Analysis on Gasification of Torrefied Bamboo in a Fluidized Bed Kanit Manatura
Keng-Tung Wu 2,* 1,4, Hung-Te Hsu 3, Kai-Cheng Yang 2, Jau-Huai Lu 1,
1 Department of Mechanical Engineering, National Chung Hsing University, Taiwan 2 Department of Forestry, National Chung Hsing University, Taiwan
3Institute of Nuclear Energy Research, Taiwan
4Kasetsart University, Thailand
9:20
GAS-2
Studies on Syngas Characteristics from Waste Gasification in a Fixed Bed Reactor Won-Seok Yang
9:40 , Yong-Chil Seo*, Jang-Soo Lee, Heung-Min Yoo, Se-Won Park Yonsei University, Korea
GAS-3
Mild Pyrolysis of Low-rank Coal for Oil Production in Molten Salts Jenny Rizkiana
10:00 1, Guoqing Guan1,2*, Xiaogang Hao3, Wei Huang3, Atsushi Tsutsumi4, Abuliti Abudula1,2 1 Graduate School of Science and Technology, Hirosaki University, Japan 2 North Japan Research Institute for Sustainable Energy (NJRISE), Hirosaki University, Japan 3 Taiyuan University of Technology, China 4 Collaborative Research Center for Energy Engineering, The University of Tokyo, Japan
GAS-4
Grading the Bio-oils Produced from Rice Husk Fluidized Bed Pyrolysis with Different Condensation Stages Hsiu-Po Kuo
Chang Gung University, Taiwan *, Chen-Pei Hsu, An-Ni Huang
10:20 Coffee break
Emerald B Fluid dynamics I
Session Co-Chairs: Dr. Chang-Keun Yi (Korea Institute of Energy Research),
Prof. Hiroyuki Kage (Kyushu Institute of Technology)
10:40
FLD-1
Correlation on Transport Velocity in an Inclined Fluidized Bed Muhammad Shahzad Khurram
Young Cheol Park2 , Chang-Keun Yi2 1Konkuk University, Korea 2Korea Institute of Energy Research, Korea 1, Jeong-Hoo Choi1,*,Yoo Sube Won1, A Reum Jeong1,
11:00
FLD-2
The Gas Dispersion Coefficient in a Rectangular Fluidized Bed Chien-Song Chyang*, Ashish Nautiyal, Hsin-Yung Hou
11:20 Chung Yuan Christian University, Taiwan
FLD-3
Flow Regime Transition of Wide PSD Particle according to Superficial Gas Velocity in the Gas-Solid CFB Riser GuanHe Rim
11:40 , Dong Hyun Lee* Sungkyunkwan University, Korea
FLD-4
Modeling of Triple bed Circulating Fluidized Bed Flow Behavior Using Equivalent Electrical

Circuit Masanori Ishizuka
12:00 , Hiroyuki Mizuno, Yui Kotani, Yasuki Kansha, Atsushi Tsutsumi* Collaborative Research Center for Energy Engineering, The University of Tokyo, Japan
FLD-5
Hydrodynamic Characteristics of Bubbles in a Bubbling Fluidized Bed with Internals Jea-Ho Shin1, Jong-Hun Lim1, Keon Bae1, Jun-Hwan Kin2, Dong-Ho Lee2, Joo-Hee Han2, Dong Hyun Lee1,* 1Sungkyunkwan University, Korea 2Hanwha Chemical R&D Center, Korea
12:20 Lunch
Emerald B Process Simulation
Session Co-Chairs: Dr. Young Cheol Park (Korea Institute of Energy Research),
Dr. Norihiko Iki (National Institute of Advanced Industrial Science and Technology)
13:40
SIM-1
Self-Heat Recuperation Technology for Process system Kazuo Matsuda
14:00 1,* 1Chiyoda Corporation, Japan
SIM-2
A Model on a Circulating Fluidized-Bed CO2 Capture Process for Flue Gas
A-Reum Jeong
1Konkuk University, Korea 1, Jeong-Hoo Choi1,*, Chang-Keun Yi2, Sung-Ho Jo2, Young Cheol Park2
2Korea Institute of Energy Research, Korea
14:20
SIM-3
A Numerical and Experimental Study for Hydrogen-rich Gas Production using Non-Thermal Plasma Reforming System Hyoung-Woon Song
14:40 1,*, Chang-Sik Choi1, Hee-Suk Jung1 Institute for Advanced Engineering, Korea
SIM-4
Methanol Production Process Based on Self-Heat Recuperation Yasuki Kansha, Hiroyuki Mizuno, Yui Kotani, Masanori Ishizuka, Chunfeng Song, Qian Fu, Atsushi Tsutsumi* Collaborative Research Center for Energy Engineering, The University of Tokyo, Japan
15:30-16:30
The International Coordinators Meeting (Organizing Committee Room (1st Floor))
15:20-17:00 Poster session (1st Floor Lobby)
Session co-chairs: Prof. Young-Kwon Park (University of Seoul),
Dr. Ha-Na Jang (Yonsei University)
18:00 Room 3 Banquet
November 11, 2014 (Tuesday)
Emerald A Pyrolysis and Gasification II
Session Co-Chairs: Dr. Koichi Matsuoka (AIST),
Dr. Uen Do Lee (KITECH)
9:00
GAS-5
Adsorption and Desorption Behavior of HCl on Molecular Sieve 13X Pellet at High Pressure Condition Jong-Ho Moon
9:20 *, Jae Young Kim, Young Cheol Park, Sung-Ho Jo, Ho-Jung Ryu, Chang-Keun Yi Korea Institute of Energy Research, Korea
GAS-6
An Application of CFD for Simulating Biomass Pyrolysis in a Moving-Bed Reactor Narumon Thimthong

9:40 1, Ryota Tanaka1, Srinivas Appari2, Shinji Kudo2, Jun-ichiro Hayashi1,2,3, Koyo Norinaga1, 2* 1Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, Japan 2 Institute for Materials Chemistry and Engineering, Kyushu University, Japan 3 Research and Education Center of Carbon Resources, Kyushu University, Japan

GAS-7

Comparison between Simulation and Experimental Hydrodynamic Characteristics in a Gasifier with Semi-Dual Fluidized Bed Reactor Chang Won Yang1, 2, Su Hwa Jung2, Jung Woo Lee3, Young Doo Kim1, 2, Uen Do Lee1, 2*, Won Yang1, 2, Young Tai Choi2, Tae U Yu2 1University of Science and Technology (UST), Korea 2Korea Institute of Industrial Technology (KITECH), Korea 3R&D center, Hansol Seen tech, Korea

10:00

GAS-8

Development and Operation of A 3mwth CFB Gasification and Power Generation System Beom-Jong Kim

2SungKyunKwan University, Korea 3University of Science and Technolongy, Korea 4Yonsei University, Korea 5Hansol SeenTec, Korea 1,2, Chang-Won Yang 1.3, Soo-Hwa Jeong1., Jae-Yong Jeong 1,3, Young-Doo Kim1,3, Ji-Hong Moon1,4, Jeung-Woo Lee5, Jea-Hun Song5, Young-Tai Chio1, Uen-Do Lee 1,3,* 1Korea Institute of industrial Technology, Korea

10:20 Coffee break

Emerald A Biomass, Biofuel, and Biochemical Processes

Session Co-Chairs: Prof. Guoqing Guan (Hirosaki University),

Prof. Yu-Kaung Chang (Ming Chi University of Technology)

10:40

BIO-1

Purification of Lysozyme from Chicken Egg White by Ion Exchange Nanofibrous Membrane Chromatography Hsing-I Cheng1, Huan-Sheng Chien2, Haw-Jer Chang2, Shin-Ying Chou2, Chen-Yaw, Chiu

2Taiwan Textile Research Institute, Taiwan 1, Yu-Kaung Chang1* 1Ming Chi University of Technology, Taiwan

11:00

BIO-2

Preparation and Characterization of Nanocellulose from Two Types of Cellulose Patchiya Phathong

11:20 , Guoqing Guan, Yufei Ma, Abuliti Abudula Hirosaki University, Japan

BIO-3

Hydrothermal Carbonization of Hevea brasiliensis Seed for Solid Fuel Chanatip Samart

11:40 1,*, Sunanta Kaipommarat1, Suwadee Kongparakul1, Prasert Reubroydharoen2, Guoqing Guan3 1 Thammasat University, Thailand 2 Chulalongkorn University, Thailand 3 North Japan Research Institute for Sustainable Energy (NJRISE), Hirosaki University, Japan

BIO-4

Pilot Autoclaving Test of Waste Paper for the Recovery of Biomass and its Eeutilization Chia-Chi Chang

12:00 1, Yen-Chi Wang1, Sheng-Wei Chiang1, Zang-Sie Hung1, Ching-Yuan Chang1,*, Chung-Fang Ho Chang2, Je-Lueng Shie3, Yi-Hung Chen4 1 National Taiwan University, Taiwan 2 Chung Yuan Christian University, Taiwan 3 National I-Lan University, Taiwan 4 National Taipei University of Technology, Taiwan

BIO-5
Characteristics of Hydrothermal Treatment of Woody Biomass and Features of Upgraded Solid Zayda Faizah Zahara1, Karnowo1, Shinji Kudo2, Koyo Norinaga1,2, Jun-ichiro Hayashi 1,2,* 1Interdisciplinary Graduate School of Engineering Sciences Kyushu University 2Institute for Materials Chemistry and Engineering, Kyushu University
12:20 Lunch
Emerald A Combustion II
Session Co-Chairs: Prof. Hyun Tae Jang (Hanseo University),
Prof. Jun-ichiro Hayashi (Kyushu University)
13:40
CMB-5
Oxy-combustion of Waste Sludge using a Circulating Fluidized Bed Ha-Na Jang
14:00 1, Hang-Seok Choi1, Seung-Ki Back1, Jin-Ho Sung1, Jeong-Hun Kim2, Yong-Chil Seo1,* 1 Yonsei University, Wonju, Korea 2 National Institute of Environmental Research, Korea
CMB-6
The Combustion Performance of Jatropha Seed Residue Pellets in a Vortexing Fluidized-bed Combustor Chien-Song Chyang 1,*, Pin-Wei Li
2 Anhui University of Technology, P.R.China 1, Feng Duan 2 1Chung Yuan Christian University, Taiwan
14:20
CMB-7
The Incineration Characteristics of Organic Waste Sludge in a Fluidized Bed Abidov Aziz Shukurovich
14:40 1, Joo Bo Lee1, MeiMei Peng1, Hyun Tae Jang1,*, Wang Seog Cha2 1Hanseo University, Korea 2Kunsan Nat'l University, Korea
CMB-8
Characteristic of Mixed Firing With The Coal and SRF ff Livestock Waste in the Circulating Fluidized Bed Combustor Jong-Seon Shin, Jae Hyeok Park, Dal-Hee Bae, Dowon Shun Korea Institute of Energy Research, Korea
15:00 Coffee break
Emerald A Syntheses III
Session Co-Chairs: Prof. Ryuji Kikuchi (University of Tokyo),
Dr. Chanatip Samart (Thammasat University)
15:20
SYN-10
Hydrogen Production from High Temperature Water-Gas Shift Reaction over a Fe2O4 Composite using Simulated Waste-Derived Syngas Dae-Woon Jeong
15:40 , Won-Bi Han, Jae-Oh Shim, Kyung-Won Jeon, Hak-Min Kim, Yeol-Lim Lee, Hyun-Seog Roh* Yonsei University, Korea
SYN-11
Development of Pelletizing Facility of Automobile Shredder Residue (ASR) as Energy Resources Tai-Jin Min
16:00 1,*, Woo-Hyun Kim1, Seon-Ah Roh1, Jung-Kyu Lee1 Korea Institute of Machinery and Materials (KIMM), Korea
SYN-12
Low-temperature Fischer–Tropsch Synthesis in Slurry-Phase Reactors on the Catalytic Performance of Ru-Co/SiO2 Catalysts Suwattana Thongkam1, Yoshiharu Yoneyama2, Noritatsu Tsubaki3, Montree Thongkam4,5* 1,4Scienctific Instruments Centre, Faculty of Science, King Mongkut's Institute of

Technology Ladkrabang, Thailand 2,3University of Toyama, Japan 5Functional Phosphate Materials and Alternative Fuel Energies Research Unit (FPM-AFE), King Mongkut's Institute of Technology Ladkrabang, Thailand

16:20

SYN-13

Interfacial Conduction Mechanism of Cesium Phosphate and Silicon Pyrophosphate Composite Electrolytes for Intermediate-Temperature Fuel Cells Ryuji Kikuchi*, Akari Ogawa, Takuya Matsuoka, Atsushi Takagaki, Takashi Sugawara, S. Ted Oyama The University of Tokyo, Japan

EmeraldB Program Management for Promoting Innovation: Theory and Practice

Session Co-Chairs: Prof. Keng-Tung Wu (National Chung Hsing University),

Dr. Dowon Shun (Korea Institute of Energy Research)

9:00

PM-1

Introductory Remarks

A New Way of Thinking Required in These Days of Uncertainty

Kunio Yoshida

University of Tokyo, Japan *

9:10

PM-2

Program Management in Context Hideo Yamamoto

Chuo University, Japan *

9:30

PM-3

Practical Methods of Project and Program Management

Hideo Kameyama

Tokyo University of Agriculture and Technology, Japan *

9:50

PM-4

Transforming to Sustainable Industries by Human Resource Strategies

~program manager development to overcome organizational chasms ~

Shigenobu Ohara

Head Office Project Research, Japan *

EmeraldB Program Management for Promoting Innovation: Case Studies

Session Co-Chairs: Prof. Rong-Chi Wang (Tatung University),

Prof. Hideo Yamamoto (Chuo University)

10:10

PM-5

A Case Study in Applying the Boost Gate Methodology in Corporate R&D Processes

Yoshiaki Wada

Tokyo University of Agriculture and Technology, Japan 1,*, Hideo Kameyama

10:25

PM-6

Developing Area-wide Energy Saving Project in Heavy Chemical Complexes by Area-wide Pinch Technology Kazuo Matsuda

Chiyoda Corporation, Japan *

10:40

PM-7

Application of Platform Management in P2M to Smart Grid Tatsuo Sato

Tokyo University of Agriculture and Technology, Japan *, Hideo Kameyama

10:55
PM-8
Proposals for the popularization and establishment of community-based micro-hydropower generation systems
Masayuki Nakayama
1Tokyo University of Agriculture and Technology, Japan 1,2,*, Hideo Kameyama1
2Japan Society for the promotion of Science, Japan
11:10
PM-9
Proposal for the Application of Ozone Water Technologies for Improving Food Safety in Vietnam Tran Thanh Phong
Alumite Catalyst Technologies Ltd, Japan *
11:25
Comprehensive Discussion
12:00 Lunch
Emerald B Pyrolysis and Gasification III
Session Co-Chairs: Prof. Young Woo Rhee (Chungnam National University),
Dr. Jung-Chin Tsai (Ming Chi University of Technology)
13:40
GAS-9
Numerical Study on Heat Transfer Characteristics of a Circulating Fluidized Bed Gasifier for Plastic Waste Ji Eun Lee
14:00 , Hang Seok Choi* Yonsei University, Korea
GAS-10
Utilizing Volatiles-char Interaction to Improve Tar Cracking in Circulating Fluidized Bed Gasification Reactor Yasumasa Kawabata1, Takaaki Wajima1, Hideki Nakagome1, Sou Hosokai2, Koji Kuramoto2, Hiroaki Sato2, Yoshizo Suzuki2, Koichi Matsuoka
14:20 2 1 Chiba University, Chiba, Japan 2 National Institute of Advanced Industrial Science and Technology (AIST), Japan
GAS-11
Drying Indonesian Sub-bituminous Coal in a Steam Fluidized-bed Dryer Jae Hyeok Park1, Chang-Ha Lee1, Dowon Shun2, Dal-Hee Bae2, Young Cheol Park2, Jong-Seon Shin2, Gi Yeong Kim3, Jaehyeon Park2* 1 Yonsei University, Seoul, Korea 2 Korea Institute of Energy Research (KIER), Korea 3 Chung Nam National University, Korea
14:40
GAS-12
A Catalytic Fluidized Bed Gasification of Indonesian Kideco Coal in Low Temperatures Gyoung Tae Jin*, Young Cheol Park, Jong-Ho Moon, Seung-Yong Lee, Ho-Jung Ryu Korea Institute of Energy Research, Korea
15:00 Coffee break
Emerald B Fluid Dynamics II
Session Co-Chairs: Prof. Hsiu-Po Kuo (Chang Gung University),
Prof. Dong Hyun Lee (Sungkyunkwan University)
15:20
FLD-6
Effect of Crude Oil Properties on the Transport Profile inside Pipeline using Computational Fluid Dynamics Simulation Wanwisa Rukthong
15:40 1, Pornpote Piumsomboon1,2, Wichapun Weerapakkaroon3, Benjapon Chalermsinsuwan1,2,* 1 Fuels Research Center, Chulalongkorn University,

Thailand 2 Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University, Thailand 3 PTT Research & Technology Institute, PTT Public Company Limited, Thailand

FLD-7

Hydrodynamic Characteristics of Multi-Walled Carbon Nanotube Agglomerates in the Fluidized Beds Sung Woo Jeong

Sungkyunkwan University, Korea , Jae Hoon Lee, Dong Hyun Lee*

16:00

FLD-8

Experimental and Numerical Investigations of a Spouted Bed with a Draft Tube W.Y Chen, H.P. Kuo, A.N. Huang

16:20 * Chang Gung University, Taiwan

FLD-9

CPFD Simulation of Bubbling Fluidized Beds with Shroud Nozzle Distributor and Vertical Internal: Effect for Bubble Flow Jong Hun Lim1, Jea Ho Shin1, Kyung Hoon Cho2, Dong Ho Lee2, Joo Hee Han2, Dong Hyun Lee1* 1 Sungkyunkwan University, Korea 2 Hanwha Chemical R&D Center, Korea

18:00 Room 3 Farewell Party

November 12, 2014 (Wednesday)

9:00 Technical Tour: GS Caltex & Sightseeing with Lunch & Dinner

Poster session (1st Floor Lobby) (15:20-17:00 November 10, 2014)

BIO-P1

Eggshell Particle as Immobilized Zinc Ion Matrix for Protein Adsorption: Equilibrium Study Guan-Yu Lin

BIO-P2 , Siao-Ying Chen, Yu-Kaung Chang* Ming Chi University of Technology, Taiwan

Lab-Scale Experimental Results of the Biogas Upgrading Using Amine Solutions Young Cheol Park

BIO-P3 1, Jong-Seop Lee1, Wonki Kim1, Jong-Ho Moon1, Byoung-Moo Min1,*, Dong-Min Shim2 1Korea Institute of Energy Research, Korea 2Hansol EME Co., Ltd, Korea

Immobilization of Lysozyme on the Extrudate-Shaped Na-Y Zeolite to Disrupt Cells： Recirculated Packed Bed Disruption Process

Kai-Jie Lin

Ming Chi University of Technology, Taiwan , Ching-Min Ko, Yu-Kaung Chang*

BIO-P4

Demonstration Set-up for Thermal Hydrolysis Reaction system Using Animal Waste Seong-Kuk Han

BIO-P5 1, Hee Suk Jung1,Hyoung-Woon Song1, Ho Kim1,* Institute for Advanced Engineering, Korea

Kinetics And Thermodynamics of Enhanced Green Fluorescent Protein Adsorption on Immobilized Metal Affinity Nanofibrous Membrane Kuei-Hsiang Chen

BIO-P6 , Jun-Hong Lin, Hsiao-Chun Yang, Yu-Kaung Chang* Ming Chi University of Technology, Taiwan

Hydrothermal Conversion of Lignin to Monomeric Phenols and Fuel Gas Using Alkaline Aqueous Solution Shingo Nishioka

2Institute for Materials Chemistry and Engineering, Kyushu University, Japan 1, Shinji Kudo2, Yuka Takashima2, Yasuyo Hachiyama2, Koyo Norinaga1,2, and Jun-ichiro Hayashi1,2,3,* 1Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, Japan

3Research and Education Center of Carbon Resources, Kyushu University, Japan
BIO-P7
Purification of Enhanced Green Fluorescent Protein by Immobilized Metal Affinity Chromatography Shih-Cheng Hong
BIO-P8 , Yan-Syun Chou, Shiau-Jyun Yang, Yu-Kaung Chang* Ming Chi University of Technology, Taiwan
Effects of Biochar from Torrefaction and Carbonization of Woody Biomass on Plant Growth Keng-Tung Wu 1,*, Li-Wei Yu 1, Yi-Hui Yen 1,4, Chia-Ju Tsai
Chia-Yu Chang 2, Rei-Yu Chein 3 1Department of Forestry, National Chung Hsing University, Taiwan 1, Chien-Teh Chen 2,
2Department of Agronomy, National Chung Hsing University, Taiwan
3Department of Mechanical Engineering, National Chung Hsing University, Taiwan
4Hsinchu Forest District Office, Council of Agriculture, Taiwan
BIO-P9
Low Concentration Effect on Fermentative Hydrogen Production by Beverage Wastewater Chun-Min Liu
CCU-P1 1, Jin-Long Cheng2, Chen-Yeon Chu1,2,3*, Shu-Yii Wu1,2,3, Chiu-Yue Lin1,2,3 1 Dept. of Chemical Engineering, Feng Chia University, Taiwan 2 Master's Program of Green Energy Science and Technology, Feng Chia University, Taiwan 3 Green Energy Development Center, Feng Chia University, Taiwan
Development of the Performance Evaluation Technology for the Dry-Sorbent CO2 Capture Process Young Cheol Park
CCU-P2 , Jae-Young Kim, Jong-Ho Moon, Seung-Yong Lee, Sung-Ho Jo, Chang-Keun Yi, Jong-Seop Lee, Byoung-Moo Min* Korea Institute of Energy Research, Korea
Techno-Economic Analysis of High Value Chemical Production Technology Using the Carbon Dioxide Contained in the Flue Gas from the Coal-Fired Power Plant Ji Hyun Lee, Dong Woog Lee, No-Sang Kwak, Se-Gyu Jang, Kyung Ryoung Jang, Jae-Goo Shim* Korea Electric Power Corporation Research Institute, Korea
CCU-P3
Nano Porous Cross Linked Poly Pyrroles for CO2 Adsorption Mei Mei Peng, Mani Ganesh, Rajangam Vinodh, Abidov Aziz, Ung Jin Jeon, Muthiahpillai Palanichamy, Hyun Tae Jang* Hanseo University, Korea
CCU-P4
Effect of Operating Parameters on System Mixing Inside Air Reactor of Chemical Looping Combustion using CFD Simulation Piriya Laiarpatorn
1 Fuels Research Center, Chulalongkorn University, Thailand 2 Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University, Thailand 1,2, Pornpote Piumsomboon1,2, and Benjapon Chalermsinsuwan1,2,*
CCU-P5
Characteristics of Continuous Adsorption/Desorption of Heat Stable Salts Using Ion Exchange Resin In CO2 Absorption Process Joon-hyung Cho
Pusan National University, Korea , Kyoung-Bin Park, Hyung-Don Lee, Soo-Bin Jeon, Min-Kyoung Kang, Kwang-Joong Oh*
CMB-P1
Numerical Study on the Thermal Fluid flow in Integrated Combustor Hyoung-Woon Song
ECN-P1 1,*, Eun-Suk Jang1, Seong-Kuk Han Institute for Advanced Engineering, Korea
Investigation of IGFC for Low Grade Coal Norihiko Iki

ECN-P2 *, Osamu Kurata National Institute of Advanced Industrial Science and Technology, Japan
Operational Optimization of 1kw Residential Power Generation System using PEM Fuel Cell by Controlling Anodic and Cathodic Utilization Minjin Kim1,2,*, Donghun Seok3, Young-Jun Sohn1,2 1 Korea Institute of Energy Research, Korea 2 University of Science and technology, Korea 3 POSCO Energy, Pohang, Korea
ECN-P3
Self-heat Recuperation System by Electrocaloric Effect Toshihiro Kaseda
Collaborative Research Center for Energy Engineering, The University of Tokyo, Japan , Yasuki Kansha, Masanori Ishizuka, Yui Kotani, Renald Rasfuldi, Atsushi Tsutsumi *
ECN-P4
Chemical Heat Transformer for High Temperature Systems Junghee Jo
Japan , Chunfeng Song, Yasuki Kansha, Masanori Ishizuka, Atsushi Tsutsumi * Collaborative Research Center for Energy Engineering,The University of Tokyo,
EPR-P1
Kinetics and Column Adsorption Characteristics of 2,4-Dichlorophenoxybutric Acid on Activated Carbon Tae Young Kim1,*, Byoung Jun Min1, Pan Pan Sun1, Sung Young Cho 1,2 1,2Chonnam National University, Korea
EPR-P2
Kinetics Study for Thermal Decomposition Reaction of Mercury in Waste Sludge Seung-Ki Back
Jeong-Hun Kim2, Ki-Heon Kim2, Young-Lan Kim2 1 Yonsei University, Korea 2 National Institute of Environment Research, Korea 1, Yong-Chil Seo1,*, Jin-Ho Sung1, Ha-Na Jang1, Bup-mook Jeong1,
EPR-P3
Study on Struvite Crystallization in a Semi-batch Jet Loop Fluidized Bed Reactor
Dae-Yeop Kang
EPR-P4 , Jea-Keun Lee * Pukyong National University, Korea
The Characteristics of Aerobic Liquid-composting of Livestock Excretions and Comparison of Liquid-composting Efficiency Hee Suk Jung
EPR-P5 , Seong Kuk Han, Hyoung Woon Song * Institute for Advanced Engineering, Korea
Evaluation of Solid-liquid Separation Efficiency of Anaerobically Digested Waste water Using CST, TTF Seong-Kuk Han
FLD-P1 1, Hee-Suk Jung1, Hyoung-Woon Song1,* Institute for Advanced Engineering, Korea
Hydrodynamic Characteristics of Absorbent/Catalyst for Pre-combustion CO2 Capture Dong-Ho Lee
2KAIST, Korea1,2, Seung-Young Lee 1, Jaehyeon Park 1, Ho-Jung Ryu 1,*, Seung Bin Park 2,* 1Korea Institute of Energy Research, Korea
FLD-P2
Hydrodynamic Characteristics at Layer Inversion Point in Three-Phase Fluidized Beds with Binary Solids Jun Young Kim
FLD-P3 , Dong Hyun Lee* Sungkyunkwan University, Korea
On the Heat Transfer Mechanism in Viscous Liquid - Solid Fluidized Beds Dae Ho Lim, Jin Kyeong Oh, Yong Kang* Chungnam National University, Korea
FLD-P4
Gas Absorption from CO2 Bubbles in Liquid Using a Bubble Generation Control Device Hiroki Uchiyama
FLD-P5 *, Mitsuharu Ide, Yosuke Matsukuma, Akira Kariyasaki Fukuoka University, Japan

A Gas Mixing Study in Partitioned Fluidized Beds Seung-Yong Lee
FLD-P6 , Gyoung Tae Jin*, Young Cheol Park, Jong-Ho Moon, Ho-Jung Ryu Korea Institute of Energy Research, Korea
Effect of Mechanical Vibration on Granulation Behaviors in a Fluidized Bed Yoshihide Mawatari
FLD-P7 *, Ryusei Tanaka, Masato Yamamura, Hiroyuki Kage Kyushu Institute of Technology, Japan
Characteristics of Solid Circulation Rate in Three-Phase Circulating Fluidized Beds Min Kon kim1
1School of Chemical Engineering, Chungnam National University, Korea , Sung Kyu Hong1, Dae Ho Lim1, Dong Jun Yoo1, Yong Kang1*, Sang Done Kim2
2 Department of Chemical & Biomolecular engineering, KAIST, Korea
GAS-P1
Reaction Kinetic Study of Samwha Coal-Chars: Characterization, Modeling, Catalytic and CO2 Gasification Jong Hoon Cho
GAS-P2 1, Sang Kyum Kim 1, Soon Choel Hwang 1, Do Kyun Lee 2, Si Hyun Lee 3, Young Woo Rhee 1,* 1Graduate School of Energy Science and Technology, Chungnam National University, Korea 2Department of Applied Chemistry and Biological Engineering, Chungnam National University, Korea 3Korea Institute of Energy Research, Korea
Adsorption Characteristics of H2S on Adsorbent Made by Fallen Leaves Tae Hyung Kil
1Daejeon University, Korea 1, Young Kuk Yoo1, Yeong Seong Park1*, Sang Guk Kim2
2Korea Institute of Energy Research, Korea
GAS-P3
Simulation of Biomass Gasification in a Circulating Fluidized Bed using Aspen Plus Jung-Chin Tsai
GAS-P4 1*, Chen-Yaw Chiu1, Chih-Shen Chen2 1Ming Chi University of Technology, Taiwan 2Taiwan Power Research Institute, Taiwan
A Comparative Study on the Characteristics of Fast Pyrolysis of Empty Fruit Bunch from Palm Mill, Banmara, and Jatropha Seed Heung-Min Yoo
GAS-P5 1, Yong-Chil Seo 1*, Jang-Soo Lee1, Won-Seok Yang1, Jun-Kyung Park1, Se-Won Park1 , Sung-Sub Yoon2 1 Yonsei University, Wonju, Korea 2 Korea Environmental Industry & Technology Institute, Korea
CO2 gasification of Biomass and Waste in Thermo-balance Reactor Seon Ah Roh
GAS-P6 *, Jin Han Yun, Sang In Keel Korea Institute of Machinery and Materials, Korea
Pyrolysis of High Moisture Indonesian Sub-bituminous Coal Jaehyeon Park
GAS-P7 1*, Dowon Shun1, Dal-Hee Bae1, Seung Yong Lee1, Young Cheol Park1, Jong-Seon Shin1, Jae Hyeok Park2, Gi Yeong Kim3 1 Korea Institute of Energy Research (KIER), Korea 2 Yonsei University, Seoul, Korea 3 Chung Nam National University, Korea
The Effect of ZnO and NiO Contents on the Physical Properties and Reactivity of Solid Sorbent for Hot Syngas Cleanup in a Circulating Fluidized-bed Reactor Jeom-In Baek
GAS-P8 , Tae Hyoung Eom, Joong Beom Lee, Byung-Kuk Kim, Seong Jegarl, Chong Kul Ryu KEPCO Research Institute, Korea
Catalytic Effect of Alkali and Alkali Earth Catalysts on CO2 Gasification Reactivity of Australia Drayton Coal Jung Su Kim, Jong Hoon Cho, Sang Kyum Kim, Young Woo Rhee* Chungnam National University, Korea
GAS-P9
Catalytic Copyrolysis of Polyethylene and Sawdust over Zeolitic Materials Hyung Won Lee1, Sung Ho Jin1, Jong-Ki Jeon2, Sung Hoon Park3, Sang-Chul Jung3, Sang

Chai Kim4, Young-Kwon Park1,5,* 1 Graduate School of Energy and Environmental System Engineering, University of Seoul, Korea 2 Kongju National University, Korea 3 Sunchon National University, Korea 4 Mokpo National University, Korea 5School of Environmental Engineering, University of Seoul, Korea

SIM-P1

Numerical Analysis for Optimum Design of 1000 by 1000 mm size Membrane plate in Filter Press Hee Suk Jung

1Clean Energy Team, Institute for Advanced Engineering, Korea 1 , Dong Shin Ko2, Seong Kuk Han1, Hyoung Woon Song1, *

2Mechatronics team, Institute for Advanced Engineering, Korea

SYN-P1

Highly Active Cobalt Catalysts for Fischer-Tropsch Synthesis using Different Type of Solvent for Catalyst Preparations Ratchprapa Satthawong

SYN-P2 , Prasert Reubroycharoen Chulalongkorn University, Thailand

Stearic Acid Deoxygenation for Production of Aliphatic Hydrocarbon over Pd Catalysts Kyung-Ran Hwang

SYN-P3 , Il-Ho Choi, Kyung-Hwan Lee, Jin-Suk Lee Korea Institute of Energy Research, Korea

Effective Dispersion Method of Entangled Multi-Walled Carbon Nanotubes by Magnetic Field Jae Hyeong Son

SYN-P4 , Sung Jin Song, Seong Yong Son, Lin Tong, Dong Hyun Lee* Sungkyunkwan University, Korea

Characteristics of Micro Drop Fluidized Reactor for Continuous Preparation of ZnO Powders Dae Ho Lim1, Jin Kyeong Oh1, Chan Ki Lee2, Bo Gyeong Choi1, Yong Kang1* 1 Chungnam National University, Korea 2 Institute for Advanced Engineering, Korea

SYN-P5

Alkoxide Intercalated Mg-Al Layered Double Hydroxides as Heterogeneous Base Catalysts for Selective Synthesis of Monoglycerides Nuchanart Siri-nguan, Chawalit Ngamcharussrivichai

SYN-P6 Fuels Research Center, Chulalongkorn University, Thailand

A Catalytic Property of ZnO for Synthesis of Dimethyl Carbonate from Urea and Methanol Chan Tae Ji

SYN-P7 1, No-Kuk Park1, Tae Jin Lee1*, Suk Hwan Kang2 1Yeungnam University, Korea 2Institute for Advanced Engineering, Korea

Hydrogen Reduction of Iron Oxides in Fluidized Bed Reactor Young-Ok Park1, Yong-Ha Kim2 1 Korea Institute of Energy Research, Korea 2 Pukyong National University, Korea

SYN-P8

Kinetics Study on the Methanolysis of Polycarbonate Shwu-Jer Chiu

SYN-P9 *, Chou-Tso Tsai Ming Chi University of Technology, Taiwan

Recovery of Platinum from Spent Reforming Catalyst by Ion Exchange with Diaion SA 10AP Resin Pan-Pan Sun

SYN-P10 *, Hyoung-Il Song, Tae Young Kim, Byoung-Jun Min, Sung-Yong Cho Chonnam National University, Korea

Formation of Macro-Porous Zirconia as Catalytic Support Material for Production of Hydrogen Yeon Baek Seong

2Institute of Clean Technology, Yeungnam University, Korea 1, No-Kuk Park2, Tae Jin Lee1,* 1Yeungnam University, Korea

SYN-P11

Synthesis of Nanosized Titania Photocatalyst Using Mesoporous Silica as a Micro-Reactor for Increasing Photodegradation of Methylene Blue Tzong-Horng Liou

SYN-P12 *, Li-Wai Hung, Liang Chu Ming Chi University of Technology, Taiwan

Development of Bed Inserts for WGS Catalyst Support in a SEWGS System Ho-Jung Ryu, Dong-Ho Lee, Seung-Yong Lee, Gyoung-Tae Jin, Jaehyeon Park Korea Institute of Energy Research, Korea

SYN-P13

Purification of Lysozyme From Chicken Egg White by Ion Exchange Nanofibrous Membrane in a Stirred Cell Contactor Chi-Lin Yang

2Taiwan Textile Research Institute, Taiwan 1, Jun-Yi Wu1, Huan-Sheng Chien2, Haw-Jer Chang2, Shin-Ying Chou2, Yu-Kaung Chang1* 1Ming Chi University of Technology, Taiwan

SYN-P14

The Effect of Preparation Method on the Catalytic Performance over Fe/Al/Cu Oxide Based Catalysts for Water-Gas Shift Reaction using Simulated Waste-Derived Synthesis Gas Dae-Woon Jeong

SYN-P15 , Won-bi Han, Won-Jun Jang, Hyun-Suk Na, and Hyun-Seog Roh* Yonsei University, Korea

Size Distribution and Sources of Fractionated Water-Soluble Organic Carbons Measured at an Urban Site Se-Chang Son, Seung-Shik Park

SYN-P16 Chonnam National University, Korea

Investigating Formation Pathways of Particulate Water-soluble Organic Carbons Observed during Non-biomass and Biomass Burning Periods Geun-Hye Yu, Sung-Yong Cho, Seung-Shik Park

SYN-P17 * Chonnam National University, Korea

Preferential CO Oxidation over Supported Pt Catalysts Dae-Woon Jeong1, Kyung-Won Jeon1, Won-Jun Jang1, Jae-Oh Shim1, Hyun-Suk Na1, Yeol-Lim Lee1, Seong-Heon Kim1, Jong Wook Bae2, Hyun-Seog Roh1,* 1 Yonsei University, Wonju, Korea 2 Sungkyunkwan University (SKKU), Korea

INSTRUCTIONS FOR PRESENTERS

Oral presentations

Speakers of the oral presentations are required to report to the session chair before the session starts. Each oral presentation is limited to 20 minutes including 5 minute discussion time.

The session room will be equipped with a laptop with a beam projector. Presenters can use their own laptops or load their presentation materials from USB memory sticks before the beginning of the session.

Poster presentations

Date and time of poster session: November 10, 2014, 15:20 – 17:00

Put-up time: Lunch Time (November 10, 2014)

Take-down time: 17:20 (after Poster Session)

The size of each poster panel is 0.9 m in width and 1.3 m in height. Each paper's ID will be indicated on the board. Push-Pins will be provided for your use. Double-sided Tape is not allowed. All presenters are required to preside at their poster panel during the session for discussion with participants. Posters must be taken down at 17:20 on the day of presentation. Posters that are not removed will be discarded.