e-ASIA Joint Research Program Final Report

1. Project title : Development of Functional Nanocarbon-Based Catalysts for Biomass Conversion Processes

2. Joint Research period : November 1 , 2014 $\,\sim\,$ March 31, 2018

- 3. Research Team :
- Japan team (up to 6 people including the Principal Investigator) Funding period: November 1, 2014 ~ March 31, 2018 Total Funded Amount (in Local Currency): 20,803,000 yen

	Name	Position	Affiliation	Role in the project		
PI	Tetsuya Kida	Professo	Kumamoto Universit	Catalyst devel		
		r	У	opment		
Co-PI	Armando Quitain	Assistan	Kumamoto Universit	Microwave tec		
		t Profes	У	hnology devel		
		sor		opment		
Co-PI	Mitsuru Sasaki	Associat	Kumamoto Universit	Supercritical fl		
		e Profes	У	uid technology		
		sor		development		
Collaborat	Elaine Mission	PhD stu	Kumamoto Universit	Microwave tec		
or		dent	У	hnology devel		
				opment		
Collaborat	Azzah Pramata	PhD stu	Kumamoto Universit	Catalyst devel		
or		dent	У	opment		
Collaborat	Azumi Miyamoto	MS stu	Kumamoto Universit	Catalyst devel		
or		dent	у	opment		
	Total number of participants including students: 18					

■ Thai team (up to 6 people including the Principal Investigator) Funding period: June 1, 2015 - May 1, 2017 Total Fundad Amount (in Level Currensul) 2,152,670 the

Total Funde	ed Amount ((in Local C	Currency): 3,	152,670 thb

	Name	Position	Affiliation	Role in the project
PI	Artiwan Shotipruk	Associat	Chulalongkorn Univ	Process desig
		e Profes	ersity	n
		sor		
Co-PI	Navadol Laosirip	Professo	King Mongkut's Uni	Catalyst devel
	ojana	r	versity of Technolo	opment
			gy, Thonburi	
Co-PI	Panatpong Boon	Lecturer	Naresuan Universit	Catalyst devel
	noun		У	opment
Collaborato	Nawin	Researc	National	Process desig
r	VIRIYA-EMPIKU	her	Nanotechnology	n
	L		Center (NANOTECH)	

			National Science			
Collaborato	Tat BOONYAK	MS stud	Department of Ch	Catalyst devel		
r	ARN	ent	emical Engineerin	opment		
			g, Chulalongkorn			
			University			
Collaborato	Piyaporn WATA	PhD stu	Department of Ch	Catalyst devel		
r	NIYAKUL	dent	emical Engineerin	opment		
			g, Chulalongkorn			
			University			
Total number of participants including students: 11						

■ Philippines team (up to 6 people including the Principal Investigator) Funding period: November 2, 2014 ~ February 2, 2018 Total Funded Amount (in Local Currency): 8,198,566 php

	1				
	Name	Position	Affiliation	Role in the project	
PI	Joseph Auresenia	Professo	De La Salle Unive	Catalyst devel	
		r	rsity-Manila	opment	
Co-PI	Luis Razon	Professo	De La Salle Unive	Process desig	
		r	rsity-Manila	n	
Co-PI	Pag-Asa Gaspillo	Professo	De La Salle Unive	Process desig	
		r	rsity-Manila	n	
Collaborat	Jurex Gallo	research	Chemical Enginee	Catalyst devel	
or		er	ring Department,	opment	
			De La Salle Univ		
			ersity-Manila		
Collaborat	Fritzie Hannah B	PhD stu	Chemical Enginee	Catalyst devel	
or	aldovino	dent	ring Department,	opment	
			De La Salle Univ	-	
			ersity-Manila		
Collaborat	Clarence Joseph	MS stud	Chemical Enginee	Process desig	
or	co	ent	ring Department.	n	
			De La Salle Univ		
			ersity-Manila		
	Tota	l number o	f participants including	Letudonte: 11	
Total number of participants including students. It j					

4. Summary of the joint research

Japan: The Japan team had successfully utilized the synergy of graphene oxide (GO) and microwave (MW) irradiation for cellulose depolymerization and biodiesel production, including glycerol conversion into fuel additives. The use of sub- and supercritical fluid as a solvent has also been investigated. Results indicated that microcrystalline cellulose can be effectively depolymerized into glucose, generating yields as high as 73% in 1 h. GO can effectively convert free fatty acid to biodiesel with 99% yield in 3 min, but would require functionalization with sodium silicate to obtain 99% conversion of the triglyceride in 30 min. Other related works that have been carried out include nitrogen-functionalization of GO obtaining 11% N-doping level (the highest reported so far) and its application to CO2 capture, liquefaction of oil palm biomass into bio-oil obtaining higher yield compared to metal oxide-based catalysts and hydrolysis of polyphenols to remove the sugar moieties.

Thailand: The Thai team had successfully synthesized and characterized sulfonated hydrothermal carbon-based acid catalyst from glucose and applied this to cellulose hydrolysis and fructose dehydration reaction obtaining 43% of glucose yield, and 87% of fructose conversion, respectively. The yield is better compared to conventionally synthesized hydrothermal carbon acid catalyst via incomplete carbonization in sulfuric acid, obtaining highest sugar yield of 40% from the hydrothermal hydrolysis of eucalyptus chips in 5 min. The possibility of enhancing the biomass conversion yield by the application of the catalyst with the addition of chromium chloride was also evaluated for the production of HMF and levulinic acid from cellulose in single and biphasic systems.

Philippines: The Philippine team has successfully synthesized carbon nanotubes from indigenous materials such as coconut shell and applied this to the synthesis of biodiesel production from microalgae, kenaf and kakawate seeds using microwave irradiation. Determination of the mechanism pertaining to the reaction and estimation of the parameters have also been studied. Supercritical carbon dioxide extraction apparatus has also been built and applied to extraction of oil feedstock for biodiesel production. The research outputs have been disseminated by journal publication and in various conferences around the region, some of which have been organized by the research team.

- 5. Outputs and Anticipated Outcomes of Joint Research
 - 5-1 Scientific achievements and implemented activities of the joint research

Japan team: Non-edible biomass, which contains valuable macromolecules and polysaccharides, has been attracting interest as a sustainable, renewable and environment-friendly alternative to fossil fuels as a biofuel and an oxychemicals resource. One of the key pathways towards biomass utilization is to convert major polysaccharides into their constituent monomers, (i.e. cellulose in terrestrial and fucoidan in aquatic biomass into glucose and fucose, respectively), that could be

easily processed into biofuels and bioplastics precursors. This pathway involves the cleaving of glycosidic bonds through the hydrolysis process. Significant attention has focused onto developing economically acceptable processes characterized by fewer processing steps, use of green solvents such as water, recoverable and reusable catalyst and operation at moderate temperatures.

Recently, carbon-based catalysts are perceived to be a suitable replacement to precious metal-based catalysts. Amongst carbon-based catalysts, graphene derivatives, such as graphene oxide (GO), reduced graphene oxide (rGO) and functionalized GO (fGO), have received the most attention due to its myriad of physical, chemical and electronic properties. To overcome, the mass transfer limitation prevailing in heterogeneous catalysis, process intensification through microwave irradiation (MW) was performed.

The synergy of MW and GO was applied to fucoidan depolymerization and fatty acids esterification. Contrary to the β -1,4 glyccosidic bond in cellulose, fucoidan contain α -1,2 glycosidic bonds. Hence, fucoidan was soluble in water and the depolymerization reaction was carried out at atmospheric conditions. The highest fucose yield of 54% was achieved at fucoidan: GO: water ratio of 5:5:1, 15 min reaction time, and 600W. Furthermore, it was found that temperature and MW power have significant contributions in increasing fucose yields. Meanwhile, in the esterification process, 99.2 % fatty acid methyl ester was achieved at 3 min, methanol/oleic acid molar ratio of 12. Even with methanol as solvent, GO still outperformed Amberlyst 15, sulfated zirconia and graphite oxide. In the proposed reaction mechanism, it is supposed that aside from being a proton donor, the carbon backbone of GO has potentially adsorbed the oleic acid which enabled the highly reactive methanol to easily access the oleic acid's carboxylate head towards alcoholysis. Oleic acid may have potentially adsorbed onto the carbon backbone of GO and thus, responds to MW irradiation thru realignment. This has facilitated the highly reactive methanol to easily access the oleic acid's carboxylate head towards alcoholysis.

Microcrystalline cellulose (MCC) was depolymerized using the synergy of MW and GO using water as the sole solvent without pretreatment. GO is thewater-

soluble precursor of graphene and has demonstrated catalytic which activities due to the varietyof oxygenated functionalities (hydroxyls, carbonyls, carboxyls and epoxides) that abounds its surface. These weakly acidic multifunctional groups synergistically overcame the extensive hvdrogen bondingnetworks and protonated the β-alycosidic bonds toward hydrolytic scission. MW, on the other hand, accelerated the heating up time suppressing side reactions and facilitated conformational changes onC-O (carbon-oxygen) glycosidic bond for easy accessibility towards



hydrolysis. Partial disruption of crystalline region and crystalline-to-amorphous transformation was activated at 473 K leading to aselective glucose formation in as short as 30 s at a MW power of 800 W, with accompanying changesin crystallinity index (from 68 to 60) and crystalline sizes (from 5.3 to 4.5 nm) of MCC after the reaction. Calculated heating rates values were in agreement with published dielectric values for water, GO, graphite (Gr) and carbon nanotubes (CNT). The heating rates was also found to signify interaction between MW and the catalyst and was found to highly correlate with the glucose yield. Thus, the activity of GO under MW was much higher than those of other solid acid catalysts such as Amberlyst 15, sulfated zirconia, and phosphotungstic acid. Control experiments with carbonnanotubes (void of functionalities) and trace sulfuric and formic acids confirmed that the activity of GOdoes not solely rely on the detached functionalities. The surface attrition mechanism was proposed tobest describe the depolymerization process as observed via scanning electron microscopy. Thegradual reduction in crystallize size indicated the layer-by-layer peeling of bulk crystalline structure.

Thai team: Suitable hydrothermal carbonization conditions including temperature (180–250°C) and time (6–24h) were determined for the preparation of glucose derived carbon material, used as a catalyst support for sugar and cellulose conversions. The suitable hydrothermal carbonization condition was found to be 220°C and 6h, providing a stable carbon support that after sulfonation, yielded carbon-based acid catalyst (HTC220-6-SO₃H) that exhibit relatively high catalytic activities for cellulose hydrolysis and fructose dehydration reaction, giving glucose and HMF yields of 43.63 ± 1.62 wt.% and 20.29 ± 1.09 wt.%, respectively. Synthesis of hydrothermal carbon was also performed from real biomass, defatted rice bran (HTCDRB). Despite having similar structural and chemical characteristics, the leaching test suggested that the DRB-based hydrothermal carbon catalyst, prepared at the same condition. The catalytic activity for cellulose hydrolysis of the catalyst was higher than that of the commercial Amberlyst 16 catalyst.

Philippines team: This multilateral joint research project aims to develop carbonbased catalysts as applied to the conversion of biomass to value-added chemicals and biofuels focusing on microalgae, marine and nonedible biomass resources as feedstocks. Specifically, the developed carbon-based catalysts were applied to conversion of biomass to value-added chemicals and biofuels focusing on microalgae, marine and non-edible biomass resources such as kenaf (Hibiscus cannabinus) and Kakawate (Gliricidia sepium) as feedstocks. Emerging carbon-based catalysts such as graphene, carbon nanotube and hydrothermal carbon chemically modified with functional groups such as sulfonic or amine groups to adjust its acidity or basicity are being developed. The functional carbonbased materials are then applied as catalyst for biodiesel production from microalgae and two non-edible seed oils. 5-2 Synergistic effects of the international joint research

Workshops were jointly organized every year in Japan, Thailand, and Philippines. *In Japan*: 1) Joint International Symposium on 「Regional Revitalization and Innovation for Social Contribution」 and 「e-Asia Functional Materials and Biomass Utilization」 2015, October 1, 2015. (Fukuoka, Japan). 2) Joint International Symposium on 「Regional Revitalization and Innovation for Social Contribution」 and 「e-Asia Functional Materials and Biomass Utilization」 2016, December 7, 2016. (Fukuoka, Japan)

In Thailand: 1) Development of Functional Nanocarbon-Based Catalyst for Biomass Conversion Processes, the e-ASIA Joint Research Program (e-ASIA JRP), September 19-20, 2016, Thailand.

In Philippines: 1) DOST East Asia organized the Asian Federation of Biotechnology (AFOB) Regional Symposium 2017 held last February 9-11, 2017 at DLSU, Manila, Philippines

5-3 Broader impacts including contribution to society

Carbon-based catalysts offer tremendous opportunities as carbon is cheap, earth-abundant, and stable. In addition, its electronic and chemical properties can be tuned easily. Our design of graphene oxide, hydrothermal carbon, and carbon nanotube catalysts leads to creating a new class of heterogeneous catalysts for the conversion of biomass to value-added chemicals.

5-4 Development and sustainability of the cooperation

We had very active research and student exchanges among the participating research teams. The Japan team sent 3 students to the Thai side as exchange students for 1-2 months and sent 17 students to participate co-organized workshops that were held in Thailand and Philippines. The Japan team accepted 6 students from the Thai team and 4 students from the Philippine team as exchange students, who studied in Japan for 6 to 12 months. They largely contributed to the advance of the collaborative research project.

6. Future Goals and Plan of Activities after the project period

The joint research program intends to strengthen cooperation among Japanese, Thai and Filipino researchers for more active future research collaboration, and to promote development of young researchers to address the imminent biomasscentered economy in the region. Now we have MoU agreements between Kumamoto University, Chulalongkorn University, and De La Salle University, which should facilitate the future academic and student exchange. Even after the project has been completed, the research exchanges will continue, and will be extended to include researchers from other countries especially in the Southeast Asian region. In this perspective, our collaboration would greatly contribute to the realization of an expanded biomass-based society in the region. 7. Scientific Achievements and Implemented Activities (Publication, Research Exchange, Workshop, etc.)

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8. Recommendations and Comments to the Program

This is a very good program that promoted our research collaboration, student exchange, and friendship. We strongly hope that this program continues, expands, and grows.

9. Others (agenda of workshop, photos of research teams, meetings, and etc.)

Some photos of research teams at meetings and workshops are shown below.







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1. Original Publication of Articles etc.

[Notes]

Please fill in only the achievements of this project by country in order of publication date. Only "published" is targeted, but please write "in press" too only for Final Report.

Please count Proceedings with peer review as original paper. The information on this form is only disclosable. Please submit Non-disclosable information in a separate file.

1. 1 Original Publications (Articles co-authored among Research Teams)

All Authors' Names, Title, Journal Name, Volume, Edition, Page, Year of Publication	DOI Code	Publication Status	Remarks (e.g. publication in top level journals etc.)
F. H. Baldovino, A. T. Quitain, Nathaniel P. Dugos, Susan A. Roces, M. Koinum,M. Yuasa and T.			
Kida, Synthesis and characterization of nitrogen-functionalized graphene oxide in high-	10.1039/C6RA22885B	published	Philippines/Japan
temperature and high-pressure ammonia, RSC Adv., 2016, 6, 113924-113932.			
A. T. Quitain, Y Sumigawa, E. G. Mission, M. Sasaki, S. Assabumrungrat, T. Kida, Graphene	10.1021/acs.energyfuel	in proce	Thai/ Japan
Oxide and Microwave Synergism for Efficient Esterification of Fatty Acids, Energy Fuels,	s.8b00119	in press	Thai/ Dapan
P. Wataniyakul, P. Boonnoun, A. T.Quitain, M. Sasaki, T. Kida, N. Laosiripoj, A. Shotipruk,	10 1016/i catcom 2017		
Preparation of hydrothermal carbon as catalyst support for conversion of biomass to 5-	10.014	published	Thai/Japan
hydroxymethylfurfural, Catalysis Communications, 2018, 104, 41-47.	10.014		
C.J.U. Co, A.T. Quitain, J.Q. Borja, N.P. Dugos, M. Takafuji, T. Kida, Synthesis and	10 1088/1757-		
characterization of hybrid composite aerogels from alginic acid and graphene oxide, IOP	8998/206/1/012053	published	Philippines/Japan
Conference Series: Materials Science and Engineering, 2017, 206, 012053.	0007/200/1/012000		

1. 2 Original Publications (Articles by Single Team only)

All Authors' Names, Title, Journal Name, Volume, Edition, Page, Year of Publication	DOI Code	Publication Status	Remarks (e.g. publication in top level journals etc.)	Country name of the team
B. Ali, S. Yusup,T. Quitain, R.N.M. Kamil, Y. Sumigawa, M. Ammar, T. Kida, Procedia Engineering, 148, 2016, 501–507.	10.1016/j.proeng.2016.0 6.539	published		Japan
A. Miyamoto,Y. Kuwaki, T Sano, K. Hatakeyama, A. Quitain, M. Sasaki, T. Kida, Solid Electrolyte Gas Sensor Based on a Proton-Conducting Graphene Oxide Membranes, ACS Omega 2017, 2, 2994–300.	10.1021/acsomega.7b0 0239	published		Japan
E. G. Mission, A. T. Quitain, M. Sasakid T. Kida, Synergizing graphene oxide with microwave irradiation for efficient cellulose depolymerization into glucose, Green Chemistry, 2017,19, 3831–3843.	10.1039/C7GC01691C	published		Japan
T. Kida, Y. Kuwaki, A. Miyamoto, N. Hamidah, K. Hatakeyama, A. T. Quitain, M. Sasaki, A. Urakawa, Water vapor electrolysis with proton-conducting graphene oxide nanosheets, ACS Sustainable Chemistry and Engineering, in press.		in press		Japan

4 Total

1. 1. 3 Original Publications (Articles by the Partner Research Teams only, excluding the Japanese Reasearch Teams)

All Authors' Names, Title, Journal Name, Volume, Edition, Page, Year of Publication	DOI Code	Language	Status	Remarks (e.g. publication in top level journals etc.)
Nopparat Suriyachai, Verawat Champreda, Chularat Sakdaronnarong, Artiwan Shotipruk, Navadol Laosiripojan, Sequential organosolv fractionation/hydrolysis of sugarcane bagasse: The coupling use of heterogeneous H3PO4-activated carbon as acid promoter and hydrolysis catalyst, Renewable Energy, 113, 2017, 1141-1148.	10.1016/j.renene.2017.0 6.003	英文(English)	published	Thai

2. presentations at Academic Conferences etc. (Seminars, Workshops, Symposia)

[Notes]

Please fill in **only the achievements of this project** by country in order of presentation date. The information on this form is only disclosable. Please submit Non-disclosable information in a separate file.

2. 1 Conference Presentations (Joint Presentations among Research Teams)

Date	Type of Presentation	Speaker, "Title", Conference Name, Location, etc.
2016/2/4-6	Oral Presentation	Fritzie Hannah Baldovino•Armando T. Quitain•Nathaniel Dugos•Susan Roces•Tetsuya Kida、"Supercritical Fluid Approach to Thermally Stable Amine Functionalization of Graphene"、2016 Kumamoto Symposium on Two Dimensional Nanomaterials、Kumamoto、Japan、2016/2/4-6
January 28–29, 2016	Oral Presentation	J. Gallo•J. Auresenia•L. Razon, R. Tan•P. Gaspillo•A. Quitain, "Production of CNT via Chemical Vapor Deposition Microwave Induced Plasma: Optimization of Process Parameters", International Conference in Nanoscience and Technology (ICNT 2016), Kuala Lumpur Malaysia, January 28–29, 2016
March 7–9, 2016	Oral Presentation	J. Gallo•J. Torres•A., Cadiz, C. Macawile•J. Auresenia•L. Razon•R. Tan•P. Gaspillo•A. Quitain、 "Development of Functional Carbon Nanotubes as Catalyst for Biodiesel Production"、Research Congress, De La Salle University - Manila, March 7-9, 2016
2016/12/2-4	Oral Presentation	Tat Boonyakarn, Armando T. Quitain, Tetsuya Kida, Artiwan Shotipruk, "Amine functionalization of graphene oxide for glucose isomerization to fructose", The 29th International Symposium on Chemical Engineering, Miyazaki, Japan, 2016/12/2-4
2016/12/2-4	Oral Presentation	Tat Boonyakarn, Armando T. Quitain, Tetsuya Kida, Artiwan Shotipruk, "Amine functionalization of graphene oxide for glucose isomerization to fructose", The 29th International Symposium on Chemical Engineering, Miyazaki, Japan, 2016/12/2-4
2017/10/26-29	Oral Presentation	Khatiya Weerasai, Verawat Champreda, Armando T. Quitain, Tetsuya Kida and Navadol Laosiripojana, "Supercritical CO2 Acidification for Separation of Kraft Lignin", Joint International Symposium of Regional Revitalization and Innovation for Social Contribution 2017, Manila, Philippines. 2017/10/26-29
2017/10/26-29	Oral Presentation	Laddawan Tumkot, Armando T. Quitain, Tetsuya Kida, Navadol Laosiripojana and Artiwan Shotipruk, "Functionalized Carbon-based Catalyzed Esterification under Microwave Irradiation", Joint International Symposium of Regional Revitalization and Innovation for Social Contribution 2017, Manila, Philippines. 2017/10/26-29
5	Total	

2. 2 Conference Presentations (by Single Team)

Date	Type of Presentation	Speaker, "Title", Conference Name, Location etc.	Country name of the team
2015/3/21	Oral Presentation	Shinnosuke Uchikado・Quitain Armando・Mitsuru Sasaki・Tetsuya Kida、 [″] GTBE合成反応促進のためのカーボン系 触媒開発及び誘電率測定 [″] 、化学工学会 第80年会、芝浦工業大学、2015年3月21日	Japan
2015/9/24-25	Oral Presentation	Yoshifumi Sumigawa Armando T. Quitani Shinnosuke Uchikad Mitsuru Sasaki Tetsuya Kida, "Microwave-Assisted Synthesis of Biodiesel Using Functional Carbon", The 22nd Regional Symposium on Chemical Engineering (RSCE 2015) Catalyst, Bangkok, Thailand, 2015/9/24-25	Japan
2015/10/1	Poster Session	Yoshifumi Sumigawa Armando T. Quitani Shinnosuke Uchikado Mituru Sasaki Tetuya Kida, "DEVELOPMENT OF MICROWAVE-ASSISTED BIODIESEL PRODUCTION USING FUNCTINALIZED CARBON BASED CATALYST", Joint International Symposium on Regional Revitalization and Innovation for Social Contribution And Ce-ASIA Functional Materials and Biomass Utilization 2015 (J.IS.R.I e-ASIA 2015), Fukuoka, Japan, 2015/10/1	Japan
2016/2/4-6	Oral Presentation	Shinnosuke Uchikado Armando T. Quitain Yoshifumi Sumigawa Mitsuru Sasaki Tetsuya Kida, "DEVELOPMENT OF MICROWAVE-ASSISTED BIODIESEL PRODUCTION USING FUNCTINALIZED CARBON BASED CATALYST", 2016 Kumamoto Symposium on Two Dimensional Nanomaterials, Kumamoto, Japan, 2016/2/4-6	Japan
2016/2/4-6	Oral Presentation	Yoshifumi Sumigawa Armando T. Quitain Shinnosuke Uchikado Mitsuru Sasaki Tetsuya Kida, "Graphene Oxide- Catalyzed Synthesis of Biodiesel Under Microwave Irradiation", 2016 Kumamoto Symposium on Two Dimensional Nanomaterials, Kumamoto, Japan, 2016/2/4-6	Japan
2028/6/17	Guest/Invited Speaker	Tetsuya Kida、「酸化グラフェンの電気化学及び触媒的応用」、第6回 酸化グラフェンシンポジウム、九州大学 筑紫 キャンパス総合研究棟、平成28年6月17日	Japan
2016/7/2	Poster Session	Wakako Ueno・三上一輝・Armando T. Quitain・Mituru Sasaki・ Tetuya Kida、「半導体ナノ結晶を用いたバイオマス太陽 電池」、第53回化学関連支部合同九州大会、福岡県北九州市、2016/7/2	Japan
2016/7/2	Poster Session	帆保拓登・Mitsuru Sasaki・Armando T. Quitain・Tetsuya Kida、「酸化グラフェン担持金触媒作製およびその糖の酸化 反応への利用」、第53回化学関連支部合同九州大会、福岡県北九州市、2016/7/2	Japan
2016/7/22-23	Poster Session	澄川佳史・キタインアルマンド・佐々木満・木田徹也、「酸化グラフェンを用いたマイクロ波照射法によるバイオディーゼ ル製造技術の開発」、第27回九州地区若手ケミカルエンジニア討論会、福岡県福岡市、2016/7/22-23	Japan
2016/7/22-23	Poster Session	Hobo Takuto、、「酸化グラフェンを用いたルチンの加水分解によるケルセチンとルチノースの高収率生産」、第27回九州地区若手ケミカルエンジニア討論会、福岡県福岡市、2016/7/22-23	Japan
2016/12/19	Oral Presentation	Hobo Takuto・Quitain Armando・Tetsuya Kida・Mituru Sasaki、「酸化グラフェンを用いたマイクロウェーブ加熱によるル チンからのケルセチンとβ-ルチノースの高収率生産」、第26回日本MRS年次大会、神奈川県横浜市、2016/12/19	Japan
2016/9/19-20	Oral Presentation	Yoshifumi Sumigawa• Quitain Armando• Mitsuru Sasaki• Tetsuya Kida, "Graphene Oxide-Catalyzed Fatty Acid Esterification Under Microwave Irradiation", The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan
2016/9/19-20	Oral Presentation	Azumi Miyamoto, Yuta Kuwaki, Kazuto Hatakeyama, Armando Quitain, Mitsuru Sasaki, Yasumichi Matsumoto, Tetsuya Kida, "Hydrogen Sensing with Proton Conducting Graphene Oxide", The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan
2016/9/19-20	Oral Presentation	Mission, Elaine G., Armando T. Quitain, Mitsuru Sasaki and Tetsuya Kida, "Single Stage Depolymerization of Cellulose Through the Synergy of Microwave and Graphene Oxide", The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan
2016/9/19-20	Oral Presentation	Yuta Kuwaki, Azumi Miyamoto, Armando T. Quitain, Misturu Sasaki and Testuya Kida, "Electrochemical applications of proton-conducting graphene oxide", The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan

2016/9/19-20	Oral Presentation	Hobo Takuto, Armando T. Quitain, Misturu Sasaki and Testuya Kida, "High-yield production of quercetin and β -rutinose by hydrolysis of rutin with graphene oxide", The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan
2016/9/19-20	Oral Presentation	Wakako Ueno•三上一輝•Quitain Armando• Mitsuru Sasaki• Tetsuya Kida、"Biomass solar cell using semiconductor nanocrystals", The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan
2016/9/19-20	Guest/Invited Speaker	Tetsuya Kida, "Electrochemical Applications of Graphene Oxide for Biomass Conversion"The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan
2016/9/19-20	Guest/Invited Speaker	Armando Quitain, "Graphene-Based Catalysis Under Microwave and Pressurized Fluids" The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	Japan
2016/10/3	Oral Presentation	A. Miyamoto, Y. Kuwaki, K. Hatakeyama, Q. Armando, M. Sasaki, Y. Matsumoto, and T. Kida, "Electrochemical Detection of Hydrogen Using Two-Dimensional Carbon Nanosheets", PRIME PACIFIC RIM MEETING on electrochemcal and solid-state science, Hawaii USA, 2016/10/3	Japan
2016/11/13-18	Poster Session	Hobo Takuto, Armando T. Quitain, Misturu Sasaki and Testuya Kida, "Microwave-Intensified Synthesis of Biodiesel Catalyzed with Graphene Oxide", 2016 American Institute of Chemical Engineers (AIChE) Annual Meeting, San Francisco, USA, 2016/11/13-18	Japan
2016/12/2-4	Oral Presentation	Hobo Takuto, Armando T. Quitain, Misturu Sasaki and Testuya Kid, "Elucidating the synergy of microwave and graphene oxide for biodiesel synthesis", The 29th International Symposium on Chemical Engineering, Miyazaki, Japan, 2016/12/2-4	Japan
2016/12/2-4	Oral Presentation	A. Miyamoto, Y. Kuwaki, K. Hatakeyama, Q. Armando, M. Sasaki, Y. Matsumoto, and T. Kida, "Planar-type hydrogen sensor using proton conducting graphene oxide", The 29th International Symposium on Chemical Engineering, Miyazaki, Japan, 2016/12/2-4	Japan
2016/12/2-4	Oral Presentation	Mission, Elaine G., Armando T. Quitain, Mitsuru Sasaki and Tetsuya Kida, "Highly Selective Cellulose Conversion into Glucose through the Synergy of Microwave Irradiation and Graphene Oxide", The 29th International Symposium on Chemical Engineering, Miyazaki, Japan, 2016/12/2-4	Japan
2016/12/7	Poster Session	Yuta Kuwaki, Azumi Miyamoto, Armando T. Quitain, Misturu Sasaki. and Testuya Kida, "Hydrogen Separation Using Two-Dimensional Carbon Nanosheets", Joint International Symposiumu on Regional Revitalization and Innovation for Social Contribution, Tagawa City, Fukuoka, Japan, 2016/12/7	Japan
2016/12/7	Poster Session	Yamamoto Ayaka, Armando T. Quitain, Mitsuru Sasaki and Tetsuya Kida, Development of a Solid Electrolyte CO2 Sensor and its Utilization for the Performance Evaluation of CO2 Capture Materials, Joint International Symposium on "Regional Revitalization and Innovation for Social Contribution" And "e-ASIA Functional Materials and Biomass Utilization 2016" (J. I. S. R. I. e-ASIA 2016), Tagawa City, Fukuoka, Japan, 2016/12/7	Japan
2016/12/7	Poster Session	Satosi Oda・Quitain Armando・Mitsuru Sasaki・Tetsuya Kida、「超臨界二酸化炭素を用いたリモネンの触媒アセチル 化反応」、第2回J.I.S.R.I.e-ASIA 2016、福岡県田川市、2016/12/7	Japan
2016/12/7	Oral Presentation	Mission, Elaine G., Armando Quitain, Mitsuru Sasaki, Tetsuya Kida, "Leveraging Synergies between Graphene Oxide and Microwave for Cellulose Depolymerization", Joint International Symposium on Regional Revitalization and Innovation for Social Contribution and e-Asia Functional Materials and Biomass Utilization 2016, Tagawa City, Fukuoka, Japan, 2016/12/7	Japan
2016/12/8-9	Oral Presentation	Yoshifumi Sumigawa Quitain Armando Mitsuru Sasaki Tetsuya Kida, [[] Catalitic Performance of Graphene Oxide Under Microwave Irradiation in Biofuel Synthesis J, The 11th International Student Conference on Advanced Science and Technology(ICAST), Kumamoto, Japan, 2016/12/8-9	Japan
2016/12/8-9	Oral Presentation	A. Miyamoto, Y. Kuwaki, K. Hatakeyama, Q. Armando, M. Sasaki, Y. Matsumoto, and T. Kida, "Electrochemical Hydrogen Sensor Based on Graphene Oxide", The 11th ICAST 2016 KUMAMOTO, Kumamoto, Japan, 2016/12/8-9	Japan
2016/12/8-9	Oral Presentation	Mission, Elaine G., Armando Quitain, Mitsuru Sasaki, Tetsuya Kida, "Graphene oxide catalyzed cellulose depolymerization under Microwave Irradiation", The 11th International Students Conference on Advanced Science and Technology, Kumamoto Japan, 2016/12/8-9	Japan

		Azumi Miyamoto, Tetsuya Kida, Yuta Kuwaki, Kazuto Hatakeyama, Armando T. Quitain, Mitsuru Sasaki, Yasumichi	
2017/2/19	Oral Presentation	Matsumoto, "A compact gas sensor using two-dimenitional carbon nanosheets", The 18th International Symposium	Japan
		on Eco-materials Processing and Design, Okinawa, Japan, 2017/2/19	
2010/2/10	Cupet /Invited Speeker	Armando Quitain,"Bioreactive Separation with CO2-H2O Hybrid Synergy", 9 th Asian Federation of Biotechnology	lanan
2010/2/10	Guest/Invited Speaker	(AFOB) Regional Symposium 2017, Manila, Philippines, 2018/2/10	Japan
2010/2/10	Cupat /Invited Speeker	Tetsuya Kida,""Catalytic and Electrochemical Applications of GrapheneOxide in Biomass Conversion"", 9 th Asian	lenen
2010/2/10	Guest/Invited Speaker	Federation of Biotechnology (AFOB) Regional Symposium 2017, Manila, Philippines, 2018/2/10	Japan
0017/0/00	Ouel Due contestion	Shohei Ninomiya, Mitsuru Sasaki, Armando Tibigin Quitain, Tetsuya Kida, Marleny Aranda Saldana, Preparation of	1
2017/8/28	Oral Presentation	Solid Acid Catalysts from Seaweeds with Subcritical Water, IUMRS-ICAM 0217, Kyoto, Japan, 2017/8/28	Japan
		Elaine G. Mission, Armando T. Quitain, Mitsuru Sasaki and Tetsuva Kida, Performance Evaluation of Graphene Oxide	
Oct 1-5, 2017	Oral Presentation	in Synergy with Microwave Irradiation for Cellulose Depolymerization: Effect of Catalyst Structure and Particle size,	Japan
,		10th World Congress of Chemical Engineering (WCCE 10), Barcelona, Spain, Oct 1–5, 2017	
		Masataka Shintani, Armand T. Quitain, Mitsuru Sasaki, Tetsuva Kida, Electrochemical Hydrogen Separation Using	
		Graphene Oxide. Joint International Symposium of Regional Revitalization and Innovation for Social Contribution and	
2017	Poster Session	DOST E-Asia Joint Research Program on Functional Materials and Biomass Utilization De La Salle University	Japan
		Welkele Llong Vite Kide Armande T Quitein Miteuru Seeski Teteurus Kide Biemese seler sell using Qu2Q	
		waako Oelio, luta Nuo, Amailoo I. Quitani, wiisulu Jasaan, reisuya Nua, Diomass solar Celi Using Guzo	
2017	Oral Presentation	Contribution and DOST E-Asia laint Enternational Symposium of Regional Revitalization and Emotivation for Social	Japan
		Contribution and DOST E-Asia Joint Research Program on Functional Materials and Biomass Otilization, De La Salle	
		Iomomi Hasunuma, Armando I. Quitain, Mitsuru Sasaki, Tetsuya Kida, Microwave-Carbocatalysis Method for	
2017	Poster Session	Conversion of Glucose to 5-HMF, Joint International Symposium of Regional Revitalization and Innovation for Social	Japan
2017		Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle	Cupan
		University, Manila, 10.26-29	
		Karen Nakashima, Armando T. Quitain, Mitsuru Sasaki, Tetsuya Kida, Synthesis of nitrogen-doped graphene oxide	
2017	Poster Session	decorated with metal nanoparticles, Joint International Symposium of Regional Revitalization and Innovation for	Japan
2017		Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De	Capan
		La Salle University, Manila, 10.26-29	
		Takuto HOBO, Armando T. QUITAIN, Tetsuya KIDA, Mitsuru SASAKI, SYNERGY OF MICROWAVE IRRADIATION	
2017	Oral Presentation	AND GRAPHENE OXIDE FOR THE HYDROLYSIS OF RUTIN IN THE PRESENCE OF CYCLODEXTRIN, Joint	lanan
2017		International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint	Capan
		Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26–29	
		Akito Hashimoto, Armando T. Quitain, Saya Yamafuku, Mitsuru Sasaki, Tetsuya Kida, Novel Reactive Separation	
2017	Oral Presentation	System for Conversion of Citrus Flavonoids using Supercritical CO2, Joint International Symposium of Regional	lanan
2017	Oral Presentation	Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional	Japan
		Materials and Biomass Utilization, De La Salle University, Manila, 10.26–29	
		Ryuto Inoue, Armando T. Quitain, Mitsuru Sasaki, Tetsuya Kida, Reactive Separation Utilizing the Synergy of Mix	
2017	Destar Session	H2O and CO2 for Conversion of Glucose to 5–Hydroxymethyl Furfural, Joint International Symposium of Regional	lanan
2017	Poster Session	Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional	Japan
		Materials and Biomass Utilization, De La Salle University, Manila, 10.26–29	
		Shohei Ninomiya, Mitsuru Sasaki, Armando T. Quitain, Tetsuya Kida, Marleny Aranda Saldana, PREPARATION OF	
2017	Quel Due e entetien	SOLID ACID CATALYSTS FROM SEAWEEDS WITH HYDROTHERMAL CARBONIZATION, Joint International	1
2017	Oral Presentation	Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach	Japan
		Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26–29	
		Yuta Kuwaki, Armando T.Quitain, Mitsuru Sasaki, Tetsuya Kida, Water Vapor Electrolysis with Graphene Oxide for	
0017		the Production of Pure Hydrogen, Joint International Symposium of Regional Revitalization and Innovation for Social	
2017	Oral Presentation	Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization. De La Salle	Japan
		University, Manila, 10.26–29	

2017	Oral Presentation	Elaine G. Mission, Armando T. Quitain, Mitsuru Sasaki and Tetsuya Kida, Graphene-based carbocatalyst in synergy with microwave irradiation for cellulose depolymerization, Joint International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	Japan
2017	Guest/Invited Speaker	Armando Quitain, Microwave-Carbocatalysis Effective Synergism for Biomass Conversion, Joint International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	Japan
2017	Guest/Invited Speaker	Tetsuya Kida, Catalytic and Electrochemical Applications of Graphene Oxide in Biomass Conversion, Joint International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	Japan
2017/11/14	Oral Presentation	Quitain Armando Yamano Saya · Mitsuru Sasaki · Tetsuya Kida, Reactive separation for conversion of Hesperidin by synergistic effect of subcritical water and supercritical carbon dioxide, KJT Chemical Engineering Conference, 韓国 釜山, 2017/11/14	Japan
2017/11/9-11	Oral Presentation	Effect of cyclodextrin addition on the microwave-assisted catalytic hydrolysis of rutin under hydrothermal conditions, Takuto HOBO, Armando T. QUITAIN, Tetsuya KIDA, Mitsuru SASAKI, The 11th International Conference on Separation Science and Technology, Busan, Korea, 2017/11/9-11	Japan
2017/11/12-15	Oral Presentation	Yuta Kuwaki, Azumi Miyamoto, Armando T.Quitain, Mitsuru Sasaki, Tetsuya Kida, Solid electrolyte gas sensor using proton conductive graphene oxide, The 12th asian conference on chemical sensors, Hanoi, Vietnam, 2017/11/12–15.	Japan
2017/11/23.24	Oral Presentation	Yudai Hirano, Armando T. Quitain, Mitsuru Sasaki, Tetsuya Kida, Hydrogen generation from water by graphene oxide electrode, The 8th International Conference on Awareness Science and Technology (iCAST 2017), 台湾、高雄, 2017/11/23.24	Japan
2017/11/2	Oral Presentation	Ueno Wakako、Tetsuya Kida、Kido Yuuta、Mitsuru Sasaki、Armando T.Quitain、Cu2O ナノ結晶/ZnO ナノロッド膜を用 いたグルコースの光酸化、平成29年度九州支部秋季合同研究発表会、北九州、2017年11月2日(木)	Japan
2017/11/2	Oral Presentation	Yuuta Kuwaki、Armando T.Quitain, Mitsuru Sasaki, Tetsuya Kida、酸化グラフェンナノシート積層膜を用いた水蒸気電解、平成29年度九州支部秋季合同研究発表会、北九州、2017年11月2日(木)	Japan

54 Total

2. 3 Conference Presentations (by Partner Research Teams, excluding Japanese Reasearch Teams)

Japanese Fiscal Year	Type of Presentation	Speaker, "Title", Conference Name, Location, Date etc.	Country name of the team
2015	Oral Presentation	J. Torres•J. Gallo•J. Auresenia•R. Tan•P. Gaspillo, "Production of Carbon Nanotubes from Coconut Biomass using Microwave Assisted Processes (MAP)", Research Congress, De La Salle University - Manila, March 7-9, 2016	
2016	Guest/Invited Speaker	Joseph Auresenia, Development of Functional Nanocarbon-Based Catalysts for Biomass Conversion Processes, The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop, Bangkok, Thailand, 2016/9/19-20	

2017	Guest/Invited Speaker	Panatpong Boonnoun, Preparation of Hydrothermal Carbon Acid Catalyst from Defatted Rice Bran, Joint International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	
2017	Oral Presentation	Kyaw Wunna, Joseph L. Auresenia, Kiyohiko Nakasaki, Leonilla Abella and Pag–asa Gaspillo, Current Status and Perspective Views of Bioethanol Production from Biosources of Biomass, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26–29	
2017	Oral Presentation	John Ephraim Torres, Jurex Gallo and Joseph Auresenia, Microwave Assisted Pyrolysis of Coconut Shells, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E−Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26–29	
2017	Oral Presentation	Jan Patrick Si, Mark Angelo Tionson, Francis Ian Tobias and Joseph Auresenia, Synthesis of CNT for PET Bottles, Sargassum using Simultaneous Microwave Assisted Pyrolysis and Microwave Plasma – Chemical Vapor Deposition, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	
2017	Oral Presentation	Alva Durian, Jurex Gallo and Joseph Auresenia, Microalgal Lipid Extraction by Supercritical Carbon Dioxide and its Conversion to Fatty Acid Methyl Ester, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	
2017	Oral Presentation	Cristina Macawile, Alva Durian, Jurex Gallo, Luis Razon, and Girard Raymond Tan, Extraction of Kenaf Seed Oil and Kakawate Seed Oil using Supercritical Carbon Dioxide, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	
2017	Oral Presentation	Tun Naing Win, Thien-Phuc Nguyen, Servillano Olano Jr., Hitoshi Kosuge and Joseph Auresenia, Biomass Utilization by Using Membrane Separation: Production of Bioethanol from Molasses by the Coupled Fermentation- Pervaporation System, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10,26-29	
2017	Oral Presentation	Cyril Benedict Lugod and Dr. Joseph Auresenia, Effect of Magnetic Field on the Synthesis of Carbon Nanotubes using MPECD, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Reseach Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	
2017	Poster Session	Jurex Gallo, Armando Quitain, Raymond Tan, Luis Razon and Pag-asa Gaspillo, "Carbon Nanotube Synthesis via Chemical Vapor Deposition Method and Microwave Induced Plasma: Optimization of Operating Parameters, International Symposium of Regional Revitalization and Innovation for Social Contribution and DOST E-Asia Joint Research Program on Functional Materials and Biomass Utilization, De La Salle University, Manila, 10.26-29	

3. Workshops, Seminars, Symposia and Other Events (Organized by the Project)

【Notes】

Please fill in only the achievements of this project in order of event date.

The information on this form is only disclosable. Please submit Non-disclosable information in a separate file.

Event duration	Name of Organizer	Title of the Event	Location (Country, City, Venue)	Number of Participants (Including Team Members)	Overview
2015/3/5~ 2015/3/5	Kumamoto University KIDA Laboratory	SAKURA Science program supported by JST	Kumamoto City	30	
2015/10/1~ 2015/10/2	Tetsuya Kida (Organizing Committee)	Joint International Symposium on 「Regional Revitalization and Innovation for Social Contribution」 And 「e-ASIA Functional Materials and Biomass Utilization 2015(J.IS.R.I e-ASIA 2015)	Tagawa, Fukuoka	74	
2015/10/3~ 2015/10/3	Kumamoto University KIDA Laboratory	SAKURA Science program supported by JST	Kumamoto City	35	
2016/2/24~ 2016/2/24	Kumamoto University KIDA Laboratory	SAKURA Science program supported by JST	Kumamoto City	40	
2016/9/19~ 2016/9/20	Chulalongkorn University and NASDA	The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop	Bangkok	90	
2016/12/5~ 2016/12/6	Kumamoto University KIDA Laboratory	SAKURA Science program supported by JST	Kumamoto City	45	
2016/12/7~ 2016/12/8	Tetsuya Kida (Organizing Committee)	Joint International Symposium on 「Regional Revitalization and Innovation for Social Contribution」And 「e-ASIA Functional Materials and Biomass Utilization 2016(J.IS.R.I e-ASIA 2016)	Tagawa, Fukuoka	80	
2017/2/9 ~ 2017/2/11	De LaSalle University and DOST	9th Asian Federation of Biotechnology (AFOB) REGIONAL SYMPOSIUM (ARS 2017) in conjunction with DOST East Asia 4th National Workshop 2017	Manila	250	
2017/6/29~ 2017/6/30	Kumamoto University KIDA Laboratory	SAKURA Science program supported by JST	Kumamoto City	30	
2017/10/26~ 2017/10/29	De LaSalle University and DOST	Joint International Symposium of Regional Revitalization and Innovation for Social Contribution 2017	Manila	200	

4. Record of Research Exchanges

[Notes]

Please fill in the record of resaerch exchange only of this project.

"Duration of exchange" is not the number of days stayed on the site, but the number of days from departure to return home. The information on this form is only disclosable. Please submit Non-disclosable information in a separate file.

4.1 Record of Visits by the Japanese Side to Overseas

4.1.1 Only those by Japanese Research Team Members

Date of Departure	Date of Return	Last Name & First Name	Country of Affiliation	Affiliation	Position	Exchange Destination (Country, City, Research Organization etc)	Description of Exchange Content/Purpose	Duration of Exchange (autocompleted)
2015/2/1	2015/2/7	Tetsuya Kida	Japan	kumamoto university	Professor	Chulalongkorn University	Research meeting	6
2015/2/1	2015/2/5	Armando T. Quitain	Japan	kumamoto university	Assistant professor	Chulalongkorn University	Research meeting	4
2015/2/19	2015/2/24	Tetsuya Kida	Japan	kumamoto university	Professor	De La Salle University	Research meeting	5
2015/2/19	2015/2/24	Armando T. Quitain	Japan	kumamoto university	Assistant professor	De La Salle University	Research meeting	5
2015/7/29	2015/8/3	Tetsuya Kida	Japan	kumamoto university	Professor	Chulalongkorn University	Research meeting	5
2015/7/31	2015/8/31	Azumi Miyamoto	Japan	kumamoto university	graduate student	Chulalongkorn University	Internship	31
2015/7/31	2015/9/25	Sumigawa Yoshifumi	Japan	kumamoto university	graduate student	Chulalongkorn University	Internship	56
2015/10/11	2015/10/13	Tetsuya Kida	Japan	kumamoto university	Professor	Chulalongkorn University	Research meeting	2
2015/10/24	2015/11/8	Armando T. Quitain	Japan	kumamoto university	Assistant professor	De La Salle University	Research meeting, Experiment	15
2016/9/17	2016/9/22	Sumigawa Yoshifumi	Japan	kumamoto university	graduate student	Chulalongkorn University	Conference presentation	5
2016/9/17	2016/9/22	Azumi Miyamoto	Japan	kumamoto university	graduate student	Chulalongkorn University	Conference presentation	5
2016/9/17	2016/9/22	Yuuta Kuwaki	Japan	kumamoto university	graduate student	Chulalongkorn University	Conference presentation	5
2016/9/17	2016/9/22	Mission, Elaine	Japan	kumamoto university	graduate student	Chulalongkorn University	Conference presentation	5
2016/8/25	2016/9/25	Wakako Ueno	Japan	kumamoto university	graduate student	Chulalongkorn University	Internship	31
2016/9/17	2016/9/22	Armando T. Quitain	Japan	kumamoto university	Assistant professor	Chulalongkorn University	Invited lecture	5
2016/9/18	2016/9/22	Mitsuru Sasaki	Japan	kumamoto university	Associate professor	Chulalongkorn University	Conference presentation	4
2016/9/17	2016/9/22	Tetsuya Kida	Japan	kumamoto university	Professor	Chulalongkorn University	Invited lecture	5
2017/2/9	2017/2/11	Tetsuya Kida	Japan	kumamoto university	Professor	De La Salle University	Invited lecture	2
2017/2/9	2017/2/11	Armando T. Quitain	Japan	kumamoto university	Assistant professor	De La Salle University	Invited lecture	2

2017/10/26	2017/10/29	Wakako Ueno	Japan	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Yuuta Kuwaki	Japan	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Saya Ymamfuku	Japan	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Akito Hashimoto	Japan	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Mission, Elaine	Japan	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Ayaka Yamamoto	Japan	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Tetsuya Kida	Japan	kumamoto university	Professor	De La Salle University	Invited lecture	3
2017/10/26	2017/10/29	Armando T. Quitain	Japan	kumamoto university	Assistant professor	De La Salle University	Invited lecture	3
								0
								0
								0
		Total (Person)	26				Total (Persond-day)	216

31

4.1.2 Excluding those by Japanese Research Team Memebers

Date of Departure	Date of Return	Last Name & First Name	Affiliation	Position	Exchange Destination (Country, City, Research Organization etc)	Description of Exchange Content/Purpose	Duration of Exchange (autocompleted)
2016/9/17	2016/9/21	神谷典穂	kyusyu university	Professor	Chulalongkorn University	Invited lecture	4
2016/9/17	2016/9/22	Takuto Hobo	kumamoto university	graduate student	Chulalongkorn University	Conference presentation	9
2017/10/26	2017/10/29	Takuto Hobo	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Shouhei Ninomiya	kumamoto university	graduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Ryuuto Inoue	kumamoto university	undergraduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Karenn Nakashima	kumamoto university	undergraduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Tomomi Hashunuma	kumamoto university	undergraduate student	De La Salle University	Conference presentation	3
2017/10/26	2017/10/29	Masaki Shinntani	kumamoto university	undergraduate student	De La Salle University	Conference presentation	3

Total (Person)

8

Total (Persond-day)

4.2 Record of Visits by Partner Reserach Teams to Overseas including Japan

4.2.1 Only those by Partner Research Team Members

Date of Departure	Date of Return	Last Name & First Name	Affiliation	Position	Exchange Destination (Country, City, Research Organization etc)	Description of Exchange Content/Purpose	Duration of Exchange (autocompleted)
01/03/2015	10/03/2015	BELTRAN ARNEL BAS	De La Salle University	Assistant professor	kumamoto university	Research、Lecture、The tour	10
02/03/2015	10/03/2015	YU JIANE MELINA LOPEZ	De La Salle University	graduate student	kumamoto university	The tour	10
03/03/2015	10/03/2015	HOLAYSAN SED ANDERSON KHE	De La Salle University	graduate student	kumamoto university	The tour	10
04/03/2015	10/03/2015	VAS-UMNUAY PARAVEE	Chulalongkorn University	Assistant professor	kumamoto university	Research、Lecture、The tour	10
05/03/2015	10/03/2015	CLOWUTIMON WEERAWAT	Chulalongkorn University	graduate student	kumamoto university	The tour	10
06/03/2015	10/03/2015	TUMKOT LADDAWAN	Chulalongkorn University	graduate student	kumamoto university	The tour	10
07/03/2015	18/07/2015	Pag-asa GASPILLO	De La Salle University	Professor	kumamoto university	Lecture	7
08/03/2015	29/05/2016	Fritzie Hannah Baldovino	De La Salle University	graduate student	kumamoto university	Internship	306
09/03/2015	31/03/2016	YU Jiane Melina	De La Salle University	graduate student	kumamoto university	Internship	188
10/03/2015	31/03/2016	CO Clarence Joseph	De La Salle University	graduate student	kumamoto university	Internship	188
11/03/2015	03/10/2015	Tapia John Frederick Daula	De La Salle University	graduate student	kumamoto university	The tour	5
12/03/2015	03/10/2015	Astillero Erik Lance Dy	De La Salle University	graduate student	kumamoto university	The tour	5
13/03/2015	03/10/2015	Wataniyakul Piyaporn	Chulalongkorn University	graduate student	kumamoto university	The tour	5
14/03/2015	03/10/2015	Bumroongsakulsawat Palang	Chulalongkorn University	Assistant professor	kumamoto university	The tour	5
15/03/2015	01/03/2016	Daorattanachai Pornlada	King Mongkut's University of Technology Thonburi	Assistant professor	kumamoto university	Research meeting、 lecture	10
16/03/2015	01/03/2016	Klaysom Chalida	Chulalongkorn University	Assistant professor	kumamoto university	Research meeting、 lecture	10
17/03/2015	01/03/2016	Aviso Kathleen Bernardo	De La Salle University	Assistant professor	kumamoto university	Research meeting、 lecture	10
18/03/2015	01/03/2016	Madrazo Cynthia Fabian	De La Salle University	Assistant professor	kumamoto university	Research meeting、 lecture	10
19/03/2015	03/10/2015	Joseph AURESENIA	De La Salle University	Professor	kumamoto university	Research meeting	5

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20/03/2015	04/03/2016	Joseph AURESENIA	De La Salle University	Professor	kumamoto university	Research meeting	11
21/03/2015	28/02/2017	Boonyakarn Tat	Chulalongkorn University	graduate student	kumamoto university	The study	365
22/03/2015	28/02/2017	Piyaporn Wataniyakul	Chulalongkorn University	graduate student	kumamoto university	The study	365
23/03/2015	11/12/2016	MEEDAM Amornrat	Chulalongkorn University	graduate student	kumamoto university	The tour	8
24/03/2015	11/12/2016	JACINTO JOMARI ANGEL AGLIAM	De La Salle University	graduate student	kumamoto university	The tour	8
25/03/2015	15/07/2016	Pag-asa GASPILLO	De La Salle University	Professor	kumamoto university	Research meeting、 lecture	5
26/03/2015	30/09/2017	Totong SANSANEE	King Mongkut's University of Technology Thonburi	graduate student	kumamoto university	The study	365
27/03/2015	10/01/2018	WEERASAI KHATIYA	King Mongkut's University of Technology Thonburi	graduate student	kumamoto university	The study	365
28/03/2015	30/01/2018	TUMKOT Laddawan	Chulalongkorn University	graduate student	kumamoto university	The study	364
29/03/2015	11/07/2017	Pag-asa GASPILLO	De La Salle University	Professor	kumamoto university	Research meeting、 lecture	3
30/03/2015	30/09/2018	JACINTO JOMARI ANGEL AGLIAM	De La Salle University	graduate student	kumamoto university	Internship	356
31/03/2015	30/03/2018	Siabbamrung Phornwimol	Chulalongkorn University	graduate student	kumamoto university	The study	181
01/04/2015	30/06/2017	Phannipha Daisuk	Chulalongkorn University	graduate student	kumamoto university	The tour	4
02/04/2015	30/06/2017	Christian Jay P. Balboa	De La Salle University	graduate student	kumamoto university	The tour	4
							0



Total (Person)

Total (Persond-day)

3218

5. Patent Applications

[Notes]

Please fill in only the achievements of this project by country in order of presentation date.

The information on this form is only disclosable. Please submit Non-disclosable information in a separate file.

5. 1 Independent Applications by Single Team

Application Number	Name of Patent/Patent Name	Application Date	Patent Applicants (Fill in All Members)	Publication Number (leave blank if unpublished)	Inventor	Country of Application	Registration Number (leave blank if unregistered)	Country Name of the Team
WO20xx-xxxxxx		January 21, 2016	00 Univ, Univ.of xx	WO/2016/xxxxxx	0000,00.00	PCT	WO20xx-xxxxxx (20xx.xx.xx)	Thailand

0 Total (Number of Application)

0 Total (Number of Registration)

5. 2 Joint Applications

Name of Patent/Patent Name	Application Date	Patent Applicants (Fill in All Members)	Publication Number (leave blank if unpublished)	Inventor	Country of Application	Registration Number (leave blank if unregistered)
	January 21, 2016	OO Univ、Univ.of xx	WO/2016/xxxxxx	0000,00.00	PCT	WO20xx-xxxxxx (20xx.xx.xx)
	Name of Patent/Patent Name	Name of Patent/Patent Name January 21, 2016	Name of Patent/Patent Name Application Date Patent Applicants (Fill in All Members) January 21, 2016 OO Univ. Univ.of xx	Name of Patent/Patent Name Application Date Patent Applicants (Fill in All Members) Publication Number (leave blank if unpublished) January 21, 2016 OO Univ, Univ.of xx WO/2016/xxxxxx Image: Comparison of the system of the syste	Name of Patent/Patent Name Application Date Patent Applicants (Fill in All Members) Publication Number (leave blank if unpublished) Inventor January 21, 2016 OO Univ, Univ.of xx WO/2016/xxxxxx OOOO.OOOO Image: Comparison of the system of the syst	Name of Patent/Patent Name Application Date Patent Applicants (Fill in All Members) Publication Number (leave blank if unpublished) Inventor Country of Application January 21, 2016 OO Univ, Univ.of xx WO/2016/xxxxxx OOOO,OOOO PCT Image: Country of Application Image: Country of Application Image: Country of Application Image: Country of Application Image: Country 21, 2016 OO Univ, Univ.of xx WO/2016/xxxxxx OOOO,OOOO PCT Image: Country 21, 2016 Image: Country 21, 2016 Image: Country 21, 2016 Image: Country 21, 2016 Image: Country 21, 2016 PCT Image: Country 21, 2016 Image: Country 21, 2016 Image: Country 21, 2016 Image: Country 21, 2016 PCT Image: Country 21, 2016 PCT Image: Country 21, 2016 Image: Country 21, 2016

0 Total (Number of Application)

0 Total (Number of Registration)

6. Awards

Date of Award	Name of Award	Recipient	Remarks	Country Name of the Team
2015/6/27	優秀研究発表賞、、酸化グラフェン膜を用いた水素センシング、第52回化学関連支部合同九州大会、福岡県北九 州市	Azimi Miyamoto		
2015/7/18	ポスター賞、マイクロ波を用いた炭素系触媒法によるバイオディーゼル製造技術の開発、第26回九州地区若手ケ ミカルエンジニア討論会、佐賀県伊万里市、	Yoshifumi Shumigawa		
2015/10/1	ポスター賞、Hydrogen sensor using graphene oxide membrane、J.I.S.R.I e-ASIA 2015、福岡県田川市	Azimi Miyamoto		
2015/10/1	口頭発表賞、DEVELOPMENT OF MICROWAVE-ASSISTED BIODIESEL PRODUCTION USING FUNCTINALIZED CARBON BASED CATALYST、Joint International Symposium on「Regional Revitalization and Innovation for Social Contribution」And「e-ASIA Functional Materials and Biomass Utilization 2015 (J.IS.R.I e-ASIA 2015)、福 岡県田川市	Yoshifumi Shumigawa		
2016/9/19	口頭発表賞、Graphene Oxide-Catalyzed Fatty Acid Esterification Under Microwave Irradiation、The e-ASIA Joint Research Program (e-ASIA JRP) Project Workshop、Bangkok, Thailand	Yoshifumi Shumigawa		
2016/12/3	Oral Presentation Award、Planar-type hydrogen sensor using proton conducting graphene oxide、The 29th International Symposium on Chemical Engineering、宮崎市	Azimi Miyamoto		
2016/12/7	Excellent Oral Presentation Award, Leveraging Synergies between Graphene Oxide and Microwave for Cellulose Depoymerization, Joint International symposium on Regional Revitalzation and Innovation for Social Contirbution and e-Asia Functional Materials and Biomass Utilization 2016, Tagawa City, Fukuoka, Japan	Elaine Mission		
2016/12/22	奨励賞、酸化グラフェンを用いたマイクロウェーブ加熱によるルチンからのケルセチンとβ-ルチノースの高収率生 産、第26回日本MRS年次大会、神奈川県横浜市	Takuto Hobo		
2017/6/30	優秀賞、酸化グラフェン膜を用いた水蒸気の電解による水素製造、第8回酸化グラフェンシンポジウム、熊本県熊 本市、	Yuuta Kuwaki		
2017/7/1	Excellent Poster Award, Hydrolytic Depolymerization of Polysachharides using Microwave-Graphene Oxide Synergism, 54th Joint meeting of Kyushu Branches of Chemistry Related Societies, Kitakyushu International Conference Hall, Kitakyushu, 2017/7/1	Elaine Mission		
2017/10/28	BEST ORAL PRESENTOR, SYNERGY OF MICROWAVE IRRADIATION AND GRAPHENE OXIDE FOR THE HYDROLYSIS OF RUTIN IN THE PRESENCE OF CYCLODEXTRIN, Joint International Symposium on [[] Regional Revitalization and Innovation for Social Contribution] and [[] e-ASIA Functional Materials and Biomass Utilization 2017], Manila, Philippines	Elaine Mission		
2018/3/15	Best Poster Award, Integrated Cellulose Depolymerization and Graphene Oxide reduction under Microwave- Hydrothermal Conditions, the 10th HOPE meeting with Nobel Laureates, Yokohama Bay Hotel Tokyu, Yokohama, Japan	Elaine Mission		
2018/3/15	The HOPE Award, Elaine G. Mission, Integrated Cellulose Depolymerization and Graphene Oxide reduction under Microwave-Hydrothermal Conditions, the 10th HOPE meeting with Nobel Laureates, Yokohama Bay Hotel Tokyu, Yokohama, Japan	Elaine Mission		