Honorary Chair Professor Toyoko Imae's Activity Report (2009.4.1~2013.8.10)

AFFILIATION:

(Since 2009, April 1) Honorary Chair Professor of Graduate Institute of Applied Science and Technology and Joint Chair Professor of Department of Chemical Engineering, National Taiwan University of Science and Technology, Taiwan, ROC
(Since 2006. April 1) Professor Emeritus of Nagoya University, Japan
(Since 2013, April 1) Visiting Professor of Tokyo University of Science
(Since 2013, September 1) Visiting Professor under Academic Icon to the Department of Pharmacology, Faculty of Medicine, University of Malaya

I. Academic Activity

I.1 Awards and Honors

1) (2009) Award of Ministry of Environment for local environmental protection service, Japan 地域環境保全功労者環境大臣表彰
2) (2011) The 54th excellence paper award at the division of technology on oils and fats from Japan Oil Chemists' Society, Japan
3) (2012) An Academic Award from Helical Science Society, Japan
4) (2012-2013) Guest Lecturer of Kazakh Nationakl Technical University
5) (2013, April 1) Visiting Professor of Tokyo University of Science
6) (2013, September 1) Visiting Professor under Academic Icon to the Department of Pharmacology, Faculty of Medicine, University of Malaya

I.2 International conferences

Committee members

1. 2004~present committee member, Asian Society for Colloid and Surface Science
2. 2006~present committee member, Asian Symposium on Advanced Materials
3. 2009~present committee member, World Federation of Engineering Organization (WFEO) Woman in Engineering and Technology (WiE)

4. 2010-2012 committee member in Japan, International Year of Chemistry 2011

Chairpersons

1. Chairperson of organizing committee, International Workshop on "Novel Nanotechnology and Nanomaterials for "Science for Human" (2010), Taipei, Taiwan, 2010
2. Chairperson of organizing committee, International Workshop on "Novel Nanotechnology and Nanomaterials for "Science for Human" (2011), Taipei, Taiwan, 2011
3. The 4th Asian symposium on Advanced Materials – Chemistry, Physics & Biomedicine of Functional and Novel Materials (ASAM-4), Taipei, Taiwan, 2013

Organizing advisory committee

1) (2009, Oct 11-14) 'The 2nd Asian Symposium on Advanced Materials – Chemistry & Physics of Functional Materials – (ASAM-2)' in Shanghai, China, International Advisory Committee
2) (2009, Oct 11-14) 'The 3rd Asian Conference on Colloid & Interface Science' in Jeju, Korea, International Advisory Committee
3) (2010, Nov 26) 'International Workshop on "Novel Nanotechnology and Nanomaterials for "Science for Human" (2010)' in Taipei, Taiwan, Chairperson of organizing committee
4) (2011, Sept 19-22) 'The 3rd Asian Symposium on Advanced Materials – Chemistry & Physics of Functional Materials – (ASAM-3)' in Vladivostok, Russia, International Advisory Committee
5) (2011, Oct 21-23) 'International Conference on Advanced Materials and Nanotechnology' in Kathmandu, Napal, International Advisory board
6) (2011, Nov 23-26) 'The 4th Asian Conference on Colloid & Interface Science' in Tainan, Taiwan, International Advisory Committee
7) (2011, Dec 16-17) 'Polymer Science and Nanotechnology : Design and Structure (PSNDS-11)' in Baroda, India, Advisory Committee
8) (2012, May 15-18) International Association of Colloid and Interface Scientists, Conference (IACIS2012), Sendai, Japan, organizing committee
9) (2012, Dec 15-17) International Conference on Advances in Polymeric Materials & Nanotechnology (PolyTech – 2012), Pune, India, organizing committee
10) (2013, Nov. 20-23) 5th Asian Conference on Colloid and Interface Science (ACCIS 2013) Darjeeling, India, organizing committee

I.3 International committees

Reviewing board (the Degree of Doctor of Philosophy, Faculty Position)

1. Member of International Experts Council of the Republic of Kazakhstan, 2006~2009
2. Panel member of experts for evaluation of candidates for faculty positions in Quaid-i-Azam University, Pakistan, 2010
3. External examiner of PhD Thesis in Jadavpur University, India, 2010
4. External examiner of PhD Thesis in University of South Australia, Australia, 2011
5. Reviewer of research grants of scientific community of Kazakhstan, National Center of Science and Technology Evaluation, Astana, Kazakhstan, 2011
6. External examiner of PhD Thesis in Quaid-i-Azam University, Pakistan, 2012
7 External examiner of PhD Thesis in Aligarh Muslim University, India, 2013

Editorial Board

1. 1993-2010 Langmuir (American Chemical Society); Editorial advisory board
2. 2003~present Journal of Surface Science and Technology; India, Editorial Adviser
3. 2009~present Journal of Nanoscience and Nanotchnology (American Scientific Publishers); Editorial Board
4. 2010~present Journal of the Chinese Institute of Engineers (JCIE) (Taylor & Francis): International Editorial Board

Commission (International)

2007~2010 Member of International Experts Council (IEC) of the Republic of Kazakhstan

2009~present Member of Women in Engineering (WIE) committee World Federation of Engineering organizations (WFEO) (世界工業団体連盟)

2010~2012/3 Member of Japan committee, International Year of Chemistry 2011

Committion (Government, Japan):

2005~2011 Council Member of Science Council (CMSC) of Japan 日本学術会議会員

2006~present Field advisor of Japan Science and Technology Agency (JST) 科学技術振興機構領域アドバイザー

2009~2013/1 Executive Member of Council for Science and Technology Policy (CSTP), Japan 内閣府総合科学技術会議議員

2010~2012 External valuation member of strategic research core constitution support project for Private university by Ministry of Eduction, Culture, Sports, Science and Technology (MEXT), Japan

2010~present Member of National University Cooperation Evaluation Committee in Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan 文部科学省高等教育局国立大学法人評価委員会委員

2011/10-present Member of Science Council (CMSC) of Japan 日本学術会議連携委員

II. Industry-University Cooperation

II.1 Patents

登録

1. Preparation of intercellular lipid-mimetic substrate of skin corneum and valuation method of rough surface by using it (Japan) Takuya Saiwaki, Takashi Oka, Yu-ichiro Mori, Toyoko Imae, Xiaojuan Wang, Masaki Ujihara 皮膚角層細胞間脂質擬似基板及びこれを用いた肌荒れの評価方法（日本）,才脇 卓也、岡 隆史、森 雄一郎、今栄東洋子、Xiaojuan Wang 、氏原 真樹、株式会社資生堂、学校法人慶應義塾　特許 4670089、2010/05/07

2. Preparation of intercellular lipid-mimetic substrate of skin corneum and valuation method of rough surface by using it (Japan) Takuya Saiwaki, Takashi Oka, Yu-ichiro Mori, Toyoko Imae, Xiaojuan Wang, Masaki Ujihara 皮膚角層細胞間脂質擬似基板及びこれを用いた肌荒れの評価方法（日本）才脇 卓也、岡 隆史、森 雄一郎、今栄東洋子、Xiaojuan Wang 、氏原 真樹、株式会社資生堂、学校法人慶應義塾　特許 4762358、2011/01/31

公開

1. Beauty regimen for repairing Rough surface (Japan) No. 2010-189300, 2010/09/02, Takashi Oka, Takuya Saiwaki, Toyoko Imae, Yen Zhu 肌荒れを修復する美容方法 (日本) 特開２０１０－１８９３００岡 隆史、才脇 卓也、今栄東洋子、Yen Zhu　株式会社資生堂、学校法人慶應義塾　特開 2010-189300, 2009/2/17

2. Preparation of intercellular lipid-mimetic substrate of skin corneum and valuation method of rough surface by using it, Takuya Saiwaki, Takashi Oka, Yu-ichiro Mori, Toyoko Imae, Xiaojuan Wang, Masaki Ujihara (EU) No. EP2372360

3. Preparation of intercellular lipid-mimetic substrate of skin corneum and valuation method of rough surface by using it, Takuya Saiwaki, Takashi Oka, Yu-ichiro Mori, Toyoko Imae, Xiaojuan Wang, Masaki Ujihara (China) No. CN102265153, 2011/10/20

4. Preparation of intercellular lipid-mimetic substrate of skin corneum and valuation method of rough surface by using it, Takuya Saiwaki, Takashi Oka, Yu-ichiro Mori, Toyoko Imae, Xiaojuan Wang, Masaki Ujihara (USA) No. US2013/0000394

出願

1) Preparation of intercellular lipid-mimetic substrate of skin corneum and valuation method of rough surface by using it, Takuya Saiwaki, Takashi Oka, Yu-ichiro Mori, Toyoko Imae, Xiaojuan Wang, Masaki Ujihara (Korea)

Application Publication

1) METHOD FOR MAKING CARBON NANOTUBE-LOADED ELECTRODE, CARBON NANOTUBE-LOADED ELECTRODE MADE BY THE METHOD; Toyoko Imae, Ampornphan Siriviriyanun; United States; No. US2013/0161066 A1; Jun. 27/2013

2) BIOCOMPARTIPLE CONFEITO-LIKE GOLD NANOPARTICLES, METHOD FOR MAKING THE SAME, AND THEIR BIOMEDICAL APPLICATIONS; Masaki Ujihara, Toyoko Imae; United States; No. US2013/0164842 A1; Jun. 27/2013

3) 一種製備負載有奈米碳管之電極之方法、以該方法製備之負載有奈米碳管之電極及其應用; 今榮東洋子、西蕊維蕊雅南安波芳; METHOD FOR MAKING CARBON NANOTUBE-LOADED ELECTRODE, CARBON NANOTUBE-LOADED ELECTRODE MADE BY THE METHOD; (Country：Taiwan, Application Type：Invention, Filing Date :2011/12/23, Application No. :100148355) ; Patent/Publication No. TW 201328006 A1; July 1/2013

4) 生物可相容的糖花狀金奈米粒子、其製備方法及其生物醫學應用; 氏原真樹, 今榮東洋子; BIOCOMPARTIPLE CONFEITO-LIKE GOLD NANOPARTICLES, METHOD FOR MAKING THE SAME, AND THEIR BIOMEDICAL APPLICATIONS; (Country：Taiwan, Application Type：Invention, Filing Date：2011/12/21, Application No.：100147776) ; Patent/Publication No.TW 201325614 A1; July 1/2013

Application

1 SYNTHESIS AND APPLICATION OF BIOCOMPATIBLE NANOPOROUS HYDROXYLAPATITE; 今榮東洋子; Taiwan; Invention;

2 樹枝狀高分子以及石墨烯氧化物的螢光混成物; 今榮東洋子、西蕊維蕊雅南安波芳; Taiwan; Invention; 2012/11/30; 1010062

3 FLUORESCENT HYBRID OF DENDRIMER AND GRAPHENE OXIDE Toyoko Imae, Ampornphan Siriviriyanun; US; Invention; 2012/11/27; 1010061

4 EVALUATION METHOD OF ANTI-FINGERPRINT PROPERTY AND NON-FLUORINATED COATING MATERIALS WITH ANTI-FINGERPRINT PROPERTY; 今榮東洋子、西蕊維蕊雅南安波芳; Taiwan; Invention;

5 EVALUATION METHOD OF ANTI-FINGERPRINT PROPERTY AND NON-FLUORINATED COATING MATERIALS WITH ANTI-FINGERPRINT PROPERTY; Toyoko Imae, Ampornphan Siriviriyanun; US; Invention; 2013/1/10; 1010061

II.2 Industry-university program

1. with Foxlink Co. Ltd. (2011) Collaboration research

(表面抗污材料與製程技術開發先期評估計劃)

III. Educational/Research Activity

III.1 PhD course students

1. Prashanta Dhoj Adhikari (化学工程系) (2007.9.1~2010.7.31) Characteristics of Functionalized Carbon Micro Coils: Immobilization of Substrates and Embedding in Polymer Matrix
2. Kinjal Shah (応用科技研究所) (2012.8.1~present)
3. Mahmoud Mohamed Mahmoud Ahmed (応用科技研究所) (2013.8.1~present)

III.2 Master course students

1. 李志軒 (化学工程系) (2010.8.1~2012.7.31) Synthesis and Investigation of Clay/G4 PAMAM Dendrimer/Uranine Nano-composite Material
2. 廖紹宏(化学工程系) (2010.8.1~2012.7.31) Spectroscopic properties and methanol oxidation applications of graphene oxide and its nanocomposites with Pt nanoparticles encapsulated by PAMAM dendrimer
3. 魏泓威 (化学工程系) (2010.8.1~2012.7.31) pH and site isolation effect on immobilization of PAMAM dendrimer/multi-wall carbon nanotube composite material at gold electrode for biosensor application
4. 吳泳翰 (材料科学興工程系) (2010.8.1~2012.7.31) Preparation of gold nanoparticle films by using Langmuir-Blodgett technique and their application for surface enhanced infra-red absorption spectroscopy
5. Yakub Fam (化学工程系) (2011.2.1~2013.1.31) Fabrication of Hydroxyapatite-Dendrimer-Platinum Nanocomposites and Their Application
6. Dang Minh Nhut (化学工程系) (2011.2.1~2013.1.31) Surface Plasmon Resonance of Confeito-like Gold Nanoparticles
7. 徐敏軒 (化学工程系) (2011.8.1~2013.7.31) Preparation of cellulose nanofiber/dendrimer nano-composite and its CO_2 adsorption ability
8. 李俊緯 (化学工程系) (2011.8.1~2013.7.31) The preparation of Ag-TiO_2 nanocomposites

9. 蔡雅如 (化学工程系) (2011.8.1~2013.7.31) Preparation of Cyclodextrin-Immobolized Graphene Oxide and Its Biomedical Functions
10. Marina Popova (化学工程系) (2011.8.1~2013.7.31) Functionalization of graphene oxide for targeted anticancer drug delivery
11. Mahmoud Mohamed Mahmoud Ahmed (応用科技研究所) (2011.8.1~2013.7.31) Preparation of Graphene from Graphite Using Physical and Chemical Methods
12. Faiza Maryani (応用科技研究所) (2011.8.1~2013.7.31) Anionic Amphiphilic Copolymer Grafted on Multi-Walled Carbon Nanotube as Drug Carrier: Drug Loaded, Encapsulating Efficiency and Nuleus Targeting
13. 李聖儒 (化学工程系) (2012.8.1~present)
14. 張家綺 (化学工程系) (2012.8.1~present)
15. 黃正昌 (化学工程系) (2012.8.1~present)
16. 李安湘 (化学工程系) (2012.8.1~present)
17. 董妮鑫 (化学工程系) (2012.8.1~present)
18. 黃偉志 (化学工程系) (2012.8.1~present)
19. Yohan Widjaja (化学工程系) (2012.8.1~present)
20. Julius Candrawan (化学工程系) (2012.8.1~present)
21. 謝蕙蓯 (化学工程系) (2013.8.1~present)
22. 劉加毅 (化学工程系) (2013.8.1~present)
23. 許宇萱 (化学工程系) (2013.8.1~present)

III.3 Oral examination commission

1. 国立台湾科技大学材料科学與工程系博士口試委員 (2011/5/10)
2. 国立台湾科技大学応用科技研究所修士口試委員 (2012/7)
3. 国立台湾科技大学応用科技研究所修士口試委員 (2013/1)
4. 国立台湾科技大学応用科技研究所修士口試委員 (2013/7/8-9)

5. 国立台湾科技大学材料科学與工程系修士口試委員 (2013/7/24)

III.4 Lecture record

1. 2010/February-June, Smart Technology 智慧科技, 化学工程系
2. 2010/ September-2011/January, Smart Technology 智慧科技, 化学工程系
3. 2011/February-June, 高等物理化学, 化学工程系 co-lecture
4. 2011/September-2012/January, Physical Chemistry of Surfaces (表面物理化學) 化学工程系 co-lecture
5. 2013/February-June, Advanced Science and Technology 化学工程系

III.5 Invited lectures for students and Scientists:

1) Lecture, 2009/10/15, Chinese Academy of Sciences, Suzhou Institute of Nano-Tech and Nano-Bionics, Suzhou, China, Dendritic Polymer: Advanced Material for Nanotechnology

2) Lecture, 2009/11/4, National Taiwan University, Taipei, Dendritic Polymer: Advanced Nanomaterial for Nanotechnology

3) Lecture, 2009/11/5, National Yang Ming University, Taipei, Taiwan, Nanomaterials and Nanotechnology toward Drug Delivery Systems

4) Lecture, 2010/2/1, Yung Chi Paint (永記造漆), Tainan, Taiwan, Analysis of Acrylic Copolymer Using Systematical Methods Including NMR, IR, GC, GPC, Mass, and Thermopyrolysis

5) Lecture for under-graduate course, 2010/5/5, Department of Chemical Engineering, NTUST, Taipei, Taiwan,

6) Lecture for graduate course, 2010/6/2, department of Chemical Engineering, NTUST, Taipei, Taiwan, What is Dendrimer? Advanced Nanomaterial for Nanotechnology

7) Lecture, 2010/6/10, Royal Institute of Technology (KTH), Stockholm, Sweden, Nanotechnological Fabrication of Hierarchical Structures of Dendritic Polymers as

Advanced Materials

8) Lecture, 2010/11/25, Department of Chemistry, National Taiwan University, Photocatalytic Activity of surface-modified TiO_2 and TiO_2 core-shell nanoparticles

9) Lecture, 2011/12/14, Dharmsinh Desai University, Nadiad, Gujarat, India, Fabrication of hybrid architectures composed of nanoparticles towards their applications

10) Lecture, 2011/12/18, V N South Gujarat University, Surat, Gujarat, India, Nanotechnological Fabrication of Hierarchical Architectures of Dendrimer-based Polymers

11) Graduate Seminar, 2012/3/30, Department of Chemical Engineering, National Cheng Kung University, Tainan, Taiwan, Recent Advances of Nanocomposites Consisting of Smart Nanomaterials

12) Lecture, 2012/5/30, Autonomous University of Barcelona (Prof. Antony Villaverde), Barcelona, Spain, Advanced Fabrication of Novel Nanomaterials for Biomedical Applications

13) Lecture, 2012/7/11, Chemistry Department, Universiti Malaya (Prof. Rauzah Hashim), Kuala Lumpur, Malaysia, Characteristics of Amphiphilic Dendritic polymers

14) Lecture, 2012/10/27-11/11, Kazakhstan National Technical University, Almaty, Kazakhstan, lecture (14 times)

15) Lecture, 2013/3/26, Chang Gung University, Tao-Yuan, Taiwan, Smart Materials ― Hybrids of Carbon, Metal, Inorganic and Polymer Materials ―

16) Lecture, 2013/5/15, International Research Center for Materials NanoArchitectonics (MANA), National Institute for Materials Science (NIMS), Tsukuba, Japan, Recent Advances of Nanocomposites Consisting of Organic and Inorganic Materials

III.6 Conferences (International)

1) International Conference on Hightech Materials, Indian Institute of Technology, Kharagpur, India, 2009/2/11-13 **(invited talk)** Synthesis and Application of Functional Mesoporous Silica toward Molecular Recognition

2) International Dendrimer Symposium 6, Royal Institute of Technology KTH, Stockholm,

2009/6/14-18 **(invited talk)** How Do PAMAM Dendrimers Emit Fluorescence?

3) The 3rd Asian Conference on Colloid and Interface Science, Jeju island, Korea 2009/10/11-14 Asian Society of Colloid and Surface Sciences **(invited talk)** Physicochemical properties of lipid-structuring mixed membrane

4) The Second Asian Symposium on Advanced Materials, Fudan University, Shanghai, China 2009/10/11-14 **(keynote talk, committee member)** Are Dendritic Polymers Possible to be Advanced Materials?

5) 1st FAPS Polymer Congress, 2009/10/20-23, Nagoya Japan, Surface functionalization and hybridization of carbon micro coils, Masaki Ujihara, Prashanta Dhoj Adhikari, and Toyoko Imae (poster)

6) International Symposium on Nano Science and Technology (ISNST), Tainan, 2009/11/20-21 **(invited talk)** Nanotechnological Fabrication of Hierarchical Structures of Dendritic Polymers

7) International Conference on Nanomaterials: Synthesis Characterization and Applications (ICN2010), Kattayam, Kerala, India 2010/4/26-29 **(invited talk)** Fabrication of metal particles with unique shapes

8) NanoFormulation 2010, Stockholm, Sweden, 2010/6/9-11 **(invited talk)** Advanced Fabrication of Smart Nanomaterials Toward Drug Delivery Systems

9) The 11th Trends in Nanotechnology, Braga, Portugal, 2010/9/6-10, Fabrication of silica hollow microcoils with mesoporous walls, Carlos Rodríguez-Abreu, Neus Vilanova, Conxita Solans, Masaki Ujihara, Toyoko Imae, and Seiji Motojima

10) Colloids and Nanotechnologies in Industry 2010, Almaty, Kazakhstan, 2010/9/20-21 **(invited talk)** Fabrication of metallic nanoparticles with various shapes and their hybrids ― towards incorporation to reactors, sensors and machines ―

11) 18th International Symposium on Surfactants in Solution (SIS2010), Melbourne, Australia, 2010/11/14-19 **(invited talk)** Damage/Recovery by Additive on Lipid Membrane as a Mimicry of Human Stratum Corneum

12) 18th International Symposium on Surfactants in Solution (SIS2010), Melbourne, Australia, 2010/11/14-19 **(invited talk)** Successive investigation of surfactant assemblies

13) 7th International Dendrimer Symposium, Gaithersburg, Maryland, USA, 2011/6/26-7/1, Ampornphan Siriviriyanun and Toyoko Imae, Immobilization of Dendrimers

Encapsulated Pt Nanoparticles on Multiwalled Carbon Nanotubes and Carbon Micro Coils and Their Utilization to Electrochemical Bio/chemical Sensors

14) IUMRS International Conference in Asia (IUMRS-ICA) 2011, Taipei, Taiwan, 2011/9/19-22, Masaki Ujihara and Toyoko Imae, One-Pot Synthesis of Confeito-Like Au Nanoparticles and Their Biomedical Applications

15) IUMRS International Conference in Asia (IUMRS-ICA) 2011, Taipei, Taiwan, 2011/9/19-22, Toyoko Imae and Ampornphan Siriviriyanun, Immobilization of Pt Nanoparticles-Encapsulated Dendrimers on Multiwalled Carbon Nanotubes and Carbon Micro Coils

16) 3rd Asian Symposium on Advanced Materials: Chemistry & Physics of Functional Materials (ASAM-3 2011), Fukuoka, Japan, 2011/9/19-22, Toyoko Imae and Masaki Ujihara, Fabrication and Functionalization of Confeito-like Au Nanoparticles

17) International Conference on Advanced Materials and Nanotechnology (ICAMN2011), Kathmandu, Nepal, 2011/10/21-23 (**Keynote Talk**) Advanced fabrication of hybrids consisting of carbon, organic and inorganic materials promoted by nanotechnology

18) 9th Asian Conference on Chemical Sensors (9th ACCS2011), Taipei, Taiwan, 2011/11/14-17, Ampornphan Siriviriyanun and Toyoko Imae, Development of Electrochemical Biosensors Consisting of Carbon Nanotube-Dendrimer -Platinum Nanoparticle

19) 4th Asian Conference on Colloid and Interface Science (ACCIS 2011), Tainan, Taiwan, 2011/11/23-25 (**invited talk**, **organizing committee)** Hybridization of Carbon Materials with Metal Nanoparticles and Their Possible Applications

20) Conference in Polymer Science & Nanotechnology: Design and Structure (PSNDS-11), Baroda, India, 2011/12/16-17 (**invited talk**) Advanced Architectures Consisting of Dendritic Polymers

21) International Association of Colloid and Interface Scientists, Conference (IACIS2012), Sendai, Japan, 2012/5/15-18 **(keynote talk, organizing committee)** Toyoko Imae and Ampornphan Siriviriyanun, Modification and functionalization of electrode surfaces for electrochemical reactions

22) International Association of Colloid and Interface Scientists, Conference (IACIS2012), Sendai, Japan, 2012/5/15-18, M. M. Alam, L. Pérez-Carrillo, J. Miras, S. Vílchez, C. Solans, T. Imae, M. Ujihara, J. Esquena, Highly Porous Carbonaceous Materials obtained

in W/O Highly Concentrated Emulsions

23) International Association of Colloid and Interface Scientists, Conference (IACIS2012), Sendai, Japan, 2012/5/15-18, Kazuki Osawa, Shin-ichi Yusa, Toyoko Imae, Masaki Ujihara, Atsushi Harada, Kanako Ochi, Kazuhiko Ishihara, Synthesis of amphiphilic diblock copolymers with pendant dendron groups

24) NanoFormulation2012, Barcelona, Spain, 2012/5/28-6/1 (**travel grant winner)** Toyoko Imae, Ujihara Masaki, Ampornphan Siriviriyanun, Therapeutic application of nanomaterials consisting of novel components such as nanoparticle or dendrimer

25) NanoFormulation2012, Barcelona, Spain, 2012/5/28-6/1, Mohammad Mydul Alam, Lourdes A. Pérez-Carrillo, Susana Vílchez, Jonathan Miras, Conxita Solans, Toyoko Imae, Masaki Ujihara, Jordi Esquena, Highly Concentrated Emulsions - a Fascinating Route for the Preparation of Carbonaceous Porous Materials

26) International Symposium on Advanced Polymeric Materials 2012 (ISAPM 2012), Malaysia, 2012/7/20-21, (**invited talk)** Recent Advances of Nanocomposites Consisting of Dendritic polymers

27) World Congress on Oleo Science (WCOS 2012), Sasebo, Japan, 2012/9/30-10/4, (**plenary talk)** Role of Scientists/Engineers in Japan after March 11, 2011

28) Colloids and Nanotechnologies in Industry 2012, Almaty, Kazakhstan, 2012/10/30-31, (**invited talk)** Advantages of Hybrids of Carbon materials

29) International Conference on Advances in Polymeric Materials & Nanotechnology (PolyTech – 2012), Pune, India, 2012/12/15-17 (**Invited talk, organizing committee)** Characterization and Application of Fluorescent Poly(amido amine) Dendrimers

30) International Conference on Recent Innovations in Nano-Bio-Polymer-Pharmaceutical Technologies, Nanded, India, 2013/01/13-14 (**Keynote talk)** Smart Materials – carbon materials and inorganic materials –

31) International Dendrimer Symposium (IDS8), Madrid, Spain, 2013/6/23-27 **(Invited talk)** Characterization and Biomedical Application of Fluorescent Poly(amido amine) Dendrimers

32) Smart System Mini-Conference 2013 (SmaSys mini 2013), Yonezawa, Japan, 2013/7/12 **(Plenary talk)** Recent Advances of Nanocomposites Consisting of organic and inorganic materials

33) 5th Asian Conference on Colloid and Interface Science (ACCIS 2013) Darjeeling, India, 2013/11/20-23 **(Plenary talk, organizing committee)** Smart Materials – Amphiphiles and Nanoparticles –

34) International Conference on Surface Science & nanotechnology in Biomedical, Pharmaceutical & Engineering, Nadiad, India, 2013/12/10-12 **(Plenary talk)**

III.7 Conferences (Domestic)

1) The annual meeting of Taiwan Colloid and Interface Society, National Cheng Kung University, Tainan, Taiwan, Taiwan Colloid and Interface Society, 2009/5/21 **(invited talk)** Fabrication of core-shell soft matters and their specific molecular recognition

2) CMC workshop (研究会) 工学院大学新宿校舎, 2009/6/24 **(invited talk)** 材料としての CMC の展望

3) 高分子討論会, 熊本, 日本 2009/9/16 2009/9/18 複合脂質膜表面層の物性評価

4) 東京工業大学男女共同参画講演会 2010/2/15 **(invited talk)**

5) 名古屋大学男女共同参画女性研究者交流会 2010/3/5 **(invited talk)**

6) 高分子学会年会, 横浜, 日本 2010/5/26-28 Characteristic Reinforcement of Functionalized CMC-embedded PVA Films

7) 日本ヘリカルサイエンス学会設立総会・記念講演会,京都, 2012 年 4 月 21 日 **(受賞講演)** CMC から成る薄膜/コンポジットの創製

8) 第 61 回高分子学会年会, 横浜, 日本 2011/5/29-31, 大澤一貴, 遊佐真一, 今栄東洋子, 氏原真樹, 原田敦史, 越智可南子, 石原一彦
疎水性デンドロンを含む両親媒性ブロック共重合体の合成と水中での会合挙動
Synthesis of amphiphilic diblock copolymers with pendant hydrophobic dendron groups and their association behavior in water

9) 第 61 回高分子討論会、名古屋、日本 2012/9/19-21、Toyoko Imae, Preparation of dendrimer/graphene oxide nanohybrids and their medical applications

III.8 Collaboration Projects for research and education (with and without Grant)

1) Organic-inorganic Hybridization Toward Functionalization of Carbon Micro Coils
新型態微米碳卷衍生之有機無機混成物的合成分析與性質探討
PI (Taiwan): Po-Da Hong, Co-PI (Taiwan): Toyoko Imae
PI (Spain): Conxita Solans, *Institut de Química Avançada de Catalunya* (IQAC), CSIC
CSIC/NSC Cooperative Research Project
申請條碼：97WFA2500132, 1/1/2009-31/12/2010

2) Fabrication of Advanced Hybrid Nanomaterials toward Drug Delivery Systems
先進奈米複合材料的製備與藥物傳遞之研究
PI (Taiwan): Toyoko Imae,
PI (Spain): Conxita Solans, *Institut de Química Avançada de Catalunya* (IQAC), CSIC
CSIC/NSC "FORMOSA PROGRAM" Cooperative Research Project (CRP)
申請條碼：98WFA2500198, 1/1/2010-31/12/2012

3) Fabrication of Carbon Nanotube Hybrids toward Nanotechnology
奈米碳管混成物之備製與其奈米技術之研究
PI (Taiwan): Toyoko Imae,
PI (India): Chivukula N. Murthy, The M. S. University of Baroda
DST/NSC Cooperative Research Project
申請條碼：98WFA2500148, 1/1/2010-31/7/2012

4) Development of high-sensitive biosensors consisting of noble metal nanoparticle-immobilized fibrous carbon electrodes
PI (Taiwan): Toyoko Imae,
PI (Japan): Naoki Nagatani, Okayama University of Science and Technology
(2010-present)

5) Development of high sensitive gas sensing systems,
PI (Taiwan): Toyoko Imae,
PI (Japan): Ryo Sasai, Shimane University, Japan
(2010-present)

6) Synthesis of functional amphiphilic block-copolymers with dendron side chain,
PI (Taiwan): Toyoko Imae,
PI (Japan): Shin-ichi Yusa, Hyogo University, Japan
(2010-present)

7) THE DEVELOPMENT AND EVALUATION OF NANO-GRAPHENE-OXIDE-ANTICANCER DRUG CONJUGATES
PI(Taiwan) Toyoko Imae
PI (Malaysia): Chung Lip Yong and Kiew Lik Voon, University of Malaya, Malaysia
(2013-present) under collaborative research agreement (MOA)

IV. Publications

IV.1 Publications (journals)

1）Recent Advances in Fabrication of Anisotropic Metallic Nanostructures, Jadab Sharma and Toyoko Imae, J. Nanosci. Nanotechnol. 9, 19-40 (2009) **(Review article)**

2) Fabrication of dendrimer porogen-capsulated mesoporous silica via sol-gel process of silatrane precursor, Walairat Tanglumlert, Sujitra Wongkasemjit, and Toyoko Imae, J. Nanosci. Nanotech., 9, 1844-1850 (2009)

3) Surface Modification of Gold Nanorods by Organosilanes, Koji Mitamura, Toyoko Imae, Nagahiro Saito, and Osamu Takai, Composite Interfaces, 16 (2009) 377-385

4) Fluorescence investigations of oxygen-doped simple amine; in comparison with fluorescent PAMAM dendrimer, Chih-Chien Chu and Toyoko Imae, Macromol. Rapid Commun., 16, 89-93 (2009)

5) Functionalization of Gold Nanorods toward Their Applications, Koji Mitamura and Toyoko Imae, Plasmonics, 4 (2009), 23-30**. (review article)**

6) Synthesis of Poly(amido amine) Dendrimer with Redox-Active Spacers, Chih-Chien Chu and Toyoko Imae, Macromolecules, 42 (2009) 2295-2299

7) Perpendicular Superlattice Growth of Hydrophobic Gold Nanorods on Patterned Silicon Substrates via Evaporation-induced Self-assembling, Xiaoming Zhang and Toyoko Imae, J. Phys. Chem. C, 2009, 113 (15), 5947-5951

8) pH Dependent Encapsulation of Pyrene in PPI-core:PAMAM-shell Dendrimers, Dinakaran Kannaiyan and Toyoko Imae, Langmuir, 25 (2009) 5282-5285

9) Synthesis of Mo-SBA-1 catalyst via sol-gel process and its activity, Sujitra Wongkasemjit; Suparb Tamuang; Walairat Tanglumlert; Toyoko Imae, Materials Chemistry and Physics, 117 (2009) 301-306.

10) Styrene oxidation with H_2O_2 over Fe- and Ti-SBA-1 mesoporous silica, Walairat Tanglumlert, Toyoko Imae, Timothy J. White, Sujitra Wongkasemjit, Catalysis Communications, 10, 1070-1073, 2009.

11) Hierarchical Structures of Dendritic Polymers, Masaki Ujihara and Toyoko Imae, Polym. Int., 59, 137-144 (2010). **(Review article)**

12) Immobilization of amphiphilic dendron on silica particles toward the application to ultrahigh pressure liquid chromatography, Chih-Chien Chu, Norio Ueno, and Toyoko Imae, J. Nanosci. Nanotec., 10, 5324-5327 (2010).

13) Bio-modulation Approach for Gold Nanoparticles: Synthesis of Anisotropic to Luminescent Particles, Jadab Sharma, Yian Tai, and Toyoko Imae, Chemistry - an Asian Jurnal, 5, 70-73 (2010).

14) Characterization of mimetic lipid mixtures of stratum corneum, Xiaojuan Wang, Masaki Ujihara, Toyoko Imae, Akira Ishikubo, Yuki Sugiyama, and Tooru Okamoto, Colloids and Surfaces B: Biointerfaces, *78*, 92-100 (2010).

15) Visual observation of selective elution of components from skin-mimetic lipid membrane, Xiaojuan Wang, Masaki Ujihara, Toyoko Imae, Takuya Saiwaki, Akira Ishikubo, and Tooru Okamoto, Colloids and Surfaces B: Biointerfaces, 2010, 81, 174-177 (2010)

16) Damage/Recovery by Additive on Lipid Membrane as a Mimicry of Human Stratum Corneum, Yan Zhu, Toyoko Imae, Takuya Saiwaki and Takashi Oka, Langmuir, 26, 4951–4957 (2010).

17) Surface functionalization of carbon micro coils and their selective immobilization on surface-modified silicon substrates, Prashanta Dhoj Adhikari, Yian Tai, Masaki Ujihara, Chih-Chien Chu, Toyoko Imae, and Seiji Motojima, J. Nanosci. Nanotec., 10, 833-839 (2010).

18) Reinforcement on Properties of Poly(vinyl alcohol) Films by Embedding Functionalized Carbon Micro Coils, Prashanta Dhoj Adhikari, Masaki Ujihara, Toyoko Imae, Po-Da Hong and Seiji Motojima, J. Nanosci. Nanotec. 11, 1004-1012 (2010).

19) Sensitizing of Pyrene Fluorescence by β-cyclodextrin-modified TiO_2 Nanoparticles, Indrajit Shown; Masaki Ujihara; and Toyoko Imae, Journal of Colloid & Interface Science, 352, 232-237 (2010)

20) Synthesis of β-cyclodextrin-modified water-dispersible Ag-TiO_2 core-shell nanoparticles and their photocatalytic activity, J. Nanaosci. Nanotec., Indrajit Shown, Masaki Ujihara and Toyoko Imae, 11, 3284-3290 (2011)

21) Visual observation and characterization of fluorescent poly(amido amine) dendrimer in film state, Govindachetty Saravanan and Toyoko Imae, J. Nanosci. Nanotech. 11 (2011) 4838-4845.

22) Visual observation of avidin-biotin affinity by fluorescent G4.5 poly(amidoamine)

dendrimer, Govindachetty Saravanan, Kenji Daigo, Toyoko Imae, and Takao Hamakubo, Colloids and Surfaces B: Biointerfaces, 83 (2011) 58–60.

23) Synthesis and Characterization of “Hairy Urchin”-like Polyaniline by Using β-Cyclodextrin as a Template, Adhimoorthy Prasannan, Tram Le Bich Truong, Po-Da-Hong, Narayanasastri Somanathan, Indrajit Shown and Toyoko Imae, Langmuir, 2011, 27 (2), 766-773.

24) A combination of hard and soft templating for the fabrication of silica hollow microcoils with nanostructured walls, Carlos Rodriguez-Abreu, Neus Vilanova, Conxita Solans, Masaki Ujihara, Toyoko Imae, Arturo Lopez-Quintela and Seiji Motojima, Nanoscale Research Letters, 2011, 6, 330.

25) Self-association behavior in water of an amphiphilic diblock copolymer comprised of anionic and dendritic blocks, Shin-ichi Yusa, Yoshihiko Shimada, Toyoko Imae, and Yotaro Morishima, Polymer Chemistry, 2, 1815-1821, 2011.

26) Selective immobilization of carbon micro coils on patterned substrates and their electrochemical behavior on ITO substrate, Prashanta Dhoj Adhikari, Toyoko Imae, and Seiji Motojima, Chemical Engineering Journal, 174 (2011) 693-698.

27) Intrinsically Fluorescent PAMAM Dendrimer as Gene Carrier and Nanoprobe for Nucleic Acids Delivery: Bioimaging and Transfection Study, Ya-Ju Tsai, Chao-Chin Hu, CHih-Chien Chu, and Toyoko Imae, Biomacromolecules, 2011, 12, 4283-4290.

28) “Two Photon Confocal Imaging Study: Cell Uptake of Two photon Dye-labeled PAMAM Dendron with HeLa Cells”, H.-C. Tsai, T. Imae, G. Calderó, C. Solans,J. Biomed. Mater. Res. A., 100A, 746-756 (2012).

29) Network of sodium hyaluronate with nano-knots junction of poly(amido amine) dendrimer, Toyoko Imae and Shin-ichi Hamaguchi, Carbohydrate Polymers, 88 (2012) 352-360.

30) Fabrication of carbon microcoil/polyaniline composite by microemulsion polymerization for electrochemical functional enhancement, Indrajit Shown, Toyoko Imae, Seiji Motojima, Chemical Engineering Journal, 187 (2012) 380-384. **(cover-page illustration)**

31) Solution-based nano-plasmonic sensing technique by using gold nanorods", Fu Han Ho, Yung-Han Wu, Masaki Ujihara and Toyoko Imae, Analyst, 2012, 137, 2545-2548.

32) Syntheses and Characterizations of Multi-walled Carbon Nanotubes-Supported Palladium Nanocomposites, Walid Mohamed Rashad Daoush, Toyoko Imae, Journal of Materials Research, 27, 2012, 1680-1687.

33) Advantages of Immobilization of Pt Nanoparticles Protected by Dendrimers on Multiwalled Carbon Nanotubes, Ampornphan Siriviriyanun and Toyoko Imae, Phys. Chem. Chem. Phys., 2012, 14, 10622-10630.

34) Fabrication and Characterization of Dendrimer-Functionalized Mesoporous Hydroxyapatite, Nabakumar Pramanik, and Toyoko Imae, Langmuir, 2012, 28, 14018−14027.

35) Surface Immobilization of Carbon Nanotubes by β-cyclodextrins and Their Inclusion Ability, Vinod I. Bhoi[1], Toyoko Imae, Masaki Ujihara and C. N. Murthy, J. Nanosci. Nanotech., 2013 in press

36) Functionalization of Carbon Microcoils by Platinum-loading through Dendrimer Binder**,** A. Siriviriyanun, T. Imae, and S. Motojima, Sci. Adv. Mater., 2013, 5, 1-6.

37) Advantages of electrodes with dendrimer-protected platinum nanoparticles and carbon nanotubes for electrochemical methanol oxidation, Ampornphan Siriviriyanun and Toyoko Imae, Phys. Chem. Chem. Phys., 2013, 15, 4921-4929.

38) Controlling Wettability and hydrophobicity of Organo Clays Modified with Quaternary Ammonium Surfactants, Kinjal J Shah; Manish Kumar Mishra; Atindra D. Shukla; Toyoko Imae; Dinesh O Shah, J. Colloid Interface Sci. 407 (2013) 493-499.

39) Renewable catalyst with Cu nanoparticles embedded into cellulose nano-fiber film, Ramaraju Bendi and Toyoko Imae, RSC Advances, in press

40) Versatile One-Pot Synthesis of Confeito-Like Au Nanoparticles and Their Surface-Enhanced Raman Scattering Effect, Masaki Ujihara and Toyoko Imae, Colloids and Surfaces A: Physicochemical and Engineering Aspects, in press

41) Fluorescence Quenching of Uranine on Confeito-Like Au Nanoparticles, Masaki Ujihara, Nhut Minh Dang, and Toyoko Imae, J. Nanosci. Nanotech., in press

IV.2 Publication (book)

1) “Neutrons in Soft Mstter” Eds. By Toyoko Imae, Toshiji Kanaya, Michihiro Furusaka and Naoya Torikai, John Wiley & Sons Inc., Hoboken, New Jersey, March 2011, ISBN: 978-0-470-40252-8 (total 668 page)

IV.3 Publication (book chapter)

1) Synthesis of water-dispersible carbon nanotube–fullerodendron hybrids in “Nanomaterials: Synthesis, Characterization, and Applications”, Kumi Hamada, Toyoko Imae, Yu Morimoto, and Yutaka Takaguchi Editors, Edited by A. K. Haghi**,** Ajesh K. Zachariah**,** Nandakumar Kalariakkal *To Be Published* March 15th 2013 by Apple Academic Press – 296 pages Series: Advances in Nanoscience and Nanotechnology Apple Academic Press Inc., 3333 Mistwell Crescent, Oakville, Ontario, L6L 0A2 Canada

2) Physicochemical Properties of Dendrimers and Dendrimer-drug Complexes in “Dendrimer-based Drug Delivery Systems: from Theory to Practice” Toyoko Imae, Ed. by YiYun Cheng, John Wiley Sons., Inc., Chapter 3, 55-92 (2012)

3) Fabrication of dendrimers towards biological application in “Nanoparticles in Translational Science and Medicine” in “Progress in Molecular Biology and Translational Science” book series, Hsieh-Chih Tsai and Toyoko Imae, Ed. Antoni Villaverde, Academic Press (Elsevier) Part I, Chapter 3, 101-140, 2011

4) Structure of Dendritic Polymers and Their Films in “Neutrons in Soft Matter”, Koji Mitamura and Toyoko Imae, Eds. Toyoko Imae, Toshiji Kanaya, Michihiro Furusaka, and Naoya Torikai, Wiley, 435-454, 2011

5) Mesophase Morphologies of Silicone Block Copolymers in a Selective Solvent Studied by SAXS, Dietrich Leisner, Md. Hemayet Uddin, M. Arturo López-Quintela, Toyoko Imae and Hironobu Kunieda, Self-Organized Surfactant Structures, edited by Tharwat F. Tadros, 161-174, 2010

V. Research Projects Executed

Title of Research Project (For NSC grant applications, indicate grant number)	Role/ Position	Duration (MM/YY~ MM/YY)	Funding or Sponsoring Institution	Project Status	Total Expenses
The Development and Evaluation of Nano-Graphene-Oxide-Anticancer Drug Conjugates (UM.C/625/1/HIR/MOHE/MED/17)	PI	2013-2015	University of Malaya High Impact Research Grant	執行予定	RM100,000 /3years
発展効能化碳材料及其於緑能行程之応用	PI	2013/08/01-2014/07/31	行政院國家科學委員會	執行中	1,320,000NTD /year
整合型:多功能性有機/無機混成材料於智慧建材之應用 100H451201	共同 PI	2013/01/01 -2013/12/31	国立台湾科技大学建築中心頂尖計書	執行中	460,000NTD /year
整合型:多功能性有機/無機混成材料於智慧建材之應用 100H451201	共同 PI	2012/01/01 -2012/12/31	国立台湾科技大学建築中心頂尖計書	已結案	520,000NTD /year
技專院校想像力與科技實作能力培育計劃 - 比與比值科學思維推升技專院校學生奈米與製造之想像力與實作能力 100-2511-S-011-007-MY2	PI	2011/08/01 -2013/07/31	行政院國家科學委員會	已結案	1,459,000NTD /2 years
整合型:多功能性有機/無機混成材料於智慧建材之應用 100H451201	共同 PI	2011/06/01 -2011/12/31	国立台湾科技大学建築中心頂尖計書	已結案	450,000/NTD /6 months
表面抗污材料與製程技術開發先期評估計劃)	PI	2011	Foxlink Co. Ltd.	已結案	662,500NTD/
奈米碳管混成物之備製與其奈米技術之研究(Taiwan-India Collaboration Program 99-2923-M-011-002-MY3	PI	2010/1/1 -2012/12/31	行政院國家科學委員會	已結案	2,040,000NTD /3years
先進奈米複合材料的製備與藥物傳遞之研究(Formosa Collaboration Project) 99-2923-M-011-001-MY3	PI	2010/1/1 -2012/12/31	行政院國家科學委員會	已結案	4,350,000NTD /3years
新型態微米碳卷衍生之有機無機混成物的合成分析與性質探討 98-2923-M-011-002-MY2	Co-PI	2009/1/1 -2010/12/31	行政院國家科學委員會	已結案	1,488,000NTD /2years

VI. Research Report

VI.1 Research Targets

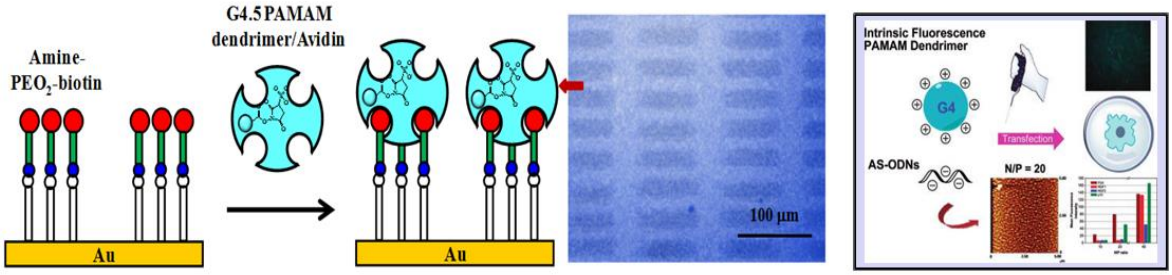
Our group, a "Nanoarchitecture and Nanotechnology" group, mainly focuses the target on the advanced nanomaterials for smart technology, especially, the fabrication of functional hybrids and composites (nanoarchitecture). The investigation is carried out using various materials such as soft materials (amphiphiles, polymers, and dendrimers), carbon materials (fullerenes, carbon nanotubes, carbon microcoils, graphenes and carbon nanohorns), nanoparticles (metal and metal oxide particles) and other inorganic materials (minerals and porous materials). Such materials can be incorporated as components in the hybrid and composite systems. The processes are performed by means of various techniques (nanotechnologies) like binding, adsorption, self-assembly, accumulation, lithography, etc., as well as traditional chemical syntheses and chemical binding. Thus-prepared hybrids/composites were characterized by means of the instrumentality of various methodologies of spectroscopy, microscopy, thermodynamics, electrochemistry and so on. Such advanced materials can be incorporated as components to build up systems, devices, and sensors, which are applicable to energy, photonics, environmental and biomedical sciences. The investigations since 2009 can be summarized in the following titles.

1. Anomalous luminescence property of dendritic polymers: Fundamental and biomedical application
2. Metal particles with unique shapes: Fabrication and biomedical application
3. Hierarchy structures of functional components on carbon materials: Construction and applications to energy/environmental/biomedical sciences
4. Biocompatible porous materials: Synthesis and application to environmental science
5. Eco-friendly cellulose firms: preparation and their functionalities

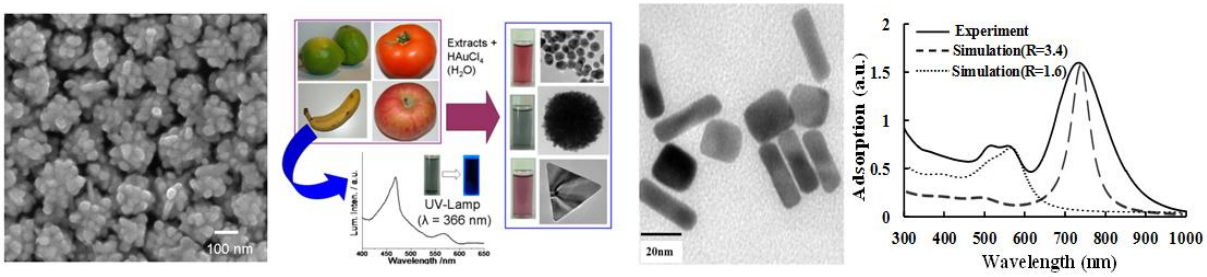
VI.2 Representative researches

Visual Observation and Bioimaging Application of Fluorescent Poly(amido amine) Dendrimers: Since we have discovered the emission of blue fluorescence from poly(amido amine) (PAMAM) dendrimers, we characterized such luminescence. Especially, the visualization of fluorescent dendrimers is possible and indispensable for the utilization as an imaging agent. When an avidin molecule was labeled with these fluorescent dendrimers, it was confirmed by the observation of fluorescent dendrimers that avidin-bound fluorescent dendrimers interact selectively with biotins immobilized on the patterned substrates. (Govindachetty Saravanan, Kenji Daigo, Toyoko Imae, and Takao Hamakubo, Colloids and

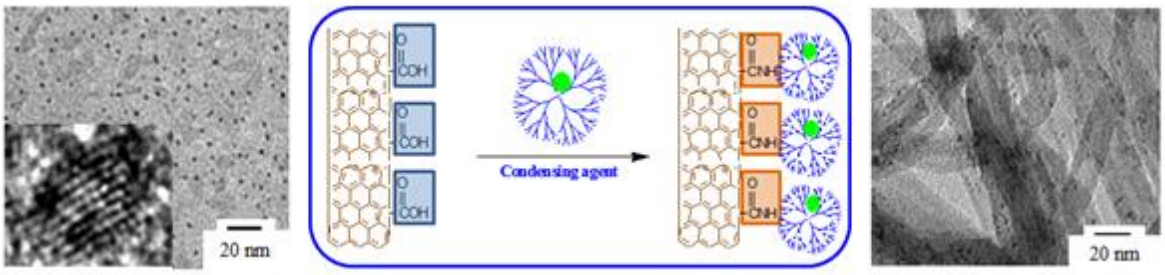
Surfaces B: Biointerfaces, 2011, 83 58–60.) On the other hand, the gene delivery and transfection toward rat C6 glioma cell lines were successfully evaluated by the blue fluorescence of PAMAM dendrimer. The fluorescent dendrimer revealed the lower vitro cytotoxicity toward C6 cells. The cellular uptake behavior could be directly analyzed by fluorescence microscopy and flow cytometry, without additional fluorescence labeling. Our preliminary results clearly indicated that fluorescent PAMAM dendrimers show the promise as gene/drug vehicles that can achieve delivery, transfection, and bioimaging at the same time. (Ya-Ju Tsai, Chao-Chin Hu, CHih-Chien Chu, and Toyoko Imae, Biomacromolecules, 2011, 12, 4283-4290.) This phenomenon is now applied to drug delivery systems.



Chemical- and Bio-modulation of Gold Nanoparticles, Their Plasmonic Properties and Development of Solution-based Nano-plasmonic Sensing Technique: Plasmonic property of metal particles is worthy of remarks because of its unique physical phenomenon and valuable applications. Gold nanostructures with "confeito-like shape" have been synthesized by a solution-phase galvanic reaction or in a solution including fruit juice. An ultraviolet-visible absorption spectrum showed surface plasmon bands at 320 to 530 nm and a broad absorption band from 650 nm to near-infrared region. These nanostructures constitute an active substrate material for the surface-enhanced Raman scattering spectroscopy. (Jadab Sharma, Yian Tai, and Toyoko Imae, Chemistry - an Asian Jurnal, 2010, 5, 70-73.) Meanwhile, we have successfully demonstrated the novel sensing technique for monitoring the variation of solution concentrations and measuring the effective dielectric constant in a medium by means of an ultra-small and label-free nanosensor, the mechanism of which is based on the localized surface plasmon resonance of gold nanorods. This promising sensing and analytical technique can be easily used for investigating the nano-scale variations of mixing or reaction process in a micro/nanofluidic channel or the biological interaction in the cytoplasm of the cell. (Fu Han Ho, Yung-Han Wu, Masaki Ujihara and Toyoko Imae, Analyst, 2012, 137, 2545-2548.) Biocompatible confeito-like nanoparticles are also intended to be synthesized and applied on the phototherapy through use of plasmonic property.

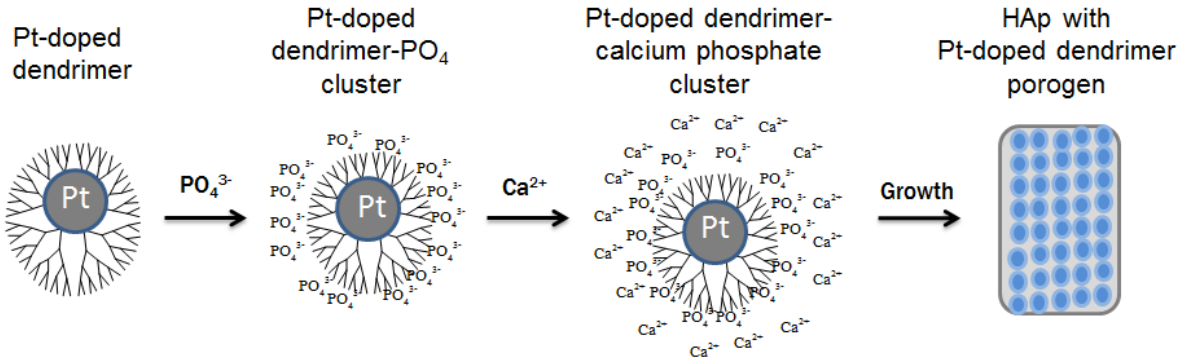


Advantages of Immobilization of Pt Nanoparticles Protected by Dendrimers on Multiwalled Carbon Nanotubes: Development of highly effective sensing systems is a universal desire owing to their worth. Pt nanoparticles (PtNPs) were synthesized in the presence of a poly(amido amine) (PAMAM) dendrimer as a stabilizer. Subsequently, PtNPs protected by dendrimers (DENPtNPs) were covalently immobilized on multiwalled carbon nanotubes (MWCNTs). PtNPs on MWCNTs dispersed with same aspect as the dispersion of DENPtNPs in water. Remarkable advantage is apparent from the enhanced electrochemical behavior of CNT/DENPtNPs loaded on the gold electrode. PtNPs promoted the electron transfer of MWCNTs and dendrimers contributed to uptake of redox materials, indicating the possible application of these hybrids as electrochemical sensing systems. (Ampornphan Siriviriyanun and Toyoko Imae, Phys. Chem. Chem. Phys., 2012, 14, 10622-10630.) Effective electrochemical detection of methanol oxidation has been confirmed using electrodes with dendrimer-protected platinum nanoparticles and carbon nanotubes. (Ampornphan Siriviriyanun and Toyoko Imae, Phys. Chem. Chem. Phys., 2013, 15, 4921-4929). These electrodes are going to be applied for detecting contaminant pollutants and biological reactions.

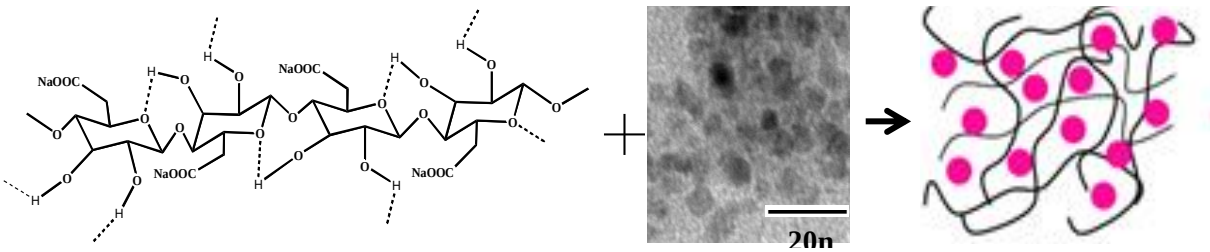


Fabrication and Characterization of Dendrimer-Functionalized Mesoporous Hydroxyapatite: Since the first report of porous silica, the synthesis of porous materials is developed using various precursors. A successful synthesis of mesostructured hydroxyapatite (HAp) using poly(amido amine) (PAMAM) dendrimer porogens has been reported. The formation of a single-phase crystal in synthesized HAp particles was revealed. The formation of the mesostructural nature of HAp was proven with a specific surface area (56−63 m^2/g)

and a certain pore size (4.7−5.5 nm). In addition, on the surface modification of mesoporous HAp particles using PAMAM dendrimer, the coating thickness corresponded to at least a double layer of dendrimer at pH 9 or higher, but it decreased sharply with decreasing pH below 9, indicating the strong non-electrostatic interaction of nonionic dendrimer with HAp. (Nabakumar Pramanik, and Toyoko Imae, Lngmuir, 2012, 28, 14018−14027.) The research is expanded to functionalize these mesoporous HAp and apply to an appropriate chemical reaction. The developed dendrimer-functionalized mesoporous hydroxyapatites may also be applicable in biocomposite material and/or bone tissue engineering.



Renewable catalyst with Cu nanoparticles embedded into cellulose nano-fiber film: The utilization of co-friendly resources is the main issues which humans must consider in current situation, because we are losing natural resources so fast and bringing on environmental breakdown by necessity. A catalytic system was designed with nano-composites of Cu nanoparticles and cellulose nano-fiber (CNF). The uptake of active Cu nanoparticles into a CNF film was successfully achieved. The Cu-loaded CNF film showed the high catalytic activity towards the reduction of 4-nitrophenol, meanwhile the Cu-free CNF film had almost no-catalytic activity. The film was easily recycled, and its catalytic activity did not decrease significantly up to at least 10 cycles of the reaction. It was suggested that the Cu nanoparticles embedded in the CNF film efficiently promoted the catalytic reaction. Thus, this novel concept demonstrates its possibility to prepare the eco-friendly film-type catalytic system with a good selectivity. (Ramaraju Bendi and Toyoko Imae, RSC Advances, in press) The Green chemistry described above must be promoted in a positive way.



VII. Summary

I started my group together with three members (an assistant professor, a postdoctoral fellow and a PhD student) in Taiwan Tec in April, 2009. The setting-up of the laboratory in TR102 was taken more than a half years. Although there were no students from Graduate Institute of engineering (name-changed to Graduate Institute of Applied Science and Technology), the first master course students joined on September, 2010, from Department of Chemical Engineering, where I was called on as a joint professors since 2010. Therefore, I would say that my academic research period was practically for three years since September in 2010.

Research was focused on the fabrication, functionalization and hybridization of advanced materials and finally their appropriate applications. As an extension of my main research field before Taiwan Tec, fundamental research of dendritic polymers was the first targeted subject. Since we already discovered the unique photoluminescent property of poly(amido amine) (PAMAM) Dendrimer (2004), we paid attention to the biomedical application of this property as well as the clarification of the mechanism of this phenomenon. The visualization of fluorescence was successfully verified, and the function of dendrimer as a gene vector was visually proved. The unique photoluminescent phenomenon of PAMAM denderimer have been brought to the knowledge of many scientists, and the relating researches are spreading in the world.

The fabrication of nanoparticles consisting of metal and metal compound was also one of targeted subjects in our group since 2005. Especially, confeito-like gold nanoparticles, which we succeeded in a pioneer synthesis in Taiwan Tec, have unique plasmon absorption at near-IR region and this property should be useful for phototherapy and energy enhancement. In fact we have proved the phototherapeutic property of these nanoparticles. The energy enhancement by confeito-like gold nanoparticles is the forthcoming subject. The researches relating to confeito-like gold nanoparticles are exclusively carried out only in our group at the moment. Metal oxides, which possess the effective photocatalytic property, are synthesized from different metal precursors in our group. It is becoming apparent that the enhancement of their catalytic properties can become effective by hybridizing with other components like dendritic polymers, metal particles and carbon materials. This enhancement effect directly reflects to the effect of solar cell systems, when the hybrids are built in. Therefore, we should be searching more effective hybrid systems.

Materials, which I get started in Taiwan Tec, are carbon materials. Carbon microcoils was denoted by a pioneering professor and assigned as materials for the investigation of the first PhD student in Taiwan Tec. The accomplished subjects relating to carbon microcoils are "surface functionalization of carbon micro coils, their selective immobilization on substrates, embedding in polymer matrix and fabrication of composite with polyaniline". Dendritic

polymers are valuable as a mediator among heterogeneous materials, especially, non-functional carbon, metal and mineral materials, to fabricate their hybrids and composites. We come along the synthesis of metal/metal oxide nanoparticle-loaded carbon nanotubes. This hybrid is immobilized on electrode and supplied for electrochemical detection of reactions such as methanol oxidation and inhibitor/biological reaction.

We treat graphene and grapheme oxide since 2010 and examine their fundamental properties, functionalization and hybridization. We successfully prepare water-dispersible graphene oxide by stabilizing with dendrimer. Drug delivery system consisting of vehicle of graphene oxide can load enough number of drugs. We also develop the new method for the exfoliation of graphene from graphite. Since last year, we started the investigation of carbon nanohorn which was first developed on 1998. We already obtain the advantage of this material in comparison with graphene oxide. Since the investigation relating to graphene/graphene oxide and carbon nanohorn exponentially increases within a couple of years, I am also throwing human power in subjects relating to these materials.

We must keep echo-friendly science in mind, because resources do not exist exhaustlessly on/in earth and the environmental destruction is serious. Therefore, we must consider using exhaustless or renewable materials and targeting environmental recovery. Thus, in an effort for green chemistry, we should select eco-friendly materials and aim the environmental low-load science. The first target is mesoporous hydroxyapatite prepared by means of micelle and dendrimer porogen. This is the first report of the synthesis of hydoxyapatite with mesopores at the mild reaction condition from cheap raw materials. Since hydroxyapatite is a main component of bone, these biocompatible mesoporous materials are expected new development on the bone-reproduction science. Clays are very popular minerals but their characters and functionalities depend on the components of clays. We recently synthesized the hybrid materials consisting of clays and dendrimers. The behaviour on CO_2 gas adsorption was different among clays. We are exploring the possibility to use these materials as selective gas adsorption materials.

Cellulose is also an echo-friendly material, because it is easy reproducible by growing plants. We preferably start the utilization of this material as a component of hybrid materials from two year ago. Following to the previous report, we can prepare nanofibers and their transparent films. However, our improvement is the loading of functional species or molecules on the films. When the catalyst is loaded on the films, the catalytic efficiency was good enough and this catalytic paper is convenient to separate from the reaction solution and reuse.

As I described above, my major researches are concentrated in a “Nanoarchitecture and Nanotechnology” and “Advanced Nanomaterials for Smart Technology”, but the research field is extending even to applied sciences in energy, photonics, environmental and biomedical fields beyond basic science. In consequence of energetic efforts of group

members, our group could publish patents (in Taiwan and USA), peer-reviewed journal articles and book chapter articles and edit a book of 'Neutrons in Soft Matter' in 2011. As a result, our excellent research works are attached a high value among scientists in the associated research society all over the world, I was allowed to distribute our researches to the world as invited lecturers in international conferences/symposiums, and finally I has been the recipient of some awards. I also contributed to the academic advancement as typified by an editorial advisory board of scientific journals and an advisory committee of international conferences/symposiums. My political activity beside academic one should also be noticed. I was an executive member of Council for Science and Technology Policy in Japan till this January 5th, but I still have a position of a member of Science Council of Japan and so on. I am also expected the activity as a committee member of a Woman in Engineering and Technology (WiE) Division in World Federation of Engineering Organization (WFEO).

The accomplishment of scientific researches, of course, is greatly indebted to members in my group but it was largely attributed to the collaboration with scientists around the world. The investigation with a central focus on carbon materials was accelerated by collaboration with Indian group of The Maharaja Sayajirao University of Baroda. The approach to environmental issues like the development of sensing systems was came out from the collaborations with Japanese groups in Okayama University of Science and Technology, Shimane University and Hyogo University. Noteworthy collaboration with Spanish group in Institute for Advanced Chemistry of Catalonia (IQAC-CSIC), CIBER en Bioingenieria, Biomateriales y Nanomedicina (CIBER-BBN) brought us the remarkable evolution in biomedical researches. Our biomedical investigation will be further deepened by the collaboration with Malaysian group, with whom we are going to sign the collaborative research agreement (MOA). Incidentally, I will contribute to the relevant university (University of Malaya) as a Visiting Professor under Academic Icon to the Department of Pharmacology, Faculty of Medicine. I am also going on-line another biomedical collaboration with professors in Tokyo University of Science, since my position as a visiting professor in Faculty of Pharmaceutical Sciences started from this year.

As an educational activity, one PhD students and 12 master course students graduated from our group till now and 2 PhD students and 11 master course students are educated in our group in the coming semester. I give a class entitled "Smart Technology" or "Advanced Science and Technology", where I introduce hot science and technology, which were most recently developed. The lectures were delivered even other universities and institutes in and out of Taiwan. Oral examination commission in Taiwan Tec and reviewing boards for the degree of doctor of philosophy and faculty position from foreign universities were also assigned me.

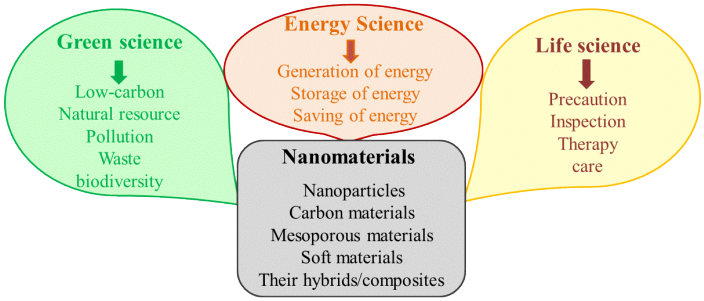
VIII. Expected Future Plan

Human being recognizes that the orientation of science in the 21st century should be "science for human", since the whole world confronts inevitable subjects relating to safe, secure, and healthy human life. On the other hand, in the second half of 20th century, nanotechnology and nanomaterials strikingly developed with deepening of science. Therefore, at present, those are key technology and materials, which overstride all sectional sciences. Thus we focus on the advanced nanotechnology and smart nanomaterials participating in and finding vent for the "science for human" and have to care for the strong correlation among them at the global view.

First we target "life science", because human population is exactly becoming an aging society and in the meanwhile there are many people who are forced unhealthy life in poverty society. In detail, we will develop our research in drug delivery systems and photo thermal therapy. Although we already started such investigation, it will be hastened by means of the collaboration with Department of Pharmacology, University of Malaya, Malaysia and Tokyo University of Science, Japan. We must complete, at least, carbon-based drug delivery systems and phototherapy-applicable non-spherical gold nanoparticles.

Pollutants have adverse effects on human health and environment, and their generation must be prevented, detected and deduced. Especially, CO_2 is a typical greenhouse effect gas and a causal agent of global warming. In order to remove pollutant gases including CO_2, we will develop the advanced filters, which selectively adsorb pollutant gases. Then the filter must equip with the functionality to self-decompose pollutants. We accomplish "the pollutant gas self-treatment membrane". Sick house/building syndrome is also serious for residents, especially, for children with atopic hypersensitivity. We begin the development of the wall materials, which have the functions to decompose sick-house gases (ex. formaldehyde).

In the past years, there is growing interest in renewable Energy generations, which are alternative of biofuel and atomic energy. Especially, the development of materials with high efficiency on solar cells and fuel cells is especially growing concern. The hybrid materials, which we have developed so far, are available as materials for such cells, and we will target our investigation to such directions. To be specific, the hybrids consisting of metal oxide + carbon material or metal oxide + organic sensitizer are valuable to solar cells and the hybrids of Pt-embedded minerals or carbon materials are utilizable for fuel cells.



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I am also grateful to colleagues in and out of Taiwan Tec. I suffered the shared utilization of the laboratory space and instruments from them and I collaborated with them. Especially, Prof. Conxita Solans and Jordi Esquena, Spain, collaborated with us under the Taiwan-Spain collaboration (Formosa) program four years, and we still keep a good relation on the research of biomedical materials even after the program. On the NSC Taiwan-India collaboration program with Prof. C. N. Murthy, India, we could develop the conjugation research of carbon materials with cyclodextrin. I also give my thanks for colleagues in Japan, Prof. Naoki Nagatani, Prof. Ryo Sasai and Prof. Shin-ichi Yusa, for devoted supports on our investigations.

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