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#### 職歴

2009-現在 国立台湾科技大学精誠荣誉学院工程技術研究所荣誉講座教授  
2008-2009 慶應義塾大学先導研究センター特別研究教授  
2006-2008 慶應義塾大学大学院理工学研究科特別研究教授  
1999-2006 名古屋大学物質科学国際研究センター教授  
1990-1999 名古屋大学理学部化学科助教授  
1975-1990 名古屋大学理学部化学科助手  
1969-1975 名古屋大学理学部化学科文部技官  
1965-1969 大阪大学蛋白質研究所文部技官

#### 受賞

2009 年 地域環境保全功労者環境大臣表彰  
2006 年 日本高分子学会功績賞  
2000 年 日本油化学会賞  
1999 年 日本女性科学者の会奨励賞

#### 所属学会

日本化学会・日本高分子学会・日本化学会コロイド界面部会・日本油化学会・日本中性子科学会・  
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#### 学術活動

Langmuir : advisory board  
Journal of Surface Science and Technology : Editorial Advisers

#### 専門分野

ナノ物質・ナノテクノロジー科学・高分子科学・環境科学

#### 最近の研究テーマ

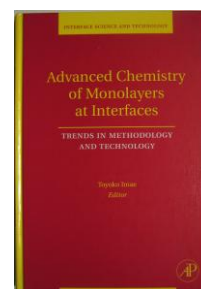
ナノ粒子・ナノ物質の創製と機能化に関する研究  
 dendritic dendrimer・ブロックコポリマーの物性と組織性に関する研究  
 溶液・界面における組織体の構築と機能性に関する研究

#### 研究業績

著書・分筆 21、翻訳 1、総説 22、原著論文 250

#### [新刊本]

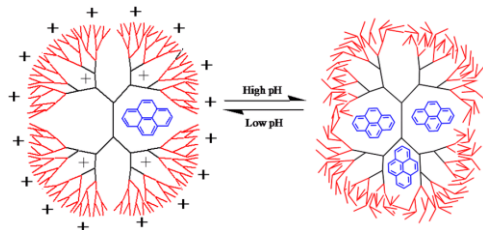
“Advanced Chemistry of Monolayers at Interfaces  
- Trends in Methodology and Technology -“



**[Topics of Researches]**

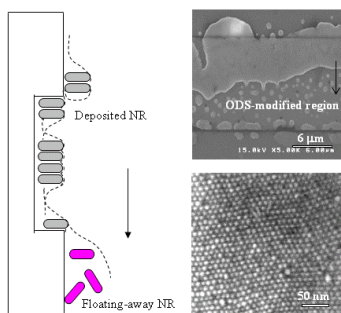
**247) pH Dependent Encapsulation of Pyrene in PPI-core:PAMAM-shell Dendrimers, Dinakaran Kannaiyan and Toyoko Imae, Langmuir, 2009, 25, 5282-5285**

Core-shell dendrimers consisting of poly(propyleneimine) (PPI) dendrimer as a core and poly(amido amine) (PAMAM) dendrons as a shell have been synthesized through the route of Michael addition reaction followed by amidation. These macromolecules were investigated their ability to solubilize a guest molecule, pyrene. Number of encapsulated pyrene molecules per dendrimer increased with pH of a solution and generation (G) of PAMAM dendron, and it reached 2.7 for PPI(G3)-core:PAMAM(G3)-shell dendrimer at pH 11. It was confirmed that the solubilized pyrene located in the hydrophobic nanocavities of the PPI dendrimer core in the dendrimer. The shrunk PAMAM dendron shell should play a role of retention fence of doped molecules.



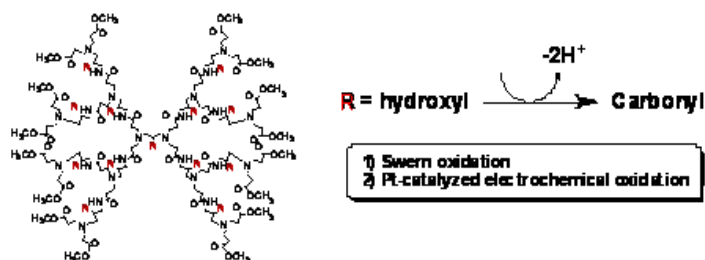
**246) Perpendicular Superlattice Growth of Hydrophobic Gold Nanorods on Patterned Silicon Substrates via Evaporation-induced Self-assembly, Xiaoming Zhang and Toyoko Imae, J. Phys. Chem. C, 2009, 113, 5947-5951**

A simple and efficient route has been reported for perpendicular superlattice self-assembly of hydrophobic gold nanorods (NRs) based on solvent evaporation. The combination of top-down surface patterning and bottom-up material assembling was used for leading to area-selective gold NR superlattice. The superlattice preferably deposited with perpendicular orientation of gold NRs on the hydrophobic stripe region in the patterned substrate. The superlattice occupied broad areas up to several square millimeters and possessed an uppermost surface of hexagonally close-packed NR monolayer.



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

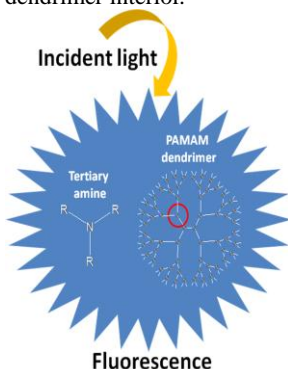
We have demonstrated a newly synthetic route for the preparation of internally modified PAMAM dendrimers. The functional diamines were synthetically embedded as the linking spacer through the amidation process on the divergent construction of dendrimer. NMR analyses supported the covalent incorporation of multiple IPA moieties inside the dendrimer by the appearance of carbon and proton signals on the secondary alcohol, and post-acetylation was also successfully carried out to confirm the existence of these internal hydroxyl functionalities. Moreover, based on the oxidation capability of IPA into corresponding ketone through dehydrogenation process, spacer-modified dendrimer successfully demonstrated a redox-active property by either chemical or electrochemical oxidation method. Potentially, one spacer-modified PAMAM dendrimer molecule can be regarded not only as the “fuel carrier”, containing multiple IPA molecules, but also as the “hydrogen donor” for further applications such as fuel cells and biosensors.



**243) Fluorescence investigations of oxygen-uptake simple amine; in comparison with fluorescent**

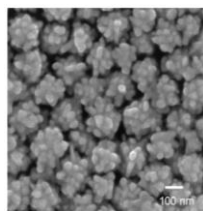
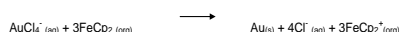
### PAMAM dendrimer, Chih-Chien Chu and Toyoko Imae, *Macromol. Rapid Commun.*, 2009, 16, 89-93

Blue emission of oxygen-doped tertiary amine (triethylamine), a key unit of fluorescent poly(amido amine) dendrimer, was first demonstrated. It was found that the fluorescence intensity could be more enhanced, if the tertiary amines locate densely in the dendrimer interior as the branching sites. Moreover, a solvatochromic phenol blue (PB) instead of oxygen is able to induce the blue fluorescence of the tertiary amino-branching sites based on a guaranteed host-guest complexation of PB molecules and dendrimer interior.



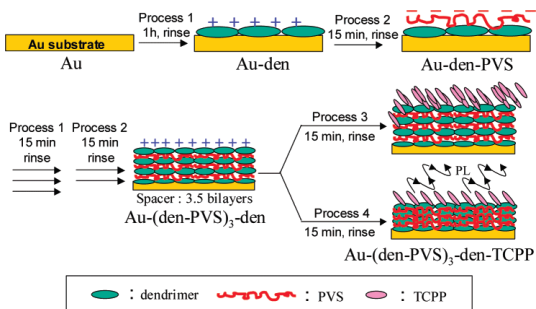
### 239) Synthesis of Confeito-Like Gold Nanostructures by a Solution Phase Galvanic Reaction, Jadab Sharma, Yian Tai, and Toyoko Imae, *J.Phys.Chem. C*, 2008, 112, 17033-17037

Anisotropic gold nanostructures with multiple cones have been synthesized by a solution phase galvanic reaction. The nanostructures are uniform in shape and size (maximum diameter: ~ 300 nm, body diameter: 100 - 150 nm, cone diameter: ~ 30 nm, and cone length: 20 - 40 nm), and they consist of single crystalline structure. A UV-visible spectrum of these nanostructures shows surface plasmon bands at 320, 415, 530 nm, and a broad absorption band around 950 nm, in which the latter is observed for large anisotropic gold nanostructures. A strong surface enhanced Raman scattering effect was also observed for the nanostructures on substrates using Rhodamine 6G as a probe molecule.



### 235) Surface Plasmon Fluorescence Investigation of Energy Transfer-controllable Organic Thin Films, Langmuir, Koji Mitamura, Toyoko Imae, Senjun Tian and Wolfgang Knoll, *Langmuir*, 2008, 24, 2266-2270

Thin functional organic films on a gold substrate were fabricated by adsorbing tetrakis(carboxyphenyl)porphyrin (TCPP) on a spacer layer, which was prepared by the layer-by-layer adsorption of a dendrimer and a linear polymer. The thickness and photoluminescence of the films were investigated by surface plasmon resonance and surface plasmon fluorescence techniques, respectively. TCPP adsorbed on the spacer layer in aqueous solutions of different ionic strengths resulted in a thick TCPP adlayer at high ionic strength and a shrunk spacer layer at low ionic strength. The fluorescence was quenched at high ionic strength but could be observed at low ionic strength. The effects are explained by the states of dye aggregation. This study shows the control of energy transfer from a metal surface to a dye layer by changing the dye adlayer. It can contribute to the development of molecular devices involving energytransfer systems.



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### [翻訳]

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- 246) Perpendicular Superlattice Growth of Hydrophobic Gold Nanorods on Patterned Silicon Substrates via Evaporation-induced Self-assembly, Xiaoming Zhang and Toyoko Imae, J. Phys. Chem. C, 2009, 113, 5947-5951
- 245) Synthesis of Poly(amido amine) Dendrimer with Redox-Active Spacers, Chih-Chien Chu and Toyoko Imae, Macromolecules, 2009, 42, 2295-2299
- 244) Functionalization of Gold Nanorods toward Their Applications, Koji Mitamura and Toyoko Imae, Plasmonics, 2009, 4, 23-30 (review)
- 243) Fluorescence investigations of oxygen-doped simple amine; in comparison with fluorescent PAMAM dendrimer, Chih-Chien Chu and Toyoko Imae, Macromol. Rapid Commun., 2009, 16, 89-93
- 242) Surface Modification of Gold Nanorods by Organosilanes, Koji Mitamura, Toyoko Imae, Nagahiro Saito, and Osamu Takai, Composite Interfaces, 2009, 16, 377-385
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- 240) Recent Advances in Fabrication of Anisotropic Metallic Nanostructures, Jadab Sharma and Toyoko Imae, J. Nanosci. Nanotechnol. 2009, 9, 19-40 (Review)
- 239) Synthesis of Confeito-Like Gold Nanostructures by a Solution Phase Galvanic Reaction, Jadab Sharma, Yian Tai, and Toyoko Imae, J. Phys. Chem. C, 2008, 112, 17033-17037
- 238) Preparation of highly ordered Fe-SBA-1 and Ti-SBA-1 cubic mesoporous silica via sol-gel processing of silatrane, Walairat Tanglumlert, Toyoko Imae, Timothy John White, Sujitra Wongkasemjit, Materials Letters, 2008, 62, 4545-4548
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- 235) Surface Plasmon Fluorescence Investigation of Energy Transfer-controllable Organic Thin Films, Langmuir, Koji Mitamura, Toyoko Imae, Senjun Tian and Wolfgang Knoll, Langmuir, 2008, 24, 2266-2270
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- 230) Fabrication and Self-Assembly of Hydrophobic Gold Nanorods, Koji Mitamura, Toyoko Imae, Nagahiro Saito, and Osamu Takai, J. Phys. Chem. B 2007, 111, 8891-8898
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- 224) Fluorescence Emission from PAMAM and PPI Dendrimers, Dongjun Wang, Toyoko Imae, and Masao Miki, J. Colloid Interface Science, 2007, 307, 354-360
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- 217) Fabrication of Metal Nanoparticle Monolayers on Amphiphilic Poly(amido amine) Dendrimer Langmuir Films, Masaki Ujihara, Koji Mitamura, Naoya Torikai and Toyoko Imae, Langmuir, 2006, 22, 3656-3661
- 216) Dendritic nano- and microhydrogels fabricated by triethoxysilyl focal dendrons, Daisuke Onoshima and Toyoko Imae, Soft Matter, 2006, 2, 141-148
- 215) Self-assembled Monolayer of Carboxyl-terminated Poly(amido amine) Dendrimer, Masahiro Ito and Toyoko Imae, J. Nanosci. Nanotech., 2006, 6, 1667-1672
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