Shun-Ichi Murahashi (Professor, Dr.)

Business Address

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Born

Osaka, Japan; May 12, 1937

Education

Bachelor: Osaka University, 1961
Master: Osaka University, 1963
Ph D.: Osaka University (Prof. Ichiro Moritani), 1967
Postdoctoral Fellow: Columbia University (Prof. Ronald Breslow) , 1968-1970

Academic Positions

Assistant Professor, Osaka University, 1963-1972
Associate Professor, Osaka University, 1972-1979
Professor, Osaka University, 1979-2001
Visiting Prof. Universite de Rennes, 1992
Visiting Prof. Institute of Fundamental Research of Organic Chemistry, Kyushu University, 1995-2000
Visiting Prof. Univerite P. M. Curie, Paris, 1997
Councilor, Osaka University, 1998
Emeritus Professor of Osaka University, 2001
Professor of Okayama University of Science, 2001-present

Field of Research

Biomimetic Catalytic Oxidation Reactions
Organometallic Chemistry directed towards Organic Synthesis
Green Catalytic Reaction, Non-salt Processes, C-H Activation
Transition-metal based Acid Base Ambiphilic catalyst
Cytochrome P-450 type Oxidation
Flavin catalyzed Oxidation reaction

Award

Award for Young Chemists, The Chemical Society of Japan (1970)
JSPS NSERC Lectureship (1991)
The Award of the Chemical Society of Japan (1995)
Docteur Honoris Causa, Universite de Rennes (1995)
MERCK-Schuchardt Lectureship (1996)
Humboldt Research Award (2002)
Bull.Chem. Soc. Award (2002)
Minakata-Avogadro Lecture Award (2003)
Special Award in Synthetic Organic Chemistry Japan (2005)
Japan Academy Prize (2010)

Chemical Society

President, The Chemical Society of Japan (2000)

Director, The Kinki Chemical Society, Japan (1985-1997)
Director, The Chemical Society of Japan (1989-1991)
Director, The Society of Synthetic Organic Chemistry, Japan (1992-1993)
Vice President, The Chemical Society of Japan (1994)
Vice President, The Kinki Chemical Society, Japan (1997-1999)

Government Office

The Member of the Science Council of Japan (2000-present)
The Member of the Committee of the Japan Science and Technology (2002-2007)
Chairman, Committee of Research on Chemistry Creating Organic Chemistry with Novel Functions, Japan Society of the Promotion of Science (2003-2007)

Research Program

Chairman, Priority Area "Reactive Organometallics" of the Grant-in-Aid for Scientific Research, Ministry of Culture, Education, and Sports (1992-1995)
Project Leader, Research for the Future Program "Enviromentally Friendly Catalytic Processes", Japan Society of the Promotion of Science (1996-2001)

Editor

Editorial Board, J. Molecular Catalysis, B (1998-2001)
Honorary Advisory Board, Synlett (1992-2009)

The Editor-in-Chief, Chemistry Letters (1994-1998)
Editorial Board, Green Chemistry (1999-2001)
Advisory Board, Chemistry Letters (2005-present)

International Conference

IUPAC symposium of Organometallic Chemistry directed towards Organic Synthesis (OMCOS)
International Advisory Board: (1991-present)
Chairman: The 7th IUPAC symposium of Organometallic Chemistry directed towards Organic Synthesis (OMCOS-7) (1993, Kobe)
The International Kyoto Conference on Organic Chemistry, Kyoto (IKCOC)
International Advisory Board:(1979-present)
The International Symposium on Homogeneous Catalysis (ISHC)
International Advisory Board: (1998-present)

Membership

The Chemical Society of Japan (Honorary Member)
Federation of Asian Chemical Societies (FACS) (Honorary Member)
American Chemical Society
The Royal Society of Chemistry
The Society of Synthetic Organic Chemistry, Japan (Honorary Member)
The Kinki Chemical Society, Japan

Recent Invited and Plenary Lectures at International Symposium

International Conference on Green & Sustainable Chemistry, Singapore, 2009. 8. 3-5.
11th International Symposium on Natural Products Chemistry, Karachi, Pakistan, 2008. 10. 29-11. 1.
15th National Conference on Organometallic Chemistry, Nanjing, China, 2008. 10. 20-23.
9th International Symposium on Green Chemistry in China, Hefei, China, 2008.5.12-14.
Farewell Symposium Roger Sheldon A Journey in Green Chemistry, Delft, The Netherlands, 2007. 12. 6-7.
A*STAR-Noyori Forum Joint Symposium, Singapore, 2007. 5. 14-16.
International Symposium on Current Perspectives in Organic Chemistry, Kolkata, India, 2006. 12. 7-9.
The 21th Century COE International Symposium, Nagaoka, Japan, 2006. 9. 29-30.
The 4th Conference on Chemistry, Cairo, Egypt, 2006. 3. 5-8.
Organic Chemistry, Today and Tomorrow, Bangalore, India, 2006. 1. 4-7.
The 2005 Pacifichem Conference, Green Chemical Processes, Hawaii, USA, 2005. 12. 7.
The 15th International Symposium on Fine Chemistry and Functional Polymers, Shanghai, China, 2005. 10. 17-20.
The 7th World Congress on Recovery, Recycle, Re-integration, Chinese Academy of Science,
Beijing, China, 2005. 9. 25-29.
The 1st International Symposium on Organic Electron Transfer Chemistry directed toward Organic Synthesis,
Osaka, Japan, 2005. 3. 19-22.
2nd Symposium of High-tech Research Center Okayama University of Science, 2003. 11.24-25.
Minakata-Avogadro Lectureship, University of Rome, 2003. 4. 28-5.5. Rome, Bari, Bologna, Milano, Italy.
The lectureship to the memory of Ta-shue Chou, Taipei, Taiwan, 2003. 2. 22.
The 11th Japan-Korea Seminar on Organic Chemistry, Teju, Korea, 2002.11.7-10.
The 13th International Symposium on Homogeneous Catalysis, Tarragona, Spain, 2002.9.3-7.
India-Japan NOST Symposium on Organic Chemistry, Trivandrum, India, 2001.12.13-15.
First Japan-Australia Symposium on Organic Chemistry (JASOC-1), Melbourne, Australia, 2001.12.10-11.
First NIAF MeRinOS Joint Meeting on Fundamental and Applied Aspect of Synthesis, Belgium, 2001.9.28-10.2.
18th International Congress of Heterocyclic Chemistry, Yokohama, Japan, 2001.7.29-8.3.
Post OMCOS-XI Symposium, Thirty Years of The Cross-Coupling reaction, Kyoto, Japan, 2001.7.27-28.
11th IUPAC Symposium on Organometallic Chemistry directed towards Organic Synthesis, Taipei, Taiwan, 2001.7.22-26.
The 87th Annual Meeting of the Korean Chemical Society, Seoul, Korea, 2001.4.20.
The Breslow Symposium-Celebrating the 70th Birthday of Ronald Breslow, New York, USA, 2001.3.24.
2000 International Chemical Congress of Pacific Basin Societies (Pacifichem 2000), Honolulu, Hawaii, USA, 2000.12.14-19.
The 10th Japan-Korea Seminar on Organic Chemistry, Sendai, Japan, 2000.11.26-28.
2000 International Symposium on Organic Reactions (ISOR 2000), Kyoto, Japan, 2000.10.24.
Special Symposium Inaugurating the Herbert C. Brown Distinguished Professorship and the Annual Industrial Associates Meeting,
West Lafyete, USA, 2000.9.28-30.
Congre's de la Socie'te' Francaise de Chimie, Rennes, France, 2000.9.18-22.
XIXth International Conference on Organometallic Chemistry (ICOMC), Shanghai, China, 2000.7.23-28.
Gratama Workshop 2000-Chemistry and Chemical Technology for a Sustainable Society, Osaka, Japan, 2000.4.21-25.

Recent Publications of Original Papers

1. S.-I. Murahashi, N. Miyaguchi, S. Noda, T. Naota, A. Fujii, Y. Inubushi and N. Komiya: Ruthenium-Catalyzed Oxidative Dearomatization of Phenols to 4-(tert-Butylperoxy)cyclohexadienones: Synthesis of 2-Substituted Quinones from p-Substituted Phenols, *Eur. J. Org. Chem*, **27**, 5355-5365 (2011).
2. S.-I. Murahash, Development of biomimetic catalytic oxidation methods and non-salt methods using transition metal-based acid and base ambiphilic catalysts, *Proc. Jpn. Acad. Ser. B*, **87**, 242-253 (2011)
3. H. Takaya, M. Ito, and S.-I. Murahashi: Rhenium-Catalyzed Addition of Carbonyl Compounds to the Carbon-Nytrogen Triple Bonds of Nitriles: α -C-H Activation of Carbonyl Compounds, *J. Am.Chem. Soc.*, **131**, 10824-10825 (2009).
4. S.-I. Murahashi, T. Naota, and Y. Nakano: Ruthenium-Catalyzed Regioselective Reactions of Nitriles and 1,3−Dicarbonyl Compounds with Terminal Alkynes, *Synlett*, 3355-3360 (2009).
5. Y. Guo, X. Zhao, D. Zhang, S.-I. Murahashi: Iridium-Catalyzed Reactions of Trifluoromethylated Compounds with Alkenes:A Csp3---H Bond Activation α to the Trifluoromethyl Group, *Angew. Chem. Int. Ed.* **48**, 2047-2949, (2009).
6. S.-I. Murahashi, T. Nakae, H. Terai, and N. Komiya: Ruthenium-Catalyzed Oxidative Cyanation of Tertiary Amines with Molecular Oxygen or Hydrogen Peroxide and Sodium Cyanide: sp3 C-H Bond Activation and Carbon-Carbon Bond Formation, *J. Am. Chem. Soc.* **130**, 11005-11012 (2008).
7. T. Naota, A. Tanna, S. Kamuro, M. Hieda, K. Ogata, S.-I. Murahashi, and H. Takaya: Switchable *C*- and *N*-Bound Isomers of Transition-Metal Cyanocarbanions: Synthesis and Interconversions of Cyclopentadienyl Ruthenium Complexes of Phenylsulfonylacetonitrile Anions, *Chem. Eur. J.* **14**, 2482-2498 (2008).
8. S.-I. Murahashi, and D. Zhang: Ruthenium Catalyzed Biomimetic Oxidation in Organic Synthesis Inspired by Cytochrome P-450, *Chemical Society Reviews* **37**, 1490-1501 (2008).
9. K. Suzuki, T. Watanabe, and S.-I. Murahashi: Aerobic Oxidative Transformation of Primary Amines to Oximes Catalyzed by 1,1-Diphenyl-2-picrylhydrazyl (DPPH) and Tungstated Alumina, *Angew. Chem. Int. Ed.* **47**, 2079-2081 (2008).
10. S.-I. Murahashi, Y. Okano, H. Sato, T. Nakae, N. Komiya: Aerobic Ruthenium-Catalyzed Oxidative Transformation of Secondary Amines to Imines, *Synlett* 1675-1678 (2007).
11. L. Provins, and S.-I. Murahashi: Oxidation of olefins catalyzed by new binaphthyl-ruthenium(III) complexes, *Arkivoc* (x)107-120 (2007).
12. S.-I. Murahashi: Development of Ruthenium Catalyzed Oxidation Reactions Inspired by Cytochrome P-450, *J. Synth. Org. Chem. Jpn.* **65**, 2-13 (2007).
13. Y. Imada, H. Iida, S. Ono, Y. Masui, and S.-I. Murahashi: Flavin-Catalyzed Oxidation of Amines and Sulfides with Molecular Oxygene: Biomimetic Green Oxidation, *Chem. Asian. J.* **1**, 136-147 (2006).
14. Y. Imada, M. Nishida, K. Kutsuwa, S. I. Murahashi, T. Naota: Palladium-Catalyzed Asymmetric Amination of 2,3-Allyl Phosphates, *Org. Lett.* **7**, 5837-5839 (2005).
15. S.-I. Murahashi, S. Noji, T. Hirabayashi, N. Komiya: Manganese-Catalyzed Enantioselective Oxidation of C-H Bonds of Alkanes and Silyl Ethers to Optically Active Ketones, *Tetrahedron Asymmetry* **16**, 3527-3535 (2005).
16. S.-I. Murahashi, N. Komiya, H. Terai: Ruthenium-Catalyzed Oxidative Cyanation of TertiaryAmines with Hydrogen Peroxide and Sodium Cyanide, *Angew. Chem. Int. Ed.* **44**, 6931-6933 (2005).
17. Y. Imada, H. Iida, S.-I. Murahashi, and T. Naota: An Aerobic Organocatalytic, and Chemoselective Method for Baeyer-Villiger Oxidation, *Angew. Chem. Int. Ed.* **44**, 1704-1706 (2005).
18. S.-I. Murahashi, S. Noji, and N. Komiya: Catalytic Enantioselective Oxidation of Alkanes and Alkenes Using (Salen)Manganese Complexes Bearing a Chiral Binaphthyl Strapped Unit, *Adv. Synth. Catal.* **346**, 195-198 (2004).
19. H. Terai, H. Takaya, and S.-I. Murahashi: Iridium-Catalyzed Selective C-C Bond Cleavage of Nitriles and Ketones. *Synlett* 2185-2187 (2004).
20. S.-I. Murahashi. S. Noji, T. Hirabayashi, and N. Komiya: Manganase-Catalyzed Oxidative Transformation of Silyl Ethers to Ketones: Enantioselective Synthesis of Optically Active β-and γ-Siloxylketones. *Synlett* 1739-1742 (2004).
21. S.-I. Murahashi: Transition-Metal-Based Lewis Acid, Base, and Ambiphilic Catalyst. Development of Non-salt Processes, *J. Syn. Org. Chem. Jpn.* **61**, 425-435 (2003).
22. S.-I. Murahashi, N. Komiya, H. Terai, and T. Nakae: Aerobic Ruthenium-Catalyzed Oxidative Cyanation of Tertiary Amines with Sodium Cyanide, *J. Am. Chem. Soc.* **125**, 15312-15313 (2003).
23. Y. Imada, H. Iida, S. Ono, and S.- I. Murahashi: Flavin Catalyzed Oxidations of Sulfides and Amines with Molecular Oxygen, *J. Am. Chem. Soc.* **125**, 2868-2869 (2003).
24. H. Takaya, K. Yoshida, K. Isozaki, H. Terai, and S.-I. Murahashi: Transition-Metal-Based Lewis Acid and Base Ambiphilic Catalysts of Iridium Hydride Complexes: Multicomponent Synthesis of Glutarimides, *Angew. Chem. Int. Ed.* **42**, 3302-3304 (2003).
25. S.-I. Murahashi, X. Zhou, and N. Komiya: Chlorinated Phthalocyanine Iron(II) Complex Catalyzed Oxidation of Alkanes and Alkenes with Molecular Oxygen in the Presence of Acetaldehyde, *Synlett* 321-324 (2003).
26. S.-I. Murahashi: Development of Biomimetic Catalytic Oxidation Reactions, *Shokubai* **44**, 259-264 (2002).
27. S.-I. Murahashi, H. Takaya, and T. Naota: Ruthenium Catalysis in Organic Synthesis, *Pure Appl. Chem.* **74**, 19-23 (2002).
28. T. Naota, A. Tanna, S. Kamuro, and S.-I. Murahashi: Mechanism of the Interconversions between C- and N-Bound Transition Metal a-Cyanocarbanions, *J. Am. Chem. Soc.* **124**, 6842-6843 (2002).
29. S.-I. Murahashi, S. Ono, and Y. Imada: Asymmetric Baeyer-Villiger Reaction with Hydrogen Peroxide Catalyzed by a Novel Planar-Chiral Bisflavin, *Angew. Chem. Int. Ed.* **41**, 2366-2368 (2002).
30. S.-I. Murahashi, Y. Imada, T. Kawakami, K. Harada, Y. Yonemushi, and N. Tomita: Enantioselective Addition of Ketene Silyl Acetals to Nitrones Catalyzed by Chiral Titanium Complexes. Synthesis of Optically Active b-Amino Acids, *J. Am. Chem. Soc.* **124**, 2888-2889 (2002).
31. S.-I. Murahashi: Palladium-Catalyzed Cross-Coupling Reactions of Organic Halides with Grignard Reagents, Organolithium Compounds, and Heteroatom Nucleophiles, *J. Organomet. Chem.* **653**, 27-33 (2002).

32. Y. Imada, K. Ueno, K. Kutsuwa, and S.-I. Murahashi: Palladium-Catalyzed Asymmetric Alkylation of Alka-2,3-dienyl Phosphates. Synthesis of Optically Active Allenes, *Chem. Lett.* 140-141 (2002).
33. T. Hottop, H.-J. Gutke, and S.-I. Murahashi: Synthesis of 4-Demethoxyadriamycinone Utilizing Ruthenium-Catalyzed Oxidation of Allyl Acetates, *Tetrahedron Lett.* **42**, 3343-3346 (2001).
34. H. Takaya and S.-I. Murahashi: Activation of C-H Bonds a to Nitriles for Combinatorial Chemistry: Ruthenium-Catalyzed Aldol and Michael Reactions of Polymer-Supported Nitriles, *Synlett* 991-992 (2001).
35. S.-I. Murahashi, N. Komiya, Y. Hayashi, and T. Kumano: Copper Complexes for Catalytic, Aerobic Oxidation of Hydrocarbons, *Pure & Appl. Chem.* **73**, 311-314 (2001).
36. H. Takaya, S. Kojima, and S.-I. Murahashi: Rhodium Complex-Catalyzed Reaction of Isonitriles with Carbonyl Compounds: Catalytic Synthesis of Pyrroles, *Org. Lett.* **3**, 421-424 (2001).
37. T. Naota, A. Tannna, and S.-I. Murahashi: Carbon-Carbon Bond Forming Reactions of N-Bound Transition Metal a-Cyanocarbanions: A Mechanistic Probe for Catalytic Michael Reactions of Nitriles, *Chem. Commun.* 63-64 (2001).
38. N. Komiya, S. Noji, and S.-I. Murahashi: Ruthenium-catalysed Oxidation of Alkanes with Peracetic Acid in Trifluoroacetic Acid: Ruthenium as an Efficient Catalyst for the Oxidation of Unactivated C-H Bonds, *Chem. Commun.* 65-66 (2001).
39. S.-I. Murahashi, N. Komiya, Y. Oda, T. Kuwabara, and T. Naota: Ruthenium-Catalyzed Oxidation of Alkanes with tert-Butyl Hydroperoxide and Peracetic Acid, *J. Org. Chem.* **65**, 9186-9193 (2000).
40. S.-I. Murahashi, A. Mitani, and K. Kitao: Ruthenium Catalyzed Glycine-Selective Oxidative Backbone Modification of Peptides, *Tetrahedron Lett.* **41**, 10246-10249 (2000).
41. T. Kawakami, H. Ohtake, H. Arakawa, T. Okachi, Y. Imada, and S.-I. Murahashi: Asymmetric Synthesis of b-Amio Acids by Addition of Chiral Enolates to Nitrones via N-Acyloxyiminium Ions, *Bull. Chem. Soc. Jpn.* **73**, 2423-2444 (2000).
42. S.-I. Murahashi, K. Take, T. Naota, and H. Takaya: Aldol and Michael Reactions of Nitriles Catalyzed by Cyclopentadienylruthenium Enolate Complexes, *Synlett* 1016-1018 (2000).
43. S.-I. Murahashi and H. Takaya: Low-Valent Ruthenium and Iridium Hydride Complexes as Alternatives to Lewis Acid and Base Catalysts, *Acc. Chem. Res.* **33**, 225-233 (2000).
44. T. Naota, A. Tannna, and S.-I. Murahashi: Synthesis and Characterization of C- and N-Bound Isomers of Transition Metal a-Cyanocarbanions, *J. Am. Chem. Soc.* **122**, 2960-2961 (2000).
45. S.-I. Murahashi, T. Tsuji, and S. Ito: Synthesis of Optically Active N-Hydroxylamines by Asymmetric Hydrogenation of Nitrones with Iridium Catalysts, *Chem. Commun.* 409-410 (2000).
46. S.-I. Murahashi, K. Kitao, and A. Mitani: Glycine-Selective Ruthenium Catalyzed Oxidative Modification of Short Peptides, *Peptide Science 1999*, 137-140 (2000).
47. S.-I. Murahashi, J. Sun, H. Kurosawa, and Y. Imada: Synthesis of Homochiral b-Sulfinyl Nitrones and Their Application for Enantioselective Synthesis of (+)-Euphococcinine, *Heterocycles* **52**, 557-561 (2000).

Recent Publications of Books and Reviews

1. S.-I. Muranashi, N. Komiya, Ruthenium-catalyzed Oxidation for Organic Synthesis, In *Modern Oxidation Methods, 2nd Ed.*, Ed., J.-E. Backvall, Wiley-VCH, Weinheim, in press.
2. S.-I. Murahashi: Palladium-Phosphine-Complex-Catalyzed Reaction of Organolithium Compounds and Alkenyl Halides: (Z)-β-[2-(N,N-dimethylamino)phenyl]styrene, In *Thematic Collection Organic Synthesis*, Ed., R. Danheiser, in press.
3. S.-I. Murahashi and Y. Imada: Asymmetric Synthesis of Amines and Amino Acids from Amines, In *Asymmetric Synthesis-The Essentials*, Eds., S. Braese, M. Christmann, Wiley-VCH, Weinheim, 40-44 (2007).
4. S.-I. Murahashi and C. Zhao: Pentahydridobis(triisopropylphosphine)iridium(V) In *Electronic Encyclopedia of Reagents for Organic Synthesis*, Ed. L. A. Paquette, Wiley, New York, (2006).
5. S.-I. Murahashi and C. Zhao: Dichlorotris(triphenylphosphine)ruthenium(II) In *Electronic Encyclopedia of Reagents for Organic Synthesis*, Ed. L. A. Paquette, Wiley, New York, (2006).
6. S.-I. Murahashi: Transition Metal Catalyzed C-H Activation of Pronucleophile by α-Heteroatom Effect, In *Handbook of CH Transformation*, Ed. G. Dyker, Wiley-VCH, Weinheim,Vol.2, 319-328 (2005).
7. S.-I. Murahashi: Synthesis of Nitriles with Retention of the Cyano Group, In *Science of Synthesis*, Ed., S.-I. Murahashi, Thieme, Stuttgart, Vol 19, 345-425 (2004).
8. S.-I. Murahashi and Y. Imada: Amine Oxidations, In *Transition Metals for Organic Syntheis, Vol 2. Second Revised and Enlarged*, Ed., M. Beller, C. Bolm, Wiley-VCH, Weinheim, 497-507 (2004).
9. S.-I. Murahashi and N. Komiya: Ruthenium-Catalyzed Oxidation of Alkenes, Alcohols, Amines, beta-Lactams, Phenols, and Hydrocarbons, In *Modern Oxidation Methods*, Ed., J.-E. Backvall, Wiley-VCH, Weinheim, 165-191(2004).
10. S.-I. Murahashi and N. Komiya: Oxidation Reactions, In *Ruthenium in Organic Synthesis*, Ed., S.-I. Murahashi, Wiley-VCH, Weinheim, 53-93 (2004).
11. S.-I. Murahashi and N. Komiya: Oxidation of Amines, Alcohols, and Related Compounds, In *Handbook of Organopalladium Chemistry for Organic Synthesis*, Ed., E. Negishi, John Wiley & Sons, New York, Vol.2, 2881–2894 (2002).
12. T. Hosokawa and S.-I. Murahashi: Oxypalladation–Dehydropalladation Tandem and Related Reactions, In *Handbook of Organopalladium Chemistry for Organic Synthesis*, Ed., E. Negishi, John Wiley & Sons, New York, Vol.2, 2169–2192 (2002).
13. T. Hosokawa and S.-I. Murahashi: Intermolecular Oxypalladation Not Accompanied by Dehydrogenation, In *Handbook of Organopalladium Chemistry for Organic Synthesis*, Ed., E. Negishi, John Wiley & Sons, New York, Vol.2, 2161–2168 (2002).
14. T. Hosokawa and S.-I. Murahashi: Other Intramolecular Oxypalladation-Dehydropalladation Reactions, In *Handbook of Organopalladium Chemistry for Organic Synthesis*, Ed., E. Negishi, John Wiley & Sons, New York, Vol.2, 2141–2159 (2002).
15. S.-I. Murahashi and Y. Imada: Palladium-Catalyzed Substitution Reactions of Nitrogen and Other Group 15 Atom Containing Allylic Derivatives, In *Handbook of Organopalladium Chemistry for Organic Synthesis*, Ed., E. Negishi, John Wiley & Sons, New York, Vol.2, 1817–1825 (2002).
16. S.-I. Murahashi: Recommendation for Green Chemistry, *Kagaku to Kyoiku*, **50**, 426-429 (2002).

17. S.-I. Murahashi: Green Chemistry-Homogeneous Complex Catalysts, In *Green Chemistry-Chemistry for Sustainable Society*, Ed., by Makoto Misonou and S.-I. Murahashi, Kodansha, Tokyo, 99-111 (2001).
18. S.-I. Murahashi: Development of Transition Metal Catalyst as Lewis Acid or Base Substitutes, *Organomet. News*, 90-93 (2001).
19. S.-I. Murahashi: Green Chemistry and the Development of New Catalyst Therefor, *Kagaku Kogyo*, **51**, 409-416 (2000).
20. S.-I. Murahashi: Exploitation of New Catalytic Reactions, *Kagaku Kogyo*, **51**, 52-57 (2000).