

2.2.17 Laboratory : Laboratory of Sustainable Materials

Member:	Professor	Kawai, Shuichi , Dr. Agric. Sci.
	Assistant Professor	Umemura, Kenji, Dr. Agric. Sci.
	Doctor's program	2
	Master's Program	4
	Post-Doctoral fellow	1
	Researcher	1

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Development of sustainable materials from plant fibers

Kenaf bast fiber with extreme high strength was converted into oriented fiberboard. The fundamental physical properties were clarified. In addition, a self-bonding board was investigated using kenaf core containing rich in hemicelluloses.

b) Development of new wood-based materials using non-fossil resources

The fundamental bonding properties of chitosan were investigated for the purpose of developing new natural adhesives. Chitosan was found to have specific bonding properties, and have a potential as a new natural wood adhesives.

c) Material flow analysis of wood biomass

The increase of carbon dioxide in the atmosphere has contributed to the global warming. We tried to evaluate the carbon flow of wood biomass by macro-analysis relating to photosynthesis, utilization of wood and bio-degradation. The sustainable system of production and utilization of wood biomass was also investigated.

d) Aging of wood and prediction of service life of wood

Changes of physical, chemical and mechanical properties on aged wood have been investigated and the mechanism of wood aging has been discussed by being compared with those of thermal treated wood. For an example, kinetic analysis is successfully applied to wood color properties which implied that color change during natural aging and heat treatment can be explained as the similar reaction.

A-2.Publications and presentations

a) Publications

Books

- Umemura K. : Sakuno T., Takatani M., Umemura K., Fujii I. ed., Science and Technology of Wood Adhesion, Kaiseisha Press, the third paragraph in Chapter 2 Other adhesives, p.57-69, the second paragraph in Chapter 3, Factors of wood, p.77-86, the third paragraph in Chapter 3, Factors of adhesives, p.87-93, the first paragraph in Chapter 5, Wood-based materials p.121-128, 5.1 of the fifth paragraph in Chapter 5, Definition of fiberboard, p.153-154, 2010
- Kawai S: Igarashi Y: Itoh M: Naganishi O: Kobayashi H: Sakurai Y: Suzuki A: Nishioka S: Hasegawa T: Hibi T: Matsumoto M: Yagi K: Chapter 10 The Role of Timber as a Carbon Stock and the Sustainable and cyclical Utilization of Domestic Wood, The Challenge on the Global Warming Problem, Japan Agriculture Society ed., Yokohama, p.185-202, 2009
- Kawai S: Sugihara K: Kono Y: Tanabe A: Tanaka K: Kosugi Y: Kozan O: Kanzaki M: Yamada A: Son S: Hoshikawa K: Fujita M: Ishikawa N: Watanabe T: Shimizu N: Kimura S: Sato T: Wada T: Chapter 7 The Creation of Tropical Forest Biosphere, "Geosphere, Biosphere and Humanities- In Search of the Sustainable Humanosphere- Sugihara K, Kawai S, Kono Y and Tanabe A ed. Kyoto University Press, p.215-231, 2010

Original Papers

- Umemura K., Kaiho K., Kawai S.: Characterization of Bagasse-Rind Particleboard Bonded with Chitosan. J. Appl. Polym. Sci. 113(4), 2103-2108, 2009
- Murata K., Umemura K., Kaimoto T., Kaimoto T., Okuda K., Manufacture of glulam with chitosan adhesive. Wood Industry, 65(2), 69-72, 2010
- Yokoyama M, Gril J, Matsuo M, Yano H, Sugiyama J, Clair B, Kubodera S, Mistutani T, Sakamoto M, Ozaki H, Imamura M, Kawai S: Mechanical characteristics of aged Hinoki wood from Japanese historical buildings, COMPTES RENDUS PHYSIQUE, 10(7), 601-611, 2009
- Miyuki Matsuo, Misao Yokoyama, Kenji Umemura, Joseph Gril, Ken'ichiro Yano, and Shuichi Kawai: Color changes in wood during heating: kinetic analysis by applying a time-temperature superposition method, Applied Physics A: Materials Science & Processing, 99; 47-52, 2010

Reviews

- Umemura K.: Development of new wood molding bonded with citric acid, *Plastics*, 61(2), 62-64, 2010

Reports

- Sasa Sofyan Munawar, Kenji Umemura, Shuichi Kawai: Development of acacia mangium bark molded products, *Bulletin of Research Institute for Sustainable Humanosphere Kyoto University*, No5, p.8, 2009
- Miyuki Matsuo, Misao Yokoyama, Kenji Umemura, Junji Sugiyama, Shuichi Kawai, Shigeru Kubodera, Takumi Mitsutani, Hiromasa Ozaki, Minoru Sakamoto, Mineo Imamura: Evaluation of the aging wood from cultural properties as compared with the accelerated aging treatment -Analysis on color properties-, *International Conference on Wood Science for Preservation of Cultural Heritage: Mechanical and Biological Factors*. 印刷中 (2009)
- Miyuki Matsuo, Misao Yokoyama, Kenji Umemura, Junji Sugiyama, Shuichi Kawai, Joseph Gril, Ken'ichiro Yano, Shigeru Kubodera, Takumi Mitsutani, Hiromasa Ozaki, Minoru Sakamoto, Mineo Imamura: Evaluation of the aging wood from historical buildings as compared with the accelerated aging wood and cellulose - Analysis of color properties., *Wood CulTher COST IE0601 Symposium*, October 7-10, Hamburg, Germany, 印刷中 (2009)
- Miyuki Matsuo, Kenji Umemura, Hakuju Kuseko, Shuichi Kawai: Artificially aged paper by heat treatment: Evaluation and application for calligraphy, *The First Academic Conference on Conservation of Cultural Heritage in East Asia*, October 17-19, Beijing, China, 114-116 (2009)
- Misao Yokoyama, Joseph Gril, Miyuki Matsuo, Hiroyuki Yano, Junji Sugiyama, Bruno Clair, Shigeru Kubodera, Takumi Mitsutani, Minoru Sakamoto, Hiromasa Ozaki, Mineo Imamura, Shuichi Kawai: Mechanical Characteristics of Aged Hinoki (*Chamaecyparis obtusa* Endl.) Wood from Japanese Historical Buildings, *The First Academic Conference on Conservation of Cultural Heritage in East Asia*, October 17-19, Beijing, China, 97-100 (2009)
- Shuichi Kawai, Miyuki Matsuo, Misao Yokoyama, Junji Sugiyama Database on the Aged Wood from Historical Buildings, *The First Academic Conference on Conservation of Cultural Heritage in East Asia*, October 17-19, Beijing, China, 110-112 (2009)
- Cihat Tascioglu, Kenji Umemura, Kunio Tsunoda: Termiticidal Performance of Zinc Borate-Incorporated Particleboard, *Proc. The Sixth Conference of the Pacific Rim Termite Research Group*, March 2,3, Kyoto Japan, 114-116 (2009)

- Kenji Umemura, Hidefumi Yamauchi, Takeshi Ito, Masaaki Shibata, Shuichi Kawai: Photodegradation of Isocyanate Resin Adhesive for Wood, Proc. CD The Third Asian Conference on Adhesion. June 7-10, Hamamatsu, Japan, 237-239 (2009)
- Kenji Umemura, Keiji Kaiho, Shuichi Kawai: Utilization of Chitosan as an Adhesive for Bagasse Particleboard, Proc. International Conference on Wood Adhesives, September 23-30, Nevada, USA (in press) (2009)
- Kenji Umemura: High performance wood-based composites composed of non fossil resources only., New Technology Presentation Meetings, Japan Science and Technology Agency, p.29-33, 2009
- Kenji Umemura: Development of novel wood-based composites using an adhesive derived from natural substance. 26th Wood-based boards and Wood-based Composites Symposium, Kansai branch of the Wood Technological Association, p.47-56, 2010
- Hidefumi Yamauchi, Koji Adachi, Yasutomo Kawahara, Takuro Mori, Kenji Umemura, Ken Hasuike, Hiroyuki Yano: Development of simple reinforce method for glulam using wood-based tape, Annual report of cooperative studies using Wood Composite Hall, p.68-73, 2010
- Kawai S: Toward the revitalization of Japanese Forestry, Shinrin Soken Quaterly, Vol.6, p.1 Forest Research Institute (2009)
- Kawai S: Sustaining the Forest with Proper Management(Interview Article), G front, No.49, p.6 June 2009

Patents

- PCT WO2010/001988 A1, Composition cured by applying heat/ pressure thereto. Inovetor: Umemura K., Applicant: Kyoto University, 1/7 2010

b) Conference and seminar papers presented

- The 60th Annual Meetings of the Japan Wood Research Society: 10 presentations
- The Third Asian Conference on Adhesion : 1 presentation
- Annual 2009 IAWS Plenary Meeting and Conference : 1 presentation
- XIXth French Congress of Mechanics : 1 presentation
- Wood CulTher COST IE0601 Symposium : 1 presentation
- The First Academic Conference on Conservation of Cultural Heritage in East Asia : 1 presentation
- The 27th Annual Meetings of the Wood Technological Association in Japan: 1 presentation

- The 31th Annual Meetings of Japan Society for the Conservation of Cultural Property: 1 presentation
- The 50th Annual Meetings of Japan Society for Atmospheric Environment: 1 presentation
- The 20th Annual Meeting of Japan Material Life Society: 1 presentation
- The Japan Indoor Environment Society: 1 presentation

A-3. Off-campus activities

Membership in academic societies

- Kawai, Shuichi D. Agric. Sci. : The Japan Wood Research Society (Member of directors board), The Society of Materials Science, Japan (Members of the Committees of Wood Composite materials and Referee), The Japanese Forest Society, The Wood Technological Association of Japan (Member of directors board), The Japan Wood Preserving Association, The Adhesion Society of Japan
- Umemura, Kenji, Dr. Agric. Sci. : The Wood Technological Association of Japan (Member of planning committee and officer of the Kansai Branch, Member of officer of the Plywood Section, Member of advisory committee of the WPC Section), The Japan Wood Research Society (Member of Annual Meeting Board), The Adhesion Society of Japan (Member of Editorial Board, Member of The Third Asian Conference on Adhesion Board), The Society of Materials Science, Japan (Referee)

Membership in Science Council of Japan, etc.

- Kawai Shuichi : The Science Council of Japan (Associate Member), The Forest, Wood and Environment Academy (Member of Director Board, Member of Steering Committee)

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Grants-in-Aid for Scientific Research (A) : Shuichi Kawai : Database of properties on the members from historical wooden buildings.
- Grants-in-Aid for Scientific Research (B) : Suzuki Shigehiko : Evaluation of the durability of wood based panels from outdoor exposure
- Grants-in-Aid for Scientific Research (C) : Umemura Kenji : Development of high-performance adhesive without using fossil resources
- Global COE Program : Sugihara Kaoru : In Search of Sustainable Humanosphere in Africa and Asia
- Grant-in-aid for Scientific Research : Kozan Osamu : Impact Assessment of Large-scale Plantation Forest in Peat Swamp area

2. Other Research Grants

- NEDO Young Researcher Grant : Murata, Koji : Development of environmentally friendly high performance engineered wood and its evaluation system.
- Grants-in-Aid from Tostem Building Material Industry Funding : Kawai Shuichi : Fundamental and applied research on air purification of sugi timber.

A-4. International cooperation and overseas activities

Membership in academic societies

- Kawai Shuichi: International Academy of Wood Science (Fellow), Forest Product Society (Member)

International meetings(country,roles)

- Kawai Shuichi : Kyoto University Forum (Bandung, Indonesia) :Lecturer
- Umemura, Kenji : The Third Asian Conference on Adhesion. Hamamatsu, Japan (Member of program board)

International joint research, overseas research surveys

- Evaluation of biomass growth in acacia plantation forest in South Sumatra, Kawai Shuichi, (Indonesia)
- Research and Development for Non-wood Lignocellulosic Materials (China)
- Evaluation of biomass growth in acacia hybrid plantation forest in Kalimantan, Kawai Shuichi, (Malaysia)
- Investigation of the vegetation and biomass in Riau Biosphere, Kawai Shuichi, (Indonesia)
- Research survey of wood industries using Acacia mangium and Oil Palm wood, Umemura Kenji, (Malaysia)

Visiting Research Scholars

- Guest Scholar 1 (China)
- Guest Research Associate 1 (China)

B. Educational Activities(2009.4-2010.3)

B-1. On-campus teaching

a) Courses given

- Undergraduate level: Wood Composites (Kawai, Yano),
Science for Sustainable Humanosphere (Kawai)

- Graduate level : Seminar in Sustainable Materials (Kawai, Umemura).
 Laboratory Course of Sustainable Materials (Kawai, Umemura).
 Sustainable Materials I (Kawai)
 Lecture of Kyoto Sustainable Initiative (Kawai)

B-2.Off-campus teaching etc.

Open lectures, etc.

- Umemura, Kenji: Wood Science Seminar, The Kansai branch of the Wood Technological Association of Japan, Lecturer
- Umemura, Kenji: 26th Wood-based boards and Wood-based Composites Symposium, The Kansai branch of the Wood Technological Association of Japan, Lecturer
- Umemura, Kenji: New Technology Presentation Meetings, Japan Science and Technology Agency, Lecturer
- Kawai Shuichi: Seminar of the Forum on Green, Habitat, and Environment (Lecturer)
- Kawai Shuichi: Seminar of Kyoto Prefectural Forestry Association (Lecturer)
- Kawai Shuichi: NPO Sainoki Talk Cafe (Lecturer)
- Kawai Shuichi: Third Nagoya International Forum (Coordinator)
- Kawai Shuichi: G-COE Paradigm Seminar (Lecturer)
- Kawai Shuichi: Seminar on Utilizing the Domestic Wood, Lecturer
- Kawai Shuichi: The 30th Seminar on the Medical Science for Human Residence, Lecturer
- Kawai Shuichi: Seminar on the Child Environment (Minoo, Osaka), Lecturer
- Kawai Shuichi: Seminar of Forest School in Nishi-Awakura Village, Lecturer
- Kawai Shuichi: Seminar of Kyoto Wood Manufacturer's Association, Lecturer

B-3.Overseas teaching

International students

- International students : Doctoral 1 (Indonesia)

Lectures and seminars

- Kawai Shuichi

 Humansphere Science School(Lecturer) : Research Institute for Sustainable Humansphere,
 Kyoto University(Indonesia)

C.Other Remarks

- Kawai Shuichi : Director of the Research Inst. for Sustainable Humansphere, , Member of education and research council, Kyoto Univ.,, Councilor of Forest Management of Kyoto Prefecture, Adviser of Okayama Pref. Wood Technology Center, Sub-committee member of JSPS Grant-in-Aid Committee, Vice-President of Kyoto University, Part-time Researcher of Architectural Research Association