# 2.2.16 Laboratory : Laboratory of Active Bio-based Materials

Member:	Professor	Yano, Hiroyuki
	Associate Professor	Morooka, Toshiro, Tanaka, Fumio
	Doctor's program	1
	Master's Program	4
	Post-Doctoral fellow	8
	Program-Specific Researcher	2
	Researcher	4

# A. Research Activities (2009.4-2010.3)

# A-1. Main Subjects

a) Production and Structurai Analysis on Cellulose Nanofibers

Extraction of cellulose nanofibers from wood, pulp, agricultural waste and their nano to micro strucrure has been studied.

b) Development of cellulose nanocomposites

Production processes of high strength cellulose nanocomposites for automotive parts and optically transparent cellulose nanocomposites for electronic devises have been studied.

c) Investigation of the moisture adsorption properties of wood and related materials

To understand physical properties of wood in a wet state above 100C, its moisture adsorption properties at high temperature above 100C has been studied.

d) Studies on house climate

Regulation mechanism of temperature and humidity in wooden house is investigated.

e) Molecular design of high-performance polysaccharides

New high-performance materials based on polysaccharide derivatives are designed using molecular simulation technique

# **A-2.Publications and presentations**

a) Publications

<u>Books</u>

- Yano, H, Nakagaito, AN, Abe, K, Nogi, M, Production of cellulose nanofibers and their utilizations., Recent research on wood-based organic resources **I**, Funaoka, M ed, CMC Publishing, Tokyo, 183-190, 2009

- Yano, H, Nakagaito, AN, Abe, K, Nogi M, Production of bio-nanofibers and their applications, Plastic Age Encyclopedia Advanced 2010, Plastic Age Encyclopedia Advanced Editorial Board 2010, Plastic Age, Tokyo, 73-80, 2009

- Yano, H, Abe, K, Kobayashi, Y, Nogi, M, Cellulose nanofibers substrates. Recent technology of printed electronics devises , Suganuma, K ed, CMC Publishing, Tokyo, 93-97, 2010

# **Original Papers**

- Nakagaito, AN, Fujimura, A, Sakai, T, Hama, Y, Yano, H, Production of microfibrillated cellulose (MFC)-reinforced polylactic acid (PLA) nanocomposites from sheets obtained by a papermaking-like process, Composites Science and Technology, 69, 7-8, 1293-1297, 2009

 Nogi, M, Yano, H, Optically transparent nanofiber sheets by deposition of transparent materials – A concept for a roll-to-roll processing –, Applied Physics Letters, 94, 233117, 2009

- Quero, F, Nogi, M, Yano, H, Abdulsalami, K, Holmes, SM, Sakakini, BH, Eichhorn, SJ, Optimization of the mechanical performance of bacterial cellulose/poly(L-lactic) acid composites, ACS Applied Materials & Interfaces, 2, 1, 321-330, 2010

- Abe, K, Yano, H, Comparison of the characteristics of cellulose microfibril aggregates of wood, rice straw and potato tuber, Cellulose, 16, 6, 1017-1023, 2009

- Abe, K, Nakatsubo, F, Yano, H, High-strength nanocomposites based on fibrillated chemi-thermomechanical pulp, Composites Science and Technology, 69, 14, 2434-2437, 2009

- Abe, K, Yano, H, Bamboo, Comparison of the characteristics of cellulose microfibril aggregates isolated from fiber and parenchyma cells of Moso bamboo (Phyllostachys pubescens), Cellulose, 17, 2, 271-277, 2010

- Ishikura, Y, Abe, K, Yano, H, Bending properties and cell wall structure of alkali-treated wood, Cellulose, 17, 1, 47-55, 2010

- Ifuku, S, Nogi, M, Yoshioka, M, Morimoto, M, Yano, H, Saimoto, H, Fibrillation of dried chitin into 10-20 nm nanofibers by a simple method under acidic conditions, Carbohydrate Polymers, 81, 134-139, 2010

 Ifuku, S, Tsuji, M, Morimoto, M, Saimoto, H, Yano, H, Synthesis of silver nanoparticles templated by TEMPO-mediated oxidized bacterial cellulose nanofibers, Biomacromolecules, 10, 2714–2717, 2009 Ifuku, S, Nogi, M, Abe, K, Yoshioka, M, Morimoto, M, Saimoto, H, Yano, H,
 Preparation of Chitin Nanofibers with a Uniform Width as α-Chitin from Crab Shells,
 Biomacromolecules 10, 1584–1588, 2009

- Shams, MI, Yano, H, Compressive deformation of phenol formaldehyde (PF) resin impregnated wood related to the molecular weight of resin, Wood Science and Technology, Published online, 4th March, 2010

- Ifuku, S, Nogi, M, Yoshioka, M, Morimoto, M, Saimoto, H, Yano, H, Simple preparation method of chitin nanofibers with a uniform width of 10 to 20 nm from prawn shell under the neutral conditions, Carbohydrate Polymers, in press.

### <u>Reviews</u>

- Nogi, M, Yano, H, 21st century paper - optically transparent low thermal expansion materials based on cellulose nanofibers, J. Jpn. Soc. Colour Mater., 82, 351-356, 2009

- Eichhorn, SJ, Dufresne, A, Aranguren, M, Marcovich, NE, Capadona, JR, Rowan, SJ, Weder, C, Thielemans, W, Roman, M, Renneckar, S, Gindl, W, Veigel, S, Keckes, J, Yano, H, Abe, K, Nogi, M, Nakagaito, AN, Mangalam, A, Simonsen, J, Benight, AS, Bismarck, A, Berglund, LA, Peijs, T, Current international research into cellulose nanofibers and nanocomposites, J. Mater. Sci., 45, 1-33, 2010

- Nakagaito, AN, Nogi, M, Yano, H, Displays from transparent films of natural nanofibers, MRS Bulletin, 35(3), 214-218, 2010

- Nogi, M, Iwamoto, S, Abe, K, Yano, H, Foldable "Glass" prepared from cellulose nanofibers, New Glass, 25(1), 12-15, 2010

- Nogi, M, Abe, K, Iwamoto, S, Yano, H, Recent reseach on bionanofiber based optically transparent materials. Web Journal, 102, 28-30, 2009

- Yano, H, Production of cellulose nanofibers and their utilizations, Wood Machinery, 210, 9-12, 2010

#### Reports

- Tanaka, F, Molecular Simulation of Biopolymers- Estimation of the Elastic Modulus of Natural Cellulose Cristal-, Bulletin of the Supercomputer Laboratory, Institute for Chemical Research, Kyoto University, p.90-91, 2010

Nogi, M, Nakagaito, AN, Yano, H, Transparent nanofiber paper -21st century paper-,
 Sustainable Humanosphere, Bulletin of research institute for sustainable humanosphere,
 Kyoto University, No.5, 7, ISSN 1880-6503, 2009

# Patents

- Submitted patent: 10. The title and contents of patents can not be disclosed because of on-going projects.

b) Conference and seminar papers presented

- 16th Annual meeting of cellulose society of Japan (5 presentations, Yano, H, Tanaka, F)

- 17 th Symposiumu of Filler Society of Japan (1 presentation, Yano, H)

- The 7th Annual Meeting of WCRS (Wood Carbonization Research Society) (1 presentation, Yano, H)

- The 60th Annual Meetings of the JWRS (8 presentations, Yano, H)

- 58th SPSJ (The Society of Polymer Science, Japan) Annual Meeting (2 presentations, Yano, H)

- 58th Symposium on Macromolecules (2 presentations, Yano, H)

- Annual Meeting of the Chemical Society of Japan West 2009(1 presentation, Yano, H)

- 23rd Japanese Chitin and Chitosan Annual Meeting (1 presentation, Yano, H)

- American Chemical Society Spring 2010 National Meeting (1 presentation, Morooka, T)

- 11th Pacific Polymer Conference (1 presentation, Yano, H)

- The 11th International Conference on Chitin and Chitosan & The 8th Asia-Pacific chitin and Chitosan Symposium (3 presentations, Yano, H)

- 10th International Conference on Wood & Biofiber Plastic Composites and Cellulose Nanocomposites Symposium (1 presentation, Yano, H)

### A-3.Off-campus activities

Membership in academic societies

- Yano, H : Member of The Japan Wood Research Society (Councilor), Member of The Society of Materials Science (Reviewer), Member of The Wood Technological Association of Japan (Kansan branchi committee member), Member of the Cellulose Society of Japan, Member of The Chemical Society of Japan

Morooka, T : Member of The Japan Wood Research Society (Reviewer), Member of The Society of Materials Science, Japan (Reviewer), Member of the Society of Rheology, Japan
Tanaka, F : Member of The Society of Polymer Science, Japan, Member of The Society of Fiber Science and Technology, Japan, Member of he Crystallographic Society of Japan, Member of Society of Computer Chemistry, Japan, Member of The Japanese Society of Carbohydrate Research, Member of The Cellulose Society of Japan, Member of The Society

# of Cyclodextrins, Japan

# Research grants

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

- Grant-in-aid for Scientific Research (B) : Yano, H : Fundmental study for the extraction of uniform nanofibers from plant resources

- Grant-in-aid for JSPS postdoctoral fellowship for Foregin Researches : Yano, H : Selective densification of wood composites

- Grant-in-aid for JSPS postdoctoral fellowship for Foregin Researches : Yano, H : Effect of hemicelluloses content on the viscoelastic properties of nanofiber sheets

2. Other Research Grants

- Funding for the practical application of the university outcomes, NEDO: Yano, H: Development of the technology for the production of modified bio-nanofibers and their utilization,

# A-4.International cooperation and overseas activities

# International meetings(country,roles)

- Yano, H: Yoshida, N, Nakatsubo, F, Abe, K, Yano, H, Chemical surface-modification of cellulose nanofibers in cellulose-compatible solvents, 239th ACS National Meeting & Exposition, San Francisco, 2010/3/24 (Invited Speaker), Nakagaito, AN, Yano, H, Cellulose nanofibers and related nanocomposites, 10th International Conference on Wood & Biofiber Plastic Composites and Cellulose Nanocomposites Symposium, Madison, Wisconsin, USA, 2009/5/11-13 (Invited Speaker)

# Visiting Research Scholars

- JSPS postdoctoral fellow 1 (Bangladesh)
- JSPS postdoctoral fellow 1 (Czech Republic)
- Invited foreign researcher 1 (China)

# B.Educational Activities(2009.4-2010.3)

# **B-1.On-campus teaching**

a) Courses given

- Undergraduate level: Wood Composite Products (Yano)

 Graduate level: Bio-based Materials Physics II (Yano, Morooka, Tanaka), Seminar in Bio-based Materials Physics (Yano, Morooka, Tanaka), Laboratory course in Bio-based Materials Science (Yano, Morooka, Tanaka), Science for Creative Research and Development of Humanosphere (Yano et al)

### **B-2.Off-campus teaching etc.**

### Part-time lecturer

- Yano, H: Tokyo University of Agriculture and Technology

#### Open lectures, etc.

- Yano, H: 28th Polymer science research group seminar (Lecturer), Japan Images Research Society symposium (Lecturer), 12th SPS symposium, 25th Space structures and materials symposium (Lecturer), 272th Japan Material Research Society Wood-based materials group meeting (Lecturer), 8th Nanotechnology Symposium(Lecturer), The 60th Annual Meetings of the JWRS special organized session (Lecturer), 15th microsymposium of Japan Cellulose Research Society (Lecturer), Seminar of Japan Adhesives Research Society (Lecturer), Photonics Industry Association, Photonics technology research group meeting (Lecturer), Seminar of electronic devises assembly reserach group (Lecturer), Monthly seminar of the society of rubber industry (Lecturer), H21 RISH open seminar (Lecturer), 144th RISH Symposium(Lecturer), 145th RISH Symposium(Lecturer), H21 2nd meeting of bio-based products group in chuubu area (Lecturer), Meeting of study group of cellulosic fine powder (Lecturer), New industrial materials seminar (Lecturer), H21 meeting of inustrial technology promoting group, nanotechnology and advanced materials branch (Lecturer), Japan bio-plastic association, technical stuff meeting (Lecturer)

- Tanaka, F: H21 RISH open seminar (Lecturer)

#### **B-3.**Overseas teaching

#### International students

- International students : Doctral 1 (Indonesia)

Lectures and seminars

- Yano, H.

Mechanical properties of wood at high temperature above 100C in the wet condition(Lecturer) : Royal Institute of Technology (KTH)(Sweden)