

International Newsletter

Wood Research Institute



Kyoto University, Japan



More International Cooperative Works for the Sustainable Utilization of Ligno-Cellulosic Resources

Shuichi Kawai

The Chair of the Committee of the International Academic Exchange, WRI, Kyoto University

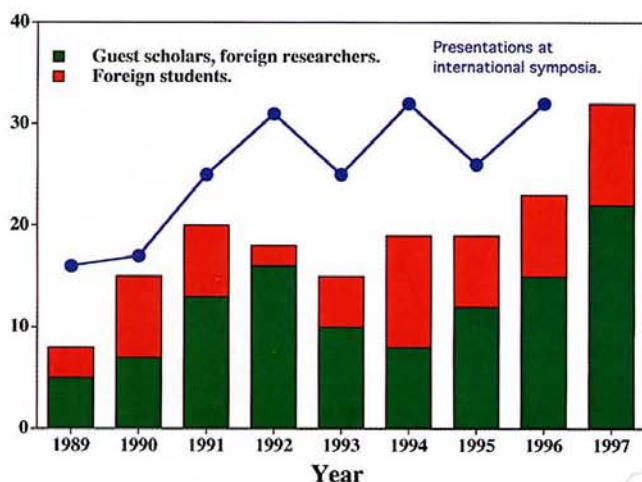
Since ligno-cellulosic resource is a bio-resource which should be developed in harmony with both sustainable utilization and environmental conservation from the global point of view, the international cooperative research programs are getting an increase of importance in the field of wood science and technology in recent years. Wood Research Institute (WRI)

has encouraged the various academic activities for promoting international cooperation.

For examples, WRI staff members gave 32 presentations in international conferences and 13 seminars and lectures at foreign research organizations, and carried out 22 overseas investigations and cooperation programs in 1996. WRI

organizes the international seminars and work shops and often opens the seminars for visiting scientists to exchange the up-to-date academic information. WRI has received an increasing number of graduate students, research fellows and guest scholars from various countries, as shown in the figure.

In 1996, the core university program of the Japan Society for the Promotion Science between Japan and Indonesia in the field of wood science started. This program followed the 12 years cooperative research program between WRI, Kyoto University, Japan and R & D Centre for Applied Physics, LIPI, Indonesia. At present, total of 30 Japanese and Indonesian research organizations and ca. 150 researchers



Increment of international academic activities of WRI (1989-1997)



Dr. Imamura, Dr. Kawai, Dr. Shimada, Dr. Kuwahara, and Mr. Subyakto (from right) discussing the cooperative program at Serpong

have participated in this core university program.

Growing the requirements of such international cooperation accelerates more systematic movements in academic activities resulting in the exchange of the Memorandum of Understandings between WRI and four

research organizations in China, New Zealand, Canada, and France.

Since eco-systems are getting more complex, science and technology in various fields must be linked together to solve the regional and global problems. The future international cooperative activities will cover wider

geographical regions and wider research fields in relation to wood science. Hopefully, such international cooperative works as the core university program will be expanded in east Asia in near future with more intensive and extensive networks of these fields.

My Experience and Expression During Stay in Japan for Three Months

Bambang Subiyanto

R & D Centre for Applied Physics, Indonesian Institute of Sciences (LIPI)

I stayed in Japan from 1st September 1997 to 29th November 1997 for doing research in the topic of production technology of oil palm cement bonded particleboard.

This major research divided into three parts of research works such as:

1. The basic research on hydration reaction of cement paste mixture with fronds and EFB using data logger.
2. The production technology of cement bonded particleboard from fronds and EFB using conventional system.
3. The basic research on hydration reaction of cement paste mixture with fronds and EFB using DSC.

Besides doing research, I had a chance to visit a university, institutes and a wood based industry, namely:

1. Shizuoka University

Prof. S. Yoshida, Prof. K. Taki and some related students in the field of wood science from Faculty of Agriculture were our host scientists in Shizuoka University. They received us with their kind hospitality, explained and discussed with us about their research activities and existing facilities. At that occasion, possibilities on future joint research also being discussed, especially in the research work of utilization of bamboo as a raw material for fiberboard.

2. Noda Gohan Cooperation

In Shizuoka, beside visiting Shizuoka University we also had a chance to visit Noda Gohan Cooperation which produces plywood and fiberboard. Related staffs accompanied us to see around the factory facilities for production of plywood, soft board, medium density fiberboard and hard board.

3. National Institute of Materials and Chemical Research

Dr. C. Nagasawa, Dr. S. Terauchi and other related researchers explained about their research activities and showed me the available facilities in the laboratory, especially those which related with wood and wood based materials science and technology.

4. Building Research Institute

Dr. Masatoshi Sato and Dr. S. Nakajima explained about the research activities in BRI especially those related to wood and wood based building materials. Large scale structural testing equipment as well as weathering testing facilities and others were shown either.

5. Forestry and Forest Product Research Institute

In the Forestry and Forest Product Research Institute, I met Dr. T. Hayashi, Mr. Y. Miyatake and Mr. T. Tanaka. I had a chance to see research activities and facilities, especially testing new timber frame house for improving the standard of timber building. The existing standard system which applied and possibilities of future research program in the field of wood grading was discussed.

6. Institute of Wood Technology, Akita Prefecture College of Agriculture

Many professors and senior researchers accepted me and showed me recent research activities on composite materials.

In the end of my staying in Japan, I had a chance to participate in the meeting of representatives from the cooperative universities in Japanese side. It was a great opportunity for me, because such meeting was first time for me. In my opinion, meeting and discussion were very useful for the improvement of the joint research between Japan and Indonesia.



Dr. Bambang Subiyanto

My impression to the science and technology development in Japan is that in almost all fields of science and technology, research and development seem in advanced state as shown by the activities conducted and facilities provided. It is also shown through the academic activity conducted in each field such as annual meetings, seminars and workshops. Also activities of joint research between research institution and private company are going very well. References as the resource for the development of science also available in the laboratory and in the library respectively.

In the field of wood science and technology itself, I am also impressed by the development of the state of science. Limited natural resources of timber have urged the people and government to develop new technology and improve existing one to be more efficient. The development of any technology, of course, should be supported by the development of science. In Japan, research activities as media for the development of science and technology have being established and developed well.

With this Core University Program sponsored by JSPS I hope this cooperation will assist the development of scientific and technical capacity of the Indonesian side through the upgrading human resources and knowledge, to promote the wood research activities in Indonesia, especially through establishment of Indonesian Wood Research Society, to strengthen the relationship between the

institutions involved in the joint activities, and, moreover, to develop good understanding and friendship between scientific communities of wood materials science and technology in Japan and Indonesia.

Finally, I would like to thank JSPS for sponsoring me to visit Japan, giving me an opportunity to brush up my knowledge which I need for my

profession as a researcher in the development of building materials especially in the field of wood and wood based materials.

I would like to express my special gratitude to Prof. S. Kawai as my host scientist who always assists me through their invaluable guidance in the research works and also takes care of me during my staying in Japan. I

would also like to express my gratitude to Dr. T. Hata and Dr. Umemura who assist me in research work activities. My further thank is extended to Prof. Kuwahara as the Coordinator of JSPS Core University Program and the Director of Wood Research Institute, Kyoto University.

My Sketch for Travel in Bogor and East Kalimantan

Tadashi Nobuchi, Kyoto University

When I was informed to be one of the visiting scientists under JSPS program, I decided to select two places to visit, Bogor and East Kalimantan. This was because there are many institutes in Bogor including Bogor Agricultural University, and Kalimantan is one of the best places to observe forests not only of Indonesia but also of the world.

I arrived at the Soekarno Hatta Airport in the evening. Dr. Wasrin SYAFII who was my counterpart picked me up at the Airport and we left for Bogor. The silhouette of coconut palms could be faintly seen in the dark and warm wind characterized the tropical country.

Bogor was a place I had so much wished to visit. In addition to having very famous Botanical Garden, many Indonesian students who were in my Faculty told me how attractive Bogor city is. Actually I realized that Bogor is a fascinating place having lovely houses with colonial style roof whose color matches very well with the surrounding greenery. I could not see any tall buildings, which accelerated my impression that the whole city is like a park. It was quite natural that many eco-tourists visited Bogor.

I visited some institutes in and around Bogor. It was, I thought, quite reasonable that many institutes including CIFOR (Center for International Forestry Research) were located there because of its moderate distance from the Capital Jakarta.

Having natural forests and plantation areas not only of fast growing tree species but also of high grade species such as Teak and Meranti, Bogor is considered to be a key place for the future research activities of JSPS project.

In Kalimantan I got to know how severe the forest fire problem was. The

whole city of Samarinda was hidden in a thick haze. In the campus of Mulawarman University, buildings some hundreds of meters ahead could only be dimly seen. Although the scenery that I saw was like a monochrome film, I quite recognized that Samarinda was the city closely associated with the forests of Kalimantan. The largest river in Kalimantan -Mahakam-, many log ponds, raft of logs, sawmills, etc., characterized Samarinda.

In Mulawarman University, I was very much impressed with the long-term research of monitoring tree growth which is being carried out under JICA project. I desire to visit this place again for my own research.

The final place of the visit was Tarakan which is located in the eastern end of Kalimantan and is bordered in the north by Malaysia. I visited one wood manufacturing factory which produces plywood, block board, etc. using timbers from natural forests. The tendency that the diameter of logs is getting decreased clearly reveals the

present situation and problem of Kalimantan forests.

From my experiences I have strongly recognized the importance of forestry and forest products research and decided to continue my study of tropical trees and woods. Finally I would like to express my sincere thanks and appreciation to the authorities in both Japan and Indonesia who gave me the opportunity to visit Indonesia.



Meranti plantation in the suburbs of Bogor



Areas of forest burnt for shifting cultivation (near Bukit Soeharto)

"Sambal" Syndrome

Ryo Funada, Hokkaido University

In last October, I had an opportunity to participate in the JSPS Core University Program (Scientist Exchange) between WRI and LIPI. I visited Indonesia with Prof. I. Furukawa, Tottori University and Prof. N. Yoshizawa, Utsunomiya University. Our research subject was "Studies on the periodicity of xylem growth in tropical trees". Prof. T. Furuno, Shimane University, also visited together as the different research subject "Wood quality and utilization of fast growing tropical trees". I regret that Prof. T. Itoh, Kyoto University, could not visit there together this time.

During the stay for 12 days in Indonesia, we visited many research places to know scientific activities, for instance, R & D Centre for Applied Physics in Serpong, PPP Biotech Centre in Serpong, Forest Products and Socio Economics Research and Development

Centre in Bogor, R & D Centre for Biology in Bogor, Bogor Agricultural University, Indonesian Biotechnology Research Institute for Estate Crops in Bogor, Bogor Botanical Garden in Bogor and Cibodas, Gadjah Mada University, Gadjah Mada University Experimental Forest in Wanagama. At each of places, we could carry out valuable discussion concerning the current research on wood science in Indonesia and Japan. We also discussed a possibility of future cooperative research. More detailed investigation on growth and wood quality of fast growing trees and non-utilized or lesser-utilized trees might be needed. We are planning to do new wood biological projects.

Our main purpose was to study the periodicity of radial increments in tropical trees. Ten planted *Paraserianthes falcataria* (Sengon)

trees growing at private forest in the suburb of Yogyakarta were selected for investigation. *Paraserianthes falcataria* is one of fast growing trees in Indonesia. We started to measure the periodical radial growth of stems with a dendrometer. In addition, we began to apply the pin marking method to investigate the precise process of xylem growth. To know the detailed information on radial growth in tropical trees, we need the continuous cooperation with Indonesian staffs for several years. During the stay in Indonesia, we had no rain. All of trees were waiting for coming wet season.

I was impressed by the Experimental Forest of Gajah Mada University in Wanagama, which is located about 35 km south-east of the main campus of University in Yogyakarta. This forest is a suitable model to see the sustainable development of environmentally fragile areas. We heard about that many guests, including Prince Charles, visited there. Also, it is a field work center for the establishment of agro-forestry. We could see many planted trees such as *Tectona* and *Acacia* among crop fields. The agro-forestry is one of better system to be stable supply of not only food but also fuel, timber and wood products.

Finally, I would like to express my sincere thanks to all of the people whom I met in Indonesia. I had a very good time. I do really appreciate our counterparts, Dr. Sri Nugroho Marsoem, Gadjah Mada University and Dr. Edi Suhaimi Bakar, Bogor Agricultural University and also Mrs. Yanni Sudiyani, LIPI in Serpong and Mrs. Ninik Setyowati and Mrs. Nurul Sumiasri, LIPI in Bogor. I very much look forward to visiting again beautiful country with excellent foods (Nasi Goreng, Soto Ayam, Bintang, Mangostine.....) and many historical places, Indonesia. I have been writing this short letter with the background music of "gamelan".



Faculty of Agriculture, Gadjah Mada University

Profiles of Ongoing Research Projects

The JSPS Core University Program between Wood Research Institute (WRI), Kyoto University and the Research and Development Centre for

Applied Physics, LIPI in the Field of Wood Science was launched in fiscal year (FY) 1996. In FY 1997, seven cooperative research projects are

ongoing under the program. Here, four of the projects are outlined by the principal investigators.

Cement Bonded Particleboard from Fast-growing Trees, Bamboo and Agro-wastes, and its Application to Housing Exterior Siding (FY 1996 - 1998)

Principal Investigators:

Shuichi KAWAI, WRI, Kyoto Univ.,
Bambang SUBIYANTO, R & D
Centre for Applied Physics, LIPI

Cooperative Researchers:

4 Japanese researchers and 5
Indonesian researchers

Purpose of Research Project

Cement bonded particleboard (CBP) will be one of the most promising wood composites in east Asia due to its excellent resistance against fire, weather, termite and fungal attacks. The product is used for siding as a substitute for bricks and concrete blocks.

The purposes of this research project are to establish the production technology of cement bonded

particleboard using fast-growing trees, bamboo and agro-wastes as raw materials supplied in local area, to investigate its resistivity against fire, fungi & termite, and weather and to investigate its applicability to the housing exterior siding.

Progress of the Research

The hydration temperature of a mixture of bamboo/oil-palm powder and ordinary Portland cement was examined. Both the compatibility factor and the inhibitory index determined from the hydration temperature vs. time curves showed the inhibitory effect of these ligno-cellulosics on the cement hydration. However, the pretreatments such as

soaking in cold-water, hot-water and a 1% NaOH solution could reduce the inhibitory effect in the hydration reaction of the bamboo-cement mixture. The addition of fortifiers such as magnesium chloride and calcium chloride improved the compatibility of bamboo/oil-palm and cement.

Cement bonded bamboo particleboard can be successfully manufactured by using some additives with both the conventional method of cold-pressing and the rapid curing method of steam-injection pressing.

Future Plan of the Research

- 1) Weatherability and the resistivity against termite and fungal attacks of CBP are to be investigated in Indonesia.
- 2) Resistivity against fire of CBP is to be evaluated.
- 3) Applicability as the exterior siding for low-cost housing is to be investigated.

Contributions

Several reports were presented in the Annual Meeting of Japan Wood Research Society, the Third Pacific Rim Bio-based Composite Symposium and the First International Wood Science Seminar. The papers were published in the proceedings of those seminars and the Journal of Japan Wood Research Society (Mokuzai Gakkaishi).

Further contributions are to be achieved in the Fourth Pacific Rim Bio-based Composite Symposium (Bogor, Indonesia, 2-5, Nov., 1998) and the Second International Wood Science Seminar (Serpong, Indonesia, 6-7, November, 1998).

(By S. Kawai)



*Bamboo-cement mat
before pressing*



*The rapid curing
method of steam-
injection pressing*

Weathering Properties of Chemically Modified Wood-based Materials from Fast-growing Trees and Agro-wastes (FY 1996 - 1998)

Principal Investigators:

Munezoh TAKAHASHI, WRI,
Kyoto Univ., **Sulaeman YUSUF**, R
& D Centre for Applied Physics,
LIPI

Cooperative Researchers:

3 Japanese researchers and 4
Indonesian researchers

For the outdoor application of wood-based materials, improvement of their weathering properties is necessary. The weathering of wood in outdoor environments occurs as a result of a complex combination of processes involving the effects of light, water, fungi, insects and airborne dirt and pollutants. While, an efficient

utilization of less or non-used lignocellulosics, such as fast-growing trees and agro-wastes, should be targeted, in consideration of saving forest resources. The purposes of this research are: i) to evaluate the weathering resistance of chemically modified wood-based materials using these raw materials in natural and artificial exposure, ii) to better understand the factors contributing to weathering properties, and iii) thereby to develop cost-competitive modified wood-based materials with superior outdoor performance.

We started from the evaluation of weathering performance of chemically modified solid wood. Modifications

were made with acetic anhydride, propylene oxide, paraformaldehyde, dimethylol dihydroxy ethyleneurea and PF-resin. Weathering properties were evaluated in weight loss, color stability, surface failure, and biological resistance after weathering. Results were discussed with SEM observation and spectroscopic analyses. Among the treatments, acetylation and PF-resin treatment were ranked better than other treatments from overall evaluation.

PF-resin-treated particleboard was selected as the test wood-based materials, because this board was able to make in one-step process by mixing the different molecular weight resins. The lower molecular weight resin was expected for property enhancement and another resin was used for glue. As raw materials, particles from three



Dr. Sulaeman Yusuf conducting weathering test at Serpong

wood species, albizzia, rubberwood and radiata pine, were used. These boards are now exposed to natural weathering at the R & D Centre for Applied Physics, Serpong, Indonesia (Photo).

Characteristics of these materials before and after weathering are now under testing. Results will be presented at the coming meetings, The Fourth Pacific-Rim Bio-based Composites Symposium, The Second JSPS/LIPI International Wood Science Seminar, and The Thirtieth Conference of the International Research Group on Wood Preservation.

(By M. Takahashi)

Fire Resistive Wood Composites from Agro-wastes and Fast-growing Trees (FY 1996 - 1997)

Principal Investigators:

Shigehisa ISHIHARA, WRI, Kyoto Univ., **SUBYAKTO**, R & D Centre for Applied Physics, LIPI

Cooperative Researchers:

2 Japanese researchers and 1 Indonesian researcher

TIME flies!

Subyakto, Anita Firmanti Lovian (Research Institute of Human Settlement) and S. Ishihara, Y. Imamura, and T. Hata did two themes of the joint research on the above titles these two years.

Development of New Fire Resistive Wood Composites using CPS (Carbon Phenolic Sphere)

CPS, developed in recent years, are the mixture of wood charcoal powder with phenolic resin. The development of this material opened the possibility to utilize wood char as a fire protection material for wood-based materials. Subyakto has investigated the anisotropy characteristic in thermal properties of CPS so that the mechanism of the anisotropy in thermal properties of the CPS would be clarified. He stayed in Wood Research Institute for 8 months from August 1997 till March 1998 as a long term foreign researcher. He has done a lot of work during the period.

Production and Fire Retardant Performance of Cement Bonded Particleboards and Other Wood-based Materials

Anita had done two studies during her staying in Japan for two months from 1 September till 30 October 1997. She produced particleboards and CBP (cement bonded particle boards) in various densities and thickness. She

had also tested fire retardant performance of CBP and other wood-based materials through new fire resistant testing method for boards. Her characteristic is bright and her way of life is very positive. She will surely make a success in the joint research in near future.

The Fruits in Two Years (Publications)

This joint research ends in March 1998 because of the retirement of the principal investigator, Prof. Ishihara. The list of the papers related to the joint research is as follows:

- 1) W. -Y. Su, Subyakto, T. Hata, Y. Imamura, S. Ishihara: Improvement of fire retardancy of strandboards and plywoods by surface treatment of melamine with boric and phosphoric acids, *3rd Pacific Rim Bio-Based*

Composites Symposium Proceedings, 193-199(1996).

- 2) W. -Y. Su, T. Hata, Subyakto, Y. Imamura, S. Ishihara: Combustion Behavior of Melamine-Boric and -Phosphoric Acids Treated Wood Using Thermographic Analysis, *First International Wood Science Seminar Proceedings*, 57- 65(1996).

- 3) Subyakto, W. -Y. Su, S. Ishihara: Mass Loss Observation of Bamboo-Particleboard and Oriented Strandboard Fire Retardant Using Cone Calorimeter, *First International Wood Science Seminar Proceedings*, 66-73(1996).

- 4) W. -Y. Su, Subyakto, M. K. Yalinkilic, T. Hata, Y. Imamura and S. Ishihara: Enhancement of Leach and Termite Resistance of Plywood Treated with Boric Compounds, *Mokuzaï Gakkaishi* 43(7), 595-601(1997).

- 5) W. -Y. Su, Subyakto, T. Hata, K. Nishimiya, Y. Imamura, and S.



Mr. Subyakto, Dr. T. Hata, Dr. Wasrin Syafii, Mr. Dede Hermawan, and Dr. Edi Suhaimi Bakar (from left) at Department of Forest Products & Technology, Faculty of Forestry, Bogor Agricultural University, Bogor

Ishihara: Improvement of Fire Retardancy of Plywood by Incorporation of Boron or Phosphate Compounds in the Glue, *J Wood Science* 44(2) (1998) (in print).

6) Subyakto, T. Kajimoto, T. Hata, S. Ishihara, S. Kawai, H. Getto: Improving Fire Endurance of Fast Growing Wood by Coating of Fire Retardant and Surface Densification, *Fire and Materials* (in submitted).

For Indonesia's Future

The two Indonesian researchers, Subyakto and Anita Firmanti Lovian, will continue to study another year in different joint research group. We hope that they enjoy the research work together with Japanese for Indonesia's brilliant future.

(By T. Hata and S. Ishihara)



Dr. T. Hata, Ms. Anita Firmanti Lovian, Mr. Maryoko Hadi (from left) at Research Institute of Human Settlement, Bandung

Growth Mechanism of Fast-growing Species in Tropical Forest (FY 1996 - 1998)

Principal Investigators:

Takashi Okuyama, Nagoya Univ., **Yusuf Sudo HADI**, Bogor Agric. Univ.

Cooperative Researchers:

2 Japanese researchers and 2 Indonesian researchers

Wood quality research contributes to the rise of added value of timber by ameliorating the technologies of the genetic improvement, silvicultural control and wood processing.

Growth stress, one of the wood characteristics, is an internal stress generated in the cell wall during the secondary growth. It reduces the timber value because of the defects at sawing like heart shake, crooking and others.

The understanding of the individual difference in the stress generation gives a target for the genetic improvement of the tree. Discerning on the effect of the growing factors, such as the growth rate, on the stress enables the improvement of the silvicultural technology, while understanding the generation mechanism of the stress in trees can improve the wood processing technologies to obtain less stresses logs.

Measurement of the growth strain *in situ* and the laboratory analysis of the wood quality factors are carried out in a perfect joint-research between IPB and Nagoya University. The species studied are *Acacia mangium*, *Paraserianthes falcataria*, *Agathis borneensis* and *Tectona grandis* in a man-made forest near Bogor, which is under Perum Perhutani management.

The tentative results up until now show that the fast growing species have high growth strain. Extremely high growth strains, approximately 4 times as high as in the normal wood, appear frequently in the region of the tension wood. In case of *Acacia mangium* heart split was observed because of the high residual stresses due to the large values of the Young's modulus. However there are no difference in the growth strains among stands with the same age and different diameter. Therefore we might be able to say that the growth stresses are not affected by the growth rate.

Picture 1 displays the growth strain measurement for *Agathis borneensis*.



Picture 1

For measuring the growth strain of the standing tree, the bark is removed to paste the strain gages around the periphery, then the surface around the strain gages is cut to release the surface stresses and finally the tree is felled. Every time we carry out the same measurement process, especially dealing with such a huge tree, I am seized with somewhat fear to act against such a beautiful creature.

Picture 2 is a strangler that kills huge tree. Its seeds are disseminated by birds and placed on the other trees. It kills the mother tree during the growing process. I hope I could measure the strangling forces of the devil species but they are protected by the people in the park. Such species could live forever without facing a killer.

(By T. Okuyama)



Picture 2

Call for Papers

The Second International Wood Science Seminar

November 6-7, 1998

R & D Centre for Applied Physics,
Indonesian Institute of Sciences
(LIPI), Puspiptek Serpong,
Indonesia

The Second Japan-Indonesia Cooperative International Seminar is scheduled to be held at R & D Centre for Applied Physics, Indonesian Institute of Sciences (LIPI), Indonesia during 6-7 November, 1998.

The R & D Centre for Applied Physics of LIPI and The Committee of International Academic Exchange of WRI are pleased to invite the members of JSPS-LIPI Core University Program to attend and participate in the seminar. The seminar is designed to provide a forum for Japanese/Indonesian researchers in the related field, together with researchers from other South-East Asian countries.

The objective of this seminar is to share the up-to-date information on the properties, processing and utilization of tropical forest resources. In the seminar, papers are presented either in a brief introductory (for about 5 min) and full presentations (for about 20 min) for the better understanding of the participants.

Those who are intending to present



papers are requested to inform the authors and the title of presentation to the organizing committee by 20 August, 1998. An abstract (for introductory presentation) or full paper (for full-paper presentation) should be submitted not later than 15 September, 1998.

The contact address:

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The Fourth Pacific Rim Bio-Based Composites Symposium

November 2-5, 1998

Bogor, Indonesia

The Fourth Pacific Rim Bio-Based Composites Symposium will be held in Bogor, Indonesia, on November 2-5, 1998. The scope of the symposium covers a wide range of topics in the bio-based composites area. The tentative topics address the following areas: properties enhancement through raw material treatment, fast growing tree species as raw material for bio-based composites, processing and products improvements, innovative and new products from lignocellulose, hybrid composites from lignocellulosic materials, and composites made from recycling materials.

Those who wish to give a presentation are invited to submit title, name and affiliation of all authors along with 300 words abstract to the Symposium Secretariat by April 1, 1998. The full paper manuscript for the proceedings should be submitted by July 1, 1998.

The contact address:

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Call for New Cooperative Research Projects

The Committee of International Academic Exchange of Wood Research Institute invites the new cooperative research projects in the fields of Wood Material Science for Sustainable Utilization of Tropical Forest Resources and of Wood Bioscience & Technology for Tropical Species under the core university program.

Those who are interested may apply by submitting the form of Project Proposal to the Committee via the Japanese principal investigators by the 20th of November, 1998. The application form may be obtained from The Committee of International Academic Exchange, Wood Research Institute, Kyoto University, Uji, Kyoto 611, Japan, or Dr. Bambang Subiyanto, Lab. of Composite Materials, R & D Centre for Applied Physics, Indonesian Institute of Sciences, Kompleks PUSPIPTEK, Serpong-Tangerang 15310, Indonesia.



The Committee of International Academic Exchange

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