

To: President, Japan Society for the Promotion of Science  
独立行政法人日本学術振興会理事長 殿

## 研究活動報告書 Research Report

1.被招へい研究者 所属・氏名 Name of Fellow, Affiliation Dr Sandrine BARDET Laboratory of Mechanics and Civil Engineering CC048 Montpellier University – CNRS 163 rue Auguste Broussonnet 34090 MONTPELLIER FRANCE
2.受入研究者 所属・職・氏名 Name of Host, Position, Affiliation Pr Hiroyuki YAMAMOTO, professor Laboratory of Wood Physics Graduate School of Bioagricultural Sciences Nagoya University Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan
3.研究テーマ Research Theme under the Fellowship Study of mechanism of hygrothermal recovery of wood
4.採用期間 Fellowship Period  2019 年 01 月 15 日 ~ 2019 年 02 月 28 日 From(Year/Month/Day) To(Year/Month/Day)
5.研究実施の状況とその成果 Research implementation and results  The viscoelastic behaviour of wood is influenced by its biologic origin. During wood maturation, various phenomena occur in the cell wall and induce maturation strains (longitudinal tension and tangential compression). The locked-in strains resulting from cell maturation and tree growth exhibit an elastic part, which is released instantaneously during cutting operations or by experimental measurements of growth stress (GS) on the periphery of trees, and a viscous part, which is released with time. By heating wet specimens, this long-term relaxation is accelerated: this is the Hygro-Thermal-Recovery (HTR) of locked-in strains. This phenomenon is of prime importance in wood industry as their instantaneous or delayed recovery can lead to dramatic defects as end splitting of logs and cracks during sawing.  During my stay in the Laboratory of Bio-Material Physics in 2016, I participated to the characterization of the relation between growth stress and HTR. Experimental analyses were conducted on specimens cut from a sugi tree in Gifu prefecture. An article about modeling HTR was achieved after my stay.  During my stay in 2019, I extended the study to the radial profile of HTR. After analysis of previous date and discussion with Pr Yamamoto and Dr Matsuo, we selected specimens in the green state from five sugi trees, which were available at the laboratory. A master course student already measured the elastic residual strains against radial position. During my

stay, I performed thermal treatment (100°C, 50 min, 2 times or 80°C, 100 min) and I measured HTR strains against radial position. Data are being analyzed but it seems that we were able to highlight a clear double-bell profile of HTR in T direction against radial position, which was never showed since Sasaki in 1983.

Two articles are in preparation: one article about experimental assessment of the influence of radial position on HTR, an other article about the influence of the microfibrils angles and the mechanisms that control the phenomenon.

During my stay, I visited Pr Obataya at Tsukuba University and we could discuss about thermal treatment, vibrational measurements and acoustic properties of wood. I was invited to a meeting at the French Embassy with Mme Sandrine Maximilien (Attaché for Science and Technology) and M. Maleval (head of CNRS Asia) to discuss about the collaboration between my laboratory (LMGC, Montpellier University, CNRS) and the laboratory of wood physics in Nagoya University. Several ways to develop the existing collaboration were presented, one of which is the opportunity to apply to the “Joint Lab” program of CNRS.

6. 受入研究者よりコメントがあれば記載してください。 Comments from Host

We have a long history of more than 25 years collaboration with the fellow's laboratory in the research topics of wood and cell wall sciences. Until now, a total of more than 20 papers and chapters have been published by the collaboration, which has played a part in the recent development of cell wall and wood physics in Japan and France. The first generation in the collaborative relationship is to retire in the next 5~8 years, and I believe the fellow Dr. Bardet will be a leader of the second generation between both laboratories, and develop new research topics of wood and cell wall sciences. During the fellow's stay in our laboratory, she has made a novel result of hygrothermal behaviors of wood that is a new and important topics of wood science and technology, with cooperation of Dr. Miyuki Matsuo who is a lecturer in my laboratory. Many of younger researchers in my laboratory received positive influence through experiments and discussions with her. This shall encourage them to be good scientists or engineers after their graduation. Thus, we deeply appreciate the JSPS Bridge Fellowship Program has given us many opportunities to deepen the relationship between both laboratories as well as developing common topics in wood and cell wall sciences.

7. 被招へい研究者よりコメントがあれば記載してください。 Comments from Fellow

The bridge fellowship gives me a very good opportunity to strengthen the scientific collaboration with the laboratory of wood physics at Nagoya University. During the first part of the stay, I had very rich discussions with Pr Yamamoto and Dr Matsuo to analyze previous data, make corrections and enhance the lacks of the previous study. Then we decided a new experimental campaign. As I already knew the experimental procedures and the device used for HTR tests, it was very efficient to carry out new experiments. Once again, I realized this stay with my daughter and family issues were easy to handle with thanks to the help of Pr Yamamoto, Dr Matsuo and also the office of gender equality of Nagoya University.

This stay is a success in a scientific point of view in the field of growth stress and hygrothermal recovery but also it opens new perspectives of collaboration, and the opportunity to apply for a joint laboratory has arisen.

注1. 本様式は受入研究者と被招へい研究者が協力して作成してください。

注2. 本様式は受入研究者より、採用期間終了後3か月以内に、電子メールにてご提出ください。

The Host is requested to make this form in cooperation with the Fellow and submit to JSPS by email within 3 months after the end of the fellowship. The form can be written either in English or in Japanese.

