

(Report 1)

FY 2010

**JAPAN SOCIETY FOR THE PROMOTION OF SCIENCE (JSPS)**  
**Report on JSPS BRIDGE Fellowship Activities**  
 by individual BRIDGE Fellows

1. Fellow's BRIDGE Fellowship ID BR100203	
2. Affiliated JSPS Alumni Association L'association des anciens boursiers francophones de la J.S.P.S.	
3. Name in Full  <div style="display: flex; justify-content: space-between; width: 100%;"> <span>FAMILY GUEGAN</span> <span>First Regis</span> <span>Middle</span> </div>	
4. Host Researcher	
Name in Full Prof. OGAWA Makoto	Affiliation Dpt of Earth Sciences, The University of Waseda, Tokyo
5. Period of BRIDGE Fellowship tenure	
From                    15 /                    08                    /                    2010 Day                    Month                    Year	To                    28                    /                    09                    /                    2010 Day                    Month                    Year
6. Mailing address	
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7. Please write on the attached form.	
8. Please write on the attached form.	
9. Please write on the attached form.	

Date: 11/11/2010NAME (Print): Guégan RégisSignature:  \_\_\_\_\_**(Notes)**

1. Please send this completed form to both JSPS's Tokyo headquarter and your affiliated alumni association within one month after finishing your tenure under the BRIDGE Fellowship.

7. Research network created, sustained and/or strengthened with Japanese researchers through your visit. (Please add lines if needed)

7-1) Research network created:

During my stay in Japan which was held from August 15<sup>th</sup> to September 28<sup>th</sup>, 2010 at the University of Waseda, Tokyo in the laboratory of Professor Ogawa, I attended to two conferences. The first, organized by JSPS and the University of Waseda on September 3<sup>rd</sup> carried out the present status and the future prospects of mesoporous materials (JSPS A3 - Japan, South Korea and China, Foresight Seminar). The second organized by the Japanese Clay Society (Asian Clay conference) was devoted to synthetic and natural lamellar materials and was held between the September 6<sup>th</sup> and on September 8<sup>th</sup> at the University of Nagoya. During these two conferences, I had the opportunity to discuss and to exchange with many senior and young emerging Japanese researchers. Thus, I could meet Dr. Yususke Yamauchi of World Premier International (WPI) of the National institute for Materials Science (NIMS) and Dr. Hirohisa Yamada of the group of research of the control of the nano-structure of the National institute for the science of the materials (Tsukuba). These two researchers work on the synthesis and the application of mesoporous materials which can be very also useful and relevant for fundamental studies of which my research is inscribed and relates to the study of the effects of confinement of complex liquids (liquid crystals, polymers) in such materials at a mesoscopic scale (2-50 nm).

Is there a possibility of the above network yielding an application for a JSPS program?

I did not have the opportunity to visit the respective laboratory of the two researchers evolving in the NIMS at Tsukuba and I think it still is too early to claim to lead a project with these actors.

If yes, please state the name of the program and researchers who may participate on both sides.

7-2) Research network sustained:

My stay in Japan, in particular between the August 15<sup>th</sup> and the August 31<sup>st</sup> was the occasion to discuss with the members of the laboratory of Professor Hajime Tanaka and more particularly Dr. P. Royall which was present at the same time. We discussed the various results obtained and more experiments are necessary to satisfy the criterion of selectivity concerning the scientific publication of the projects undertaken when I was a JSPS postdoctoral fellow.

Is there a possibility of the above network yielding an application for a JSPS program?

The projects are finished and were made perpetual by the publication of some papers. However it is difficult to foresee other activities with the group of Professor Tanaka due to the divergence of our current scientific activities.

If yes, please state the name of the program and researchers who may participate on both sides.

7-3) Research network strengthened:

Lastly, the collaboration undertaken with Professor Ogawa inscribing in the framework of the Bridge project was very prolific and very interesting from a scientific point of view as it will be more developed in the following section 8. From a human point of view, I strongly appreciated the reception, the kindness and the hospitality of the various members of the laboratory of Professor Ogawa. In the same way, I have to underline and thank Professor Ogawa for the organization of my stay in Japan and to have proposed to me the two conferences in which I attended. By the means of Prof Ogawa, I could meet Dr. Nakato from the University of Tokyo of Agriculture and Technology or Dr. Usami from Shinshu University with who it was very interesting to discuss. I had the opportunity to exchange with the former students of Prof Ogawa who now have some assistant professor positions (Dr. Okada and Dr. Ide) and Dr. Nithima Khaorapapon, confirmed researcher, who evolves now in Thailand (Khon Kaen University, Thailand) and who stayed at the same time than me at the Ogawa laboratory at the University of Waseda. Since our research fields are similar, these meetings allow us to foresee possible future collaborations and to draft innovating projects.

Is there a possibility of the above network yielding an application for a JSPS program?

Lastly, the discussions with Professor Ogawa allow defining projects on the synthesis of new mesoporous materials in geometry and porosity controlled in the form of films and a better comprehension of the effects of containment by the use of various geometries of containment (use of lamellate materials).

If yes, please state the name of the program and researchers who may participate on both sides.

Invitation Fellowship Program for Research in Japan (Short-term) or Sakura program (Egide and JSPS program for exchange of researchers)

Prof. Ogawa and his PhD students

R. Guégan, Prof. Lionel Mercury from the same institute than me

8. Results of your research and networking activities in Japan

The work conditions and the techniques present in the laboratory of Prof. Ogawa were in adequacy to carry out my research project which was related to the confinement of a thermotropic liquid crystal in porous silica films. Indeed, the range of the techniques present in the laboratory of Professor Ogawa (X-Ray Diffraction at small and big angles, infra-red and UV-Visible spectrometers, SEM...) and on the site of the University of Waseda (Nuclear Magnetic Resonance spectrometer and Raman scattering, among many others) was more than sufficient to characterize the composite materials.

The primary goal of the Bridge project was the synthesis of mesoporous silica films in collaboration with Professor Ogawa of which its knowledge to make such kind of porous material is internationally recognized [1-3]. The recent synthesis developed makes it possible to obtain mesoporous silica films on substrates of various natures. In the case of this project we selected for the substrate a mono-crystal of silicon which has the advantage of being easily identifiable by various techniques and can be use as a reference, moreover the samples are easier to handle). Although the process of synthesis is easy to implement, by this way, the maximum of thickness for the mesoporous silica films is limited to 200 nm. However, in order to identify the effects of confinement and to identify the different observable by techniques such as XRD or Raman scattering which are techniques sensitive to the amount of samples studied, it is essential to work on mesoporous films of which the thickness is close to 5  $\mu\text{m}$  (minimum thickness). Thus, most of my work was to carry out cycles of synthesis to manufacture the mesoporous films in order to obtain samples with the critical thickness. A student at the laboratory of Prof Ogawa is currently in responsibility to repeat these operations of synthesis and once the satisfied thickness of films is reached, the mesoporous silica samples will be sent to France.

In addition of this activity and after having exchanged with Professor Ogawa, we undertook to work on the intercalation of this same thermotropic liquid crystal (8CB) in organoclays (chemically modified clays which present a hydrophobic surface) which have a lamellar structure as natural clays can display. The objectives are to identify for the same liquid crystal the effects of confinement in various geometries, in one dimension (case of mesoporous silica films) and in two dimensions, by the use of lamellar materials. In addition, the effects of surface will be also studied by the modification of the chemical nature (hydrophilic and hydrophobic) of the host materials by the grafting of hexa-methyl-siloxane and surfactant for silica and clays respectively. Thus, in parallel of the synthesis of mesoporous silica films, we have studied the intercalation in various organoclays and a natural clay of reference (bentonite). The first results of XRD have showed a modification of the profile of the spectra before and after the exchange between organoclays and the 8CB. For the organoclays, whose interlayer space is strongly expanded, the 8CB intercalates and orders better the silicate layers. On the other hand, for another lamellar materials studied, the liquid crystal does not present a well affinity and cannot be intercalated in the interlayer space. The use of complementary techniques such as infra-red spectroscopy, as well as the characterization of composite materials by X-Ray scattering at small angles on synchrotron radiation is necessary to understand deeply the systems. Nevertheless, these first results are encouraging and make it possible to consider the drafting of projects aiming at reinforcing collaboration with the group of Professor Ogawa.

- [1] M. Ogawa, 'Formation of Novel Oriented Transparent Film of Layered Silica-Surfactant Nanocomposites', *J. Am. Chem. Soc.*, 116, 7941-7942 (1994).
- [2] Shimura N., Ogawa M., 'Deposition of thin mesoporous silica films on glass substrates from basic solution', *J. Colloid Interface Sci.*, 303 250-255 (2006).
- [3] Ogawa M., Shimura N., Ayrál A., 'Deposition of thin nanoporous silica layer on solid surfaces', *Chem. Mater.*, 18, 1715-1718 (2006).