

Form 7/様式7

FY 2011

(Report 1)

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

1. Fellow's BRIDGE Fellowship ID											
BR110202											
2. Affiliated JSPS Alumni Association											
JSPS French Alumni Association											
3. Name in Full											
VILQUIN				Bertrand							
FAMILY				First				Middle			
4. Host Researcher											
Name in Full								Affiliation			
YANAGIDA Takeshi								Osaka University			
5. Period of BRIDGE Fellowship tenure											
From	01		03		2012	To	01		04		2012
	Day	/	Month	/	Year		Day	/	Month	/	Year

7. Please write on the attached form.

8. Please write on the attached form.

9. Please write on the attached form.

Date: April 24, 2012

NAME (Print): Bertrand Vilquin

Signature:  \_\_\_\_\_

**(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 program.
2. The names and affiliations of Fellows and hosts and their reports may be given public access.

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

7-1) Research network created:

Following the Todai Forum held in Lyon in 2011, I visited Prof. Delaunay'lab and Prof. Tabata'lab at the University of Tokyo on March 8<sup>th</sup> and 9<sup>th</sup>. Since our research fields (oxides nano-materials) are similar, these meetings allow us to foresee possible future collaborations and to draft innovating projects, especially on ZnO films and nanowires for photonic and water splitting. We are currently looking to strengthen the contact between the University of Tokyo and the Université de Lyon by applying to collaborative programs.

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

Yes

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

Transnational Interdisciplinary G8 Program

Prof. B. MASSELLI, Dr. A. APOSTOLUK, Dr. B. VILQUIN, Université de Lyon

Prof. H. TABATA, Prof. J.J. DELAUNAY and Prof. M. OHTSU, The University of Tokyo

7-2) Research network sustained:

My stay in Japan, during the Bridge fellowship was the occasion to discuss with the members of the laboratories of Professor T. Yanagida and Professor H. Tanaka at ISIR, Osaka University. We discussed the various results obtained during the Bridge fellowship and also the research program for the JSPS Summer fellowship of one of my PhD student in July and Aug. 2012 in their labs. 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 Yanagida. In the same way, I have to underline and thank Professor Yanagida for the organization of my stay in Japan and the possibility to perform experiments and characterizations in his lab.

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

Yes

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

Already obtained a JSPS Summer Fellowship for one of my PhD student, Alexis Borowiak

Mr. A. BOROWIAK, Prof. B. GAUTIER, Dr. B. VILQUIN, Université de Lyon

Prof. H. TANAKA, Dr. T. KANKI, Osaka University

7-3) Research network strengthened:

Lastly, the collaboration undertaken with Professor Tsuda inscribing in the framework of a GCOE program was very prolific and very interesting from a scientific point of view. I had the opportunity to exchange with the PhD student of Prof. Tsuda, Mr. D. Tanaka, who visited my institute during 4 months last year. With Prof. Tsuda, we discussed about the results of D. Tanaka on photonic devices during his stay in Lyon and we decided to continue our collaboration through a SAKURA project.

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

Yes

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

JSPS-Egide SAKURA Project

Dr. P. ROJO-ROMEO, Dr. B. VILQUIN, Université de Lyon

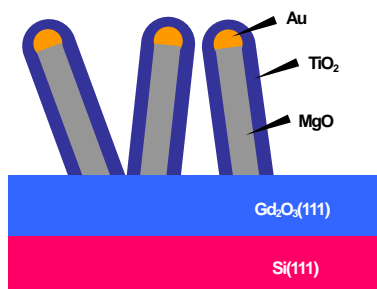
Mr. D. TANAKA, Pr. H. TSUDA, Keio University

## 8. Results of your research and networking activities in Japan

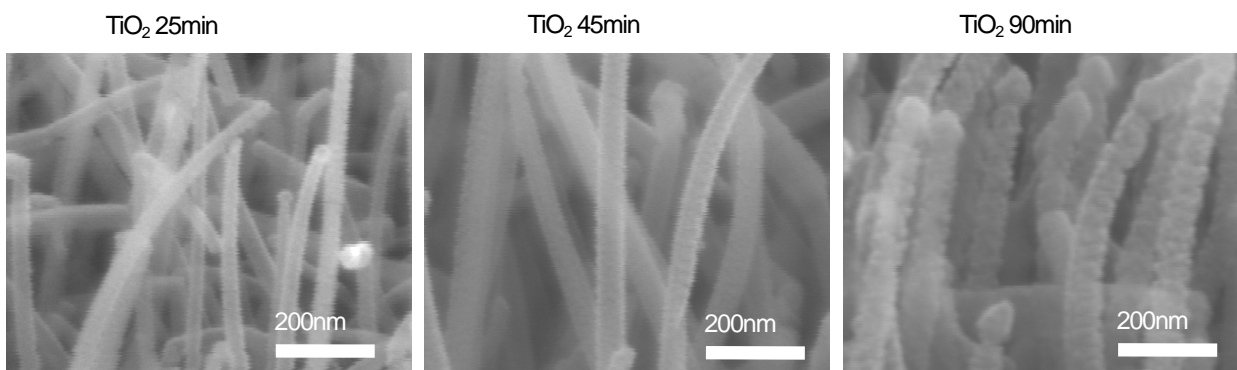
One goal of my stay in Osaka University was to realize the growth of  $\text{TiO}_2$  nanowires (NW) on silicon based wafer. The recent interest in anatase  $\text{TiO}_2$  was motivated by its key role in the injection process in a photochemical solar cell with high conversion efficiency. The optical properties based on anatase  $\text{TiO}_2$  materials have been the subject of intensive research.

My researcher host, T. Yanagida, is now well recognized for the elaboration of oxide nanowires of MgO, NiO, Indium Tin Oxide (ITO), SrO, etc. As my present lab in Lyon, Institut des Nanotechnologies de Lyon (INL) is involved in the realization of functional oxides on silicon, especially  $\text{Gd}_2\text{O}_3$  and  $\text{SrTiO}_3$  by Molecular Beam Epitaxy, one idea was to use this oxide-silicon templates to promote the integration of oxide NW on silicon.

With the members of the group of Prof. Yanagida, we did not find the growth window (substrate temperature, succeed the growth of  $\text{TiO}_2$  NW. Then we decided to prepare core-shell NW: as the group has a good knowledge of growing MgO NW, we used them as core for  $\text{TiO}_2$  around.



This approach gave very good results as it can be observe on the above SEM images.



$\text{TiO}_2$  shell layer around the MgO NW can be observed, with different thicknesses depending of the deposition time, between 25 minutes and 90 minutes. The next step is now to perform in Lyon X-Rays diffraction on theses samples to check their structural properties, i.e., the  $\text{TiO}_2$  obtained phase (anatase or rutile) and crystallographic orientations. We will also realize photoluminescence measurements under UV lamp in Lyon to determine the gap of the  $\text{TiO}_2$  (~3.3 eV) films and check the existence of defects in their structures, leading to visible emission. If such type of emission is found, these NW should be used for conversion of high-energy solar photons (UV range) into visible range photons in order to increase the performance of solar cell devices.

In France, before the JSPS Bridge fellowship, I realized the epitaxy of  $\text{VO}_2$  films on  $\text{Gd}_2\text{O}_3$ -Si(111) template. Using a prober in Yagagida's group, I realized resistance versus temperature measurements (in the range 77K-400K) of these samples and from the electrical characterizations: I found that the  $\text{VO}_2$  films have a monoclinic phase (C2/m, #12). This compound is thus named  $\text{VO}_2(\text{B})$ .

9. Contributions to networking between researchers in your alumni association's country and colleagues in Japan