NanoSquare Newsletter (English) Vol. 11

OSAKA PREFECTURE UNIVERSITY

NanoSquare Newsletter

Vol. 11 March 31, 2014

NanoSquare

公立大学法人 大阪府立大学 OSAKA PREFECTURE UNIVERSITY

Contents

Leading research from simple creativity to value creation
~Towards return of outcome of N^2 program to society~

Yoshiro AKAGI, Ph.D., Coordinator; Doctor of Science, Master of Intellectual Property,
Center for Industry, University and Government Cooperation

In this note, I express my brief comments and expectations for the leading research activities of the Tenure-Track Faculty Members (TTFMs) under the NanoSquare program (N^2 program) of Osaka Prefecture University (OPU), from the perspective of the liaison organization. We are carrying out mutual communication with TTFMs in order to acquire intellectual proprietary rights and research funds.

The NanoSquare program entered the PHASE-II stage supported by OPU in 2013. For the last five years, it is praiseworthy that three TTFMs have obtained the Young Scientists' Prize of the Commendation for Science and Technology by MEXT, and hundreds of papers by TTFMs have been published in highly-cited international journals. The external funds obtained by TTFMs in those years amounted to nearly 960 million yen, which is π(=3.14) times as much as the expenses they were provided. There are also distinguished outcomes from seven TTFMs under the PRESTO JST program (SAKIGAKE).

I have had several chances to visit universities and companies overseas after arriving at OPU as a coordinator. In the UK and the US, I was amazed that people already knew about OPU's N^2 program and the advanced scientific results carried out by the TTFMs. I recognized that OPU's N^2 program and its results are already prevalent globally.

Recently, a university could be evaluated from the perspective of both its global and regional contributions. I hope that OPU is expected to play an important role as a global leader to become a leading research university.

I started my research activities using quantum physics and chemistry to study molecular motion at the faculty of science. Along with theoretical study, I have also been asked to show experimental results at an unprecedented level. At the university where I worked, I had a chance to carry out joint research with the late Prof. Hajime KAWAMURA, who was one of the most distinguished researchers in solid state physics. He worked in the semiconductor industry as well as at Osaka University, Osaka City University, and Tokyo University, and played a vital role in fundamental research on semiconductors. I sometimes watched him traversing the boundary between the fundamental and the practical very naturally. Thus I became deeply influenced and moved to the electronics industry for the study of new devices and materials. In the industry, I was amazed and convinced that even a liquid crystal display of 100 inches was governed by the motion of the liquid crystal molecules, semiconductor lasers less than 50 microns by quantum electro-magnetism, the output design of a solar cell by the band design taking into account quantum effects, and the antigen-antibody biological reaction by the *ab-initio* quantum computing approach. Although there are plenty of devices and materials around us, they were discovered, invented and developed 40 or 50 years ago, and have already become mature commodities. Thus we should elucidate new leading research for new principles, new materials and new concepts. The time lines of fundamental research and practical application have become shortened and appear to have come together as a single line.

I sometimes have opportunities to discuss funding issues with referees, and they stress that even for a fundamental study, an applicant should have the drive for a study to play the role from planning and execution to management, showing and forecasting its outcome. I have experience in both academia and industry. I am convinced that there is essentially little difference between them from the perspective of this capability. Both academia and industry are now facing a new era of creating new value from each of the results obtained so far.

The traditional platform of a university educational system might be changing as MOOCs (Massive Open Online Courses) are prevailing globally, and new researchers and new research efforts are becoming noticeable and tangible around the world. Under these circumstances, OPU's N^2 program becomes important and is expected to play a role for an innovative leading research university. I expect OPU will contribute to returning its outcomes to society, as well as make a regional contribution, as a result of increasing its external funding and reputation.

Under the Guidelines of Assessment Criteria for Promotion to Tenure, the candidate is required to obtain competitive external funding. In this volume, some Tenure Track faculty members introduce the research that brought them large amounts of funding through “PRESTO-JST” or “Grants-in-Aid for Scientific Research”, the receiving of which is the first step to a successful career for a number of young researchers in science fields.

Dr. Yoshihiko TOGAWA

PRESTO-JST

＊ also adopted by JSPS, Grant-in-Aid for Young Scientists (A)

“Spin Phase Electronics using Chiral Magnetic Order”

FY2013-FY2016

In this project, using macroscopic order of spin phase uniquely formed in a chiral magnetic crystal, a novel research field named "Spin Phase Electronics" is exploited. By utilizing quantum phenomena and functions that emerge due to macroscopic coherence of spin phase, a basic principle such as multi-bit processing and high-speed transmission of sliding soliton will be developed for a dramatic improvement of information-processing technology. As well, a route to innovate magnetic devices for information processing using chiral magnetic order will be given.

Dr. Tomoaki NISHINO

PRESTO-JST

“Single Molecule Analyses by Intermolecular Tunneling Microscopy”

FY2007–FY2010

In this project, I developed a novel methodology to selectively visualize the chemical identities of a single molecule, which had remained unseen. This method has provided a unique means to explore single-molecule chemistry on a solid surface.

Dr. Yasuhiro SAKAMOTO

PRESTO-JST

“Direct Observation of Hereroatoms in Zeolite Frameworks and Control of their Atomic Sites”

FY2013-FY2016

In this project, I will directly image the heteroatoms in the zeolite frameworks by state-of-the-art electron microscope, and get the knowledge to control their atomic sites.

Dr. Yasushi TAKAHASHI

PRESTO-JST

＊ also adopted by JSPS, Grant-in-Aid for Young Scientists (A)

“Silicon Raman Laser using Photonic Crystal Nanocavity”

FY2009-FY2012

In this project, I have aimed to develop the Raman silicon laser using a photonic crystal high-Q nanocavity. I achieved the continuous-wave, room-temperature lasing with an unprecedented ultralow threshold of one μW adopting a unique nanocavity design.

Dr. Takuya IIDA

PRESTO-JST

“Dynamics Control of Nano-composite Materials by Designed Light Field”

FY2007-FY2010

Here, I clarified a novel principle for the bottom-up creation of photo-functional nano-composites by "optical force" & "fluctuations". Moreover, a collaborative effort with TT-FM for its experimental demonstration was accepted by Grants-in-aid for Scientific Research (B), which was developed into biological applications.

Dr. Rie MAKIURA

PRESTO-JST

“Creation of Highly Oriented Functional Molecular Films utilizing Liquid Phase Interfaces”

FY2012-FY2015

The aim of the research is to establish a molecular engineering approach to create a nano-heterojunction, which is an ideal structure for photo-electric conversion, where molecular columns of electron acceptors and donors are alternately aligned at the nanoscale.

Dr. Shiho TOKONAMI

JSPS, Grant-in-Aid for Young Scientists (A)

“Rapid and Selective Bacteria Detection using a Molecularly Imprinted Polymer Film”

FY2012-FY2014

I aim to develop a detection system enabling the identification of bacteria rapidly and directly by using a conductive polymer, not by using a marker such as a fluorescent molecule.

Dr. Shunsuke YAGI

JSPS, Grant-in-Aid for Young Scientists (A)

“Electrolytic Synthesis of Framework Structures having Conductivity of Polyvalent Cations”

FY2013-FY2014

I will establish the electrolytic synthesis of precise thin films of framework structures with micropores through the present work. Furthermore, I will try to achieve novel rechargeable batteries using polyvalent cations as carrier ions by utilizing the framework structures as solid electrolytes and/or electrode active materials.

Dr. Ikuya YAMADA

PRESTO-JST

“Development of Innovative Functions in Novel Materials containing Unusual High-Valence State Metals”

FY2011-FY2013

The objective of this project is to synthesize new transition metal oxides with unusual high-valence ions such as Fe^{4+} for the development of novel functions. A negative thermal expansion has been obtained, which is never observed in normal-valence iron oxides.

The 8th NanoSquare Café

Dr. Rie MAKIURA, The third term Tenure Track Faculty Member

Amid strong demand for the popularization of photovoltaic power generation as a clean and renewable energy source, creating high-performance energy devices which are simply generated by easily available elements and a low-energy process will certainly support a sustainable society. While Organic Photovoltaics (hereinafter OPV) brings advantages such as an affordable price, lightweight, flexibility and ease of manufacture, one of the major challenges that we face is how to improve photoelectric conversion efficiency so as to put OPV to practical use.

In my NanoSquare Café, following an explanation of the history, variety and structure of OPV, I introduced the advanced research on how to form an ideal photovoltaic device structure by structuring molecular building blocks as organic molecules. In my lab, we create nanometer-scale

thin films composed of organic molecules on a liquid surface. I let the audience observe this process and they were amazed to see how the films were shaped by adding the solution containing molecules on its surface in real time through a display monitor. After answering many questions, the NanoSquare Café ended as a great success with words of encouragement from the audience such as “I really had a great time” and “I am looking forward to your future research.”

NanoSquare Event Calendar FY2013

N2RC Seminar		
26th	April 17th, 2013	“Insights into Properties of Monolayer-Protected Gold Au25 Clusters” (including results on cells) Lecturer: Prof. Flavio MARAN (University of Padova)
27th	July 8th, 2013	“COMPLEX THERMOELECTRIC MATERIALS & Campus Life at California Institute of Technology” Lecturer: Dr. G. Jeffrey SNYDER & Mr. Masayuki OONO (California Institute of Technology)
28th	March 11th, 2014	“Material Characterization by Powder Diffraction and XAFS” Lecturer: Prof. Fujio IZUMI (Nagoya Institute of Technology) Dr. Takanori ITO (AGC SEIMI CHEMICAL CO., LTD.)
NanoSqure Café		
8th	May 22nd, 2013	“Nanoenergy Materials Created by Molecular Building Blocks” Guest Speaker: Dr. Rie MAKIURA (N2RC, Osaka Prefecture University)
9th	March 28th, 2014	“New Technology created by Nanomaterials” Guest Speaker: Dr. Shiho TOKONAMI (N2RC, Osaka Prefecture University)
NanoSquare Workshop		
7th	November 27th, 2013	Speaker: Dr. Astuko KOSUGA, Dr. Shiho TOKONAMI, Dr. Ikuya YAMADA, Dr. Ryo NOUCHI, Dr. Ikuhiko NAKASE and Dr. Hidekazu IKENO (N2RC, Osaka Prefecture University)
Open Lab at the Nanoscience and Nanotechnology Research Center		
May 25th, 2013 **November 1st, 2013** **February 3rd, 2014**	Laboratories of Tenure-Track Faculty Members at N2RC (Nakamozu Campus, Osaka Prefecture University)	

NanoSquare Newsletter Vol. 11

issued by the NanoSquare Acting Committee (March 31, 2014)

MEXT Program to Disseminate Tenure Tracking System

Contact address: The NanoSquare Office, Osaka Prefecture University

1-1 Gakuen-cho, Naka-ku, Sakai, Osaka 599-8531, Japan

Direct Phone: +81-72-254-8278 Fax: +81-72-254-7854

E-mail: nanosquare2<at>21c.osakafu-u.ac.jp