



## International Materials Institute for New Functionality in Glass SPOTLIGHT ARTICLE – Seth Berbano

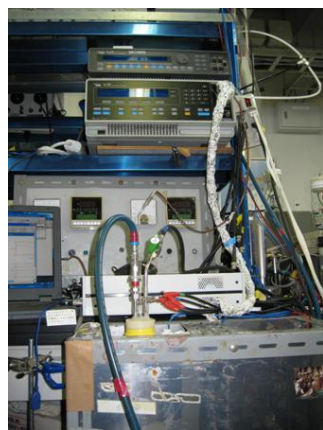
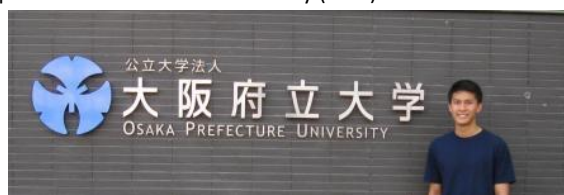


**Seth Berbano**, a Materials Engineering Junior at Iowa State University has been busy in the labs of Osaka Prefecture University (OPU) in Sakai City, Japan on a 10 week research experience (REU program) sponsored by the International Materials Institute for New Functionality in Glass. The purpose of the REU in Glass summer program is to introduce US undergraduate students, like Seth, to the opportunities in glass research through active involvement in research at a world class glass technical facility both domestic and abroad.

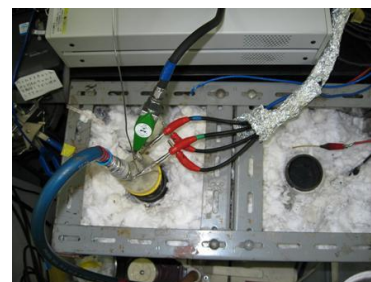
Under the expert guidance of head Professors Tatsumisago, Tadanaga and Hayashi in the Inorganic Chemistry Division of Osaka Prefecture University, Seth is investigating the effects of substituting different sulfide compounds in glass and ceramic systems. “All the laboratory members are very friendly people. They are accommodating and willing to take time to answer my questions. They are also very hard working” Seth explained.

*Left: Seth holding a conductivity cell*

The Inorganic Chemistry group at Osaka Prefecture University (OPU) is renowned for its experience and research in mechanical milling which has been highlighted in a number of papers published in *Solid State Ionics*, the *Journal of Non-Crystalline Solids* and the *Journal of Power Sources*. For those not familiar with this process, Seth described mechanical milling as the “solid-state inter-diffusion process that allows full amorphization of crystalline powders at room temperature and pressure”. Other research interests at OPU include solid electrolytes, all-solid-state batteries, proton conductors, and inorganic-organic composites.



During Seth’s time at OPU he will be involved in investigating the effects of substituting different sulfide compounds in glass and ceramic systems. “So far, I have characterized a 70 mol% lithium sulfide and 30 mol% phosphorus sulfide glass and glass ceramic by X-ray diffraction, Differential thermal analysis, Raman spectroscopy, and Impedance spectroscopy. For this particular composition, the glass ceramic has a higher ionic conductivity than the corresponding glass and crystalline states. This is because the glass ceramic contains a precipitated superionic crystal  $\text{Li}_7\text{P}_3\text{S}_{11}$  that is formed as a result of heating the glass past its crystallization temperature” Seth reported.



*(Photos Above Left: Impedance analyzer Above Right: looking at the conductivity cell and associated instrumentation)*

Seth was encouraged to share his research experience with all his group members. “I have moved on to study systems with substitutions of phosphorus sulfide with aluminum sulfide. I was able to share my progress on this glass and glass ceramic system at the research group’s monthly, Saturday seminar”.



Such meetings develop the network of international exchange even more as Seth describes the atmosphere of the lab as “truly international.” There are currently a number of students from the University of Rennes, France.

The cultural exchange experience continues outside the walls of the lab. Seth has become good friends with undergraduate student, Benoit, (*pictured left*) who is from the University of Rennes, France. “He invited me with some of his other French friends to visit Nara one weekend. Nara is a quaint town near the mountains filled with hundreds of years of Japanese history. Nara has tame deer, temples, shrines, and what seemed to be a never ending trail. It was an enjoyable weekend”.



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When asked about his life in Japan so far Seth told us “..life in Japan is different than my Iowa State University (ISU) life. To get to the OPU campus, I hop on my bike (a used one which I purchased for about \$55) and bike about 20 minutes. Biking is a popular way to get around [in Japan}. It’s not uncommon to see about 50 people on bicycles behind the train crossing near where I live. Last Sunday, I went on a biking adventure. I went from my dormitory to Namba Station (one of the famous Osaka train stations) which was about 35 km roundtrip...”

Collaboration between the OPU and Iowa State University (ISU) will not end after Seth’s 10 week International REU program. Seth explained “Minami, my primary graduate student mentor, is traveling back to Iowa State University with me. He will spend two months in our laboratory. I believe he wants to collaborate on researching different glass systems prepared by both melt-quenching and mechanical milling. I hope to help him adjust to his daily life and research [in Iowa] in the same way he has helped me”.

For Seth, this experience in Japan will be one he will never forget. He expressed “.... I am truly grateful to the program directors Prof. Jain and Prof. Pantano; and Dr. Heffner and Ms. Wing at the International Materials Institute for New Functionality in Glass for this international research experience; the students and professors of the Inorganic Chemistry group at OPU, and to Dr. Martin and my lab group at ISU.”

For the IMI, Seth’s involvement in their International REU program is an example of how the IMI has further encouraged and facilitated international collaborations with bright, young undergraduate students that will lead to the creation of new applications and opportunities for glass.