

2018 FaSTRAC Visit Summary

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Microcrystallography of tellurite- and lanthanide-based metal organic frameworks (MOFs) for development of nonlinear optical materials

I and my student, Dawanya Burgess participated the FaSTRAC program at APS in the summer of 2018. We heard this program from the Sponsor Program Office at Claflin University and applied this program online with all required application materials, including my CV, application form, and a proposal for the planned research project at APS. This our first visit to APS. As a faculty, I went to APS in July 2 and had worked in APS for 4 four weeks and my student arrived in July 16 and spent two weeks there. The objective of our visit was to learn the cutting-edge synchrotron techniques and use it to study the crystal structure of small crystals of tellurite-based and lanthanide organic frameworks non-linear optical materials. We also aimed to build up a collaboration with APS and provide research opportunities for underrepresented STEM students to learn the synchrotron X-ray techniques.

During the time in APS, we were given three eight-hour shifts and had analyzed totally 36 samples, including few data collections under low temperature (15 K) with helium gas, under the guidance of 15ID sector beamline scientists, Dr. Yusheng Chen, Dr. Grass Wang and visiting Ph.D. student Tieyan Chang. We were taught how to pick and mount small single crystals and collect crystallographic data on synchrotron facilities. We also learned how to analysis and interpret the synchrotron experimental data. Actually, we have a Bruker APEX Duo single crystal XRD in our home institution and we use it to conduct crystal structure analysis. Comparing to our in-house XRD, the synchrotron XRD is much more powerful and is perfect for analyzing small crystals (~100 micrometer) and weakly diffracted organic compounds which are difficult to be analyzed using regular XRD. Although I have several years of experience on crystallography, I am still excited about this powerful synchrotron facilities. And for my student, this is his first experience on this structural determination techniques and this will benefit to his future research work at Claflin.

Dr. Chen organized our schedules in a very efficient and flexible way. Before each experimental shift, he met with us and helped us to draft an experimental plan. He mixed our schedule with two other graduate student users, Jesse Murillo from University of Texas at El Paso, and Eric Sylvester from University of Buffalo. By doing that, we got chance to know their research projects and learn some knowledge about photo-crystallography. In addition, Dr. Chen organized several meetings for us to discuss the experimental results and a workshop to learn how to the determine crystal structure using powder XRD data.

I had a long discussion with Dr. Chen about the collaboration between Claflin and ChemMatCARS program on the research, education and training for minority students in South Carolina. We plan to build up a joint synchrotron crystallographic workshop at Claflin for STEM students from minority schools in South Carolina, including Claflin University, Benedict College, Voorhees College and South Carolina State University. As an agreement with Dr. Chen, I plan to send more students to ChemMatCARS program to conduct summer research. We will use the synchrotron crystal structure data obtained at APS to prepare peer-reviewed papers and present this work in national and/or regional conferences as oral or poster presentations.

Overall, I want to say I had a good time in APS. I learned a lots of new technology and had a lots of hands-on experience on synchrotron facilities. I would like to acknowledge the help and collaboration provided by the entire ChemMatCARS, including Dr. Binhua Lin, Dr. Yusheng Chen, Dr. Grass Wang, Dr. Wei Bu, Mr. Tieyan Chang, and Ms. Kimberly Simms, during our visit at APS.

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