

WORKSHOP #3

X-ray based technologies in emerging fuel cell research

Organizers: Vivian Stojanoff (BNL) and Narayanasami Sukumar (NECAT, Cornell University, Argonne National Laboratory)

The “X-ray based technologies in emerging fuel cell research” is a one-day workshop that aims to bring together researchers, beamline scientists, management and developers, who seek to advance fuel cell technology based on model systems such as natural photosynthesis and redox enzymes. The goal is to discuss recent advances and the current status of the various techniques used to characterize natural and artificial model systems including their limitations (both x-ray as well as non-x-ray techniques). The expectation is that participants will find an environment in which discussions allow the collaborations among researchers and those responsible for the increased understanding of new systems through the development of new techniques.

Fuel cells are essential for the creation of sustainable energy. Many scientists around the world are working to convert energy-poor molecules to energy-rich molecules using sunlight as energy source. Capture, conversion, and storage of solar energy in the form of chemical feedstocks has enormous potential to revolutionize the energy sector. One of the major areas of research focuses on the creation of artificial photosynthesis. During the natural photosynthesis pathway, plants trap solar energy to split water and convert it into oxygen and hydrogen equivalent, leading to the generation of electrons. A highly efficient and durable fuel cells based on catalysts that use more abundant natural resources and less energy will reduce our dependence on fossil fuel resources, and in turn, mitigate CO₂ emissions.

The target audience are students, post-doctoral associates and researchers from both academic and non-academic institutions doing research in fuel cells.

Start Time (EDT)	Title	Speaker (Affiliation)
8:30	Welcome	Vivian Stojanoff (NSLS II, BNL) & N Sukumar (NECAT, ANL, Cornell University)
8:45	NSLS-II tools to understand natural processes and applications in energy science	Sean McSweeney (NSLS II, BNL)
Session I	Natural and Artificial Photosynthesis	Chair Tood Deutsch
9:15	How evolution shapes photosynthetic light harvesting	Masakazu Iwai (LBL)
9:45	Photoelectrochemical materials at the synchrotron	Francesca Maria Toma (Heoron Institute, Helmholtz) - VIRTUAL
10:15	Break – GROUP PHOTO	PHOTOGRAPHER
10:45	Science Opportunities in Energy Applications with LCLS-II and LCLS-II-HE	Mathias Kling (LCLS)

11:15	Why don't plants get sunburn?	Gabriela Schlau-Cohen (MIT) - <i>VIRTUAL</i>
11:45	The role of light sources and XFELs to understand energy conversion in Photosynthesis towards bio-inspired solar fuel production	Petra Fromme (Arizona State University)
12:15	Q&A	
12:30	Lunch	
Session II	Redox enzymes as model systems	Chair Mathias Kling
1:15	Engineered Biocatalysts for Light-Driven Fuel Formation	Kara Bren (University of Rochester)
1:45	Designing artificial metalloenzymes to gain insights into how nature catalyzes oxygen reduction reaction, an essential process in fuel cells	Yi Lu (University of Texas)
2:15	MX beamlines, Copper protein and fuel cell research	Narayanasami Sukumar (Cornell University)
2:45	The catalytic activity of the archetype from group 4 of the FTR-like ferredoxin:thioredoxin reductase family is regulated by unique $S=7/2$ and $S=1/2$ $[4Fe-4S]$ clusters	Anupkumar Rai (Southern Illinois University)
3:00	Break	
Session III	Advances in renewable energy	Chair Kara Bren
3:15	Biologically Inspired Catalytic Systems for Solar-to-Fuel Technologies	Smaranda Marinescu (USC)
3:45	Uncovering degradation mechanisms in (solar)fuel-producing systems with X-ray-based characterizations	Todd Deutsch (NREL)
4:15	Using Structural Biology to support the mission of a Bio-Energy Research Center	Jose Henrique Pereira (JBEI)
4:45	Panel Discussion - Looking Forward	Chair Vivian Stojanoff
5:30	Adjourn - Poster Session @ Berkner Hall	Main Meeting