
AMLCI MATERIALS DAY 2021

MATERIALS FOR ENERGY AND SENSING

Program

Hosted by



Advanced Materials and
Liquid Crystal Institute

Co-hosted by



Environmental Science
and Design Research Initiative



ADVANCED MATERIALS AND
LIQUID CRYSTAL INSTITUTE
at Kent State University

Theme

The theme of the **2021 AMLCI Materials Day** “Materials for Energy and Sensing” recognizes the societal need for materials and methods for energy harvesting, energy storage, and energy efficiency as well as for materials and devices that can interpret cues from their environment (sensors). Topics will range from artificial photosynthesis to produce chemical fuels, fuel cells, and switchable liquid crystal devices for energy savings in buildings to toxic gas or biosensors to organic field effect transistors for medical sensor technology and much more.

Materials Day 2021 is co-hosted by the AMLCI and the Environmental Science and Design Research Initiative (ESDRI) at KSU and will focus particularly on select classes of advanced materials that are designed to have a direct and beneficial impact on our environment, our health, and our safety. In addition to these more applied aspects, **Materials Day 2021** will also feature fundamental research on how certain types of advanced materials interact with or affect their environment in new and unusual ways; interacting with biological entities, responding to exposure to light etc., which will form the basis for future energy harvesting and sensors applications.



Venues for Materials Day
2021: ↑ Virtual Meeting
access via AMLCI
FaceBook (Live Event)

Keynote Speaker

NATHAN S. LEWIS

*George L. Argyros Professor of Chemistry
California Institute of Technology*

Nathan S. Lewis, Ph.D., is the George L. Argyros Professor of Chemistry at the California Institute of Technology where he has been a faculty member since 1988. Lewis is best known for developing artificial photosynthesis technology that enables sustainable production of hydrogen fuel using sunlight, water and carbon dioxide as well as an “electronic nose” for artificial olfaction. From 2009 to 2019 he served as editor-in-chief of Energy and Environmental Science, a journal focusing on sustainable energy research, published by the Royal Society of Chemistry. He is the recipient of the Princeton Environmental Award and the American Chemical Society Award in Pure Chemistry. In 2019, he is the recipient of the Europe Section Heinz Gerischer Award for his outstanding contribution to the science of semiconductor electrochemistry and photoelectrochemistry. In 2017, Lewis was elected to the National Academy of Inventors. He holds approximately 70 U.S. and foreign patents. Lewis has authored over 500 papers and mentored more than 100 graduate students and postdoctoral researchers.



Nate Lewis (Caltech)

Time	
5:45 - 6:00 p.m.	Opening Remarks by Paul DiCorleto (VP, Research & Sponsored Programs, KSU) and Introduction of Keynote Speaker by Torsten Hegmann (Director, AMLCI, KSU)
6:00 - 7:00 p.m.	Keynote Lecture - Nathan S. Lewis (California Institute of Technology)

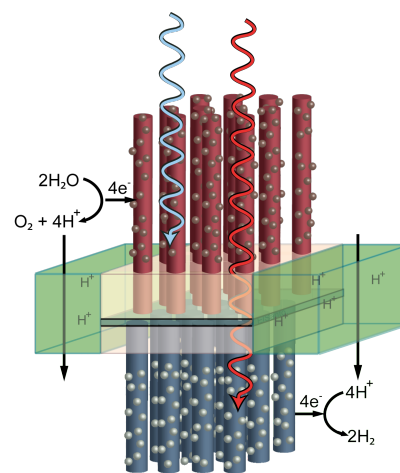
Keynote Lecture (Nathan S. LEWIS)

“Direct Production of Fuels from Sunlight by Artificial Photosynthesis”

Friday, April 9th, 6:00 p.m. (EST)

[FaceBook Live](#) (click here for access)

We are developing an artificial photosynthetic system that will utilize sunlight and water as the inputs and produce hydrogen and oxygen as the outputs. We are taking a modular, parallel development approach in which three distinct primary components—the photoanode, the photocathode, and the product-separating but ion-conducting membrane—are fabricated and optimized separately before assembly into a complete water-splitting system. The design principles incorporate two separate, photosensitive semiconductor/liquid junctions that will collectively generate the 1.7-1.9 V at open circuit necessary to support both the oxidation of H₂O (or OH⁻) and the reduction of H⁺ (or H₂O). The photoanode and photo-cathode will consist of rod-like semiconductor components, with attached heterogeneous multi-electron transfer catalysts, which are needed to drive the oxidation or reduction reactions at low overpotentials. The high aspect-ratio semiconductor rod electrode architecture allows for the use of low cost, earth abundant materials without sacrificing energy conversion efficiency due to the orthogonalization of light absorption and charge-carrier collection. Additionally, the high surface-area design of the rod-based semiconductor array electrode inherently lowers the flux of charge carriers over the rod array surface relative to the projected geometric surface of the photoelectrode, thus lowering the photocurrent density at the solid/liquid junction and thereby relaxing the demands on the activity (and cost) of any electrocatalysts. A flexible composite polymer film will allow for electron and ion conduction between the photoanode and photocathode while simultaneously preventing mixing of the gaseous products. Separate polymeric materials will be used to make electrical contact between the anode and cathode, and also to provide structural support. Interspersed patches of an ion conducting polymer will maintain charge balance between the two half-cells.



Device architecture (top) and hydrogen generation (bottom)

AMLCI Fellowships - Award Ceremony

Friday, April 9th, 7:10 p.m.

[FaceBook Live](#) (click here for access)

Glenn H. Brown Fellowship: For outstanding graduate students who are engaged in research on biological or biology related topics of liquid crystals.

Alfred Saupe Fellowship: For outstanding graduate students working on physics or material sciences of liquid crystals

James Fergason Fellowship: For outstanding graduate students working on applied research using liquid crystals.

Time	Speaker "Title"
Session Chair: Torsten Hegmann (Director, AMLCI)	
7:10 - 7:20 p.m.	Runa KOIZUMI (Winner - Glenn Brown Fellowship; <i>presented by Nancy Brown; daughter of Dr. Glenn H. Brown - Founder of the LCI</i>) TED Talk: "Using liquid crystals to control living systems"
7:25 - 7:35 p.m.	Chenrun FENG (Winner - Alfred Saupe Fellowship; <i>presented by Arne Saupe; son of Dr. Alfred Saupe</i>) TED Talk: "Electro-responsive ionic liquid crystalline elastomers"
7:40 - 7:50 p.m.	C.P. Hemantha RAJAPAKSHA (Winner - James Fergason Fellowship; <i>presented by Torsten Hegmann</i>) TED Talk: "Novel applications of liquid crystal elastomers"
8:00 p.m.	Closing Day 1

Program

Saturday, April 10th, 9:00 a.m. - noon

[FaceBook Live](#) (click here for access)

Time	Speaker (Affiliation) "Title"
<i>Session Chair: Soumya Chandrasekhar (Materials Science Graduate Program)</i>	
9:00 - 9:20 a.m.	Rui LIU (Kent State University, ESDRI) <i>"Eco-friendly construction materials developed from dredged material"</i>
9:20 - 9:40 a.m.	Yanhai DU (Kent State University, Aeronautics & Engineering, AMLCI) <i>"Supporting hydrogen economy with enabling technologies and materials"</i>
9:40 - 10:00 a.m.	Bill YU (Case Western Reserve University, Institute for Smart, Secure and Connected Systems, ISSACS) <i>"Bioinspired adaptive roof materials for energy efficient buildings"</i>
10:00 - 10:20 a.m.	Break
<i>Session Chair: Sarah Sternbach (Biomedical Sciences)</i>	
10:20 - 10:40 a.m.	John WEST (Kent State University, Chemistry & Biochemistry, AMLCI) <i>"LC clad fibers for wearable applications"</i>
10:40 - 11:00 a.m.	Nicholas L. ABBOTT (Cornell University, Member External Advisory Board AMLCI) <i>"Machine learning and liquid crystal sensors"</i>
11:00 - 11:20 a.m.	Chenhui ZHU (Lawrence Berkeley National Labs, Advanced Light Source) <i>"Advanced X-ray characterization tools for accelerated material discovery"</i>
11:20 - 11:40 a.m.	Bob TWIEG (Kent State University, Chemistry & Biochemistry, AMLCI) <i>"The influence of fluorination on mesogenic behavior"</i>
11:40 - 12-noon	Chunming LIU (University of Akron, Chemistry) <i>"Magnetic tweezers as a tool for studying single synthetic polymers"</i>

Saturday, April 10th, Noon - 1:30 p.m. (Lunch Break)

Location	
Participants	Zoom Breakout Room
AMLCI Advisory Boards	Working lunch - Zoom Breakout Room

Saturday, April 10th, 1:30 p.m. - 5:05 p.m.

[FaceBook Live](#) (click here for access)

Time	Speaker (Affiliation) "Title"
Session Chair: Timothy Ogolla (Materials Science Graduate Program)	
01:30 - 01:50 p.m.	Björn LÜSSEM (Kent State University, Physics, AMLCI) <i>"Versatile biosensors made of organic semiconductors"</i>
01:50 - 02:10 p.m.	Burcu GURKAN (Case Western Reserve University, Energy Lab) <i>"Engineering solvents for energy storage, separations and sensors"</i>
02:10 - 02:30 p.m.	Barry DUNIETZ (Kent State University, Chemistry & Biochemistry, AMLCI) <i>"Modeling photo and bias induced electron transfer and transport. An ab-initio perspective on kinetics"</i>
02:30 - 02:50 p.m.	Geneviève SAUVÉ (Case Western Reserve University, Chemistry) <i>"Developing molecular electron acceptors for organic photovoltaics"</i>
02:50 - 03:20 p.m.	Break
Session Chairs: Şenay Üstünel & C. P. Hemantha Rajapaksha (Materials Science Graduate Program)	
03:20 - 03:35 p.m.	Camilo R. PIEDRAHITA (Luxembourg Institute of Science and Technology (LIST)) <i>"Flexoelectric effect in polymer electrolytes membranes"</i>
03:35 - 03:50 p.m.	Marianne E. PRÉVÔT (Kent State University, AMLCI) <i>"Liquid crystal based zero power sensor for toxic gases and vapors"</i>
03:50 - 04:05 p.m.	Arosha C. DASSANAYAKE (Kent State University, Chemistry & Biochemistry) <i>"From bench-top to the real world: Fabrication of advanced carbon nanomaterials to meet modern industrial demands"</i>
04:05 - 04:20 p.m.	Raj Kishen RADHA KRISHNAN (Kent State University, Physics) <i>"Organic doping at ultra-low concentrations"</i>
04:20 - 04:35 p.m.	Runa KOIZUMI (Kent State University, Materials Science, AMLCI) <i>"Control of active matter by patterned liquid crystal"</i>
04:35 - 04:50 p.m.	Chung-Fu CHENG (University of Akron, Polymer Science) <i>"Nanomaterials from polymer templates for Li storage"</i>
04:50 - 05:05 p.m.	Priyanka RANA (Kent State University, Biological Sciences) <i>"Evidence for macromolecular crowding as a direct apoptotic stimulus"</i>
05:05 - 06:00 p.m.	End of Session / Break before Poster Session starting at 6:00 p.m.

Organizing Committee

Torsten HEGMANN, Director AMLCI, Department of Chemistry and Biochemistry (Chair)
Mary Ann KOPCAK, AMLCI (Secretary, Treasurer)
Jack DAUPHARS (IT Specialist)

Antal I. JÁKLI, Director CPIP, Department of Physics (Scientific Board)
Michael FISCH, AMLCI, College of Aeronautics and Engineering (Scientific Board)
Elda HEGMANN, AMLCI, Department of Biological Sciences (Scientific Board)
Hanbin MAO, AMLCI, Department of Chemistry and Biochemistry (Scientific Board)
Roberto M. URIBE, AMLCI, College of Aeronautics and Engineering (Scientific Board)
Şenay ÜSTÜNEL, Materials Science Graduate Program (Scientific Board - Graduate Student Member)
C.P. Hemantha RAJAPAKSHA, Materials Science Graduate Program (Scientific Board - Graduate Student Member)

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Advanced Materials and
Liquid Crystal Institute

Cheng CHEN



Stay Tuned for Next Year's AMLCI Materials Day (April 2022)

AMLCI MATERIALS DAY 2022

BIOLOGICAL AND BIOMIMETIC MATERIALS

Hosted by



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Liquid Crystal Institute

Co-hosted by



Brain Health
Research Institute



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