

# 2019 U.S. DEPARTMENT OF ENERGY SOLID-STATE LIGHTING R&D WORKSHOP AGENDA

January 29–31, 2019 • Dallas, TX

## TUESDAY, JANUARY 29

7:00 a.m. *Registration Opens and Continental Breakfast*

### PLENARY SESSIONS

8:00 a.m.

#### **WORKSHOP INTRODUCTION**

DAVID NEMTZOW, DIRECTOR, BUILDING TECHNOLOGIES OFFICE, U.S. DEPARTMENT OF ENERGY

#### **WORKSHOP WELCOME AND KEYNOTE**

STEVEN CHALK, DEPUTY ASSISTANT SECRETARY OF ENERGY EFFICIENCY, U.S. DEPARTMENT OF ENERGY

8:30 a.m.

#### **PLENARY 1: MATERIALS DESIGN FOR LONG-WAVELENGTH LEDs**

There has been great progress in improving efficiency in blue LEDs the past decade, though long-wavelength LEDs (green, amber, red) have not followed a similar trajectory. New materials design and selection are needed to improve LED emitters over today's efficiency levels. This talk will provide a computational viewpoint on developing new or improved emitter materials with an advanced fundamental understanding of materials-synthesis-performance relationships for LEDs.

CHRIS VAN DE WALLE, UNIVERSITY OF CALIFORNIA, SANTA BARBARA

9:15 a.m.

#### **PLENARY 2: THE PATH FOR OLEDs IN LIGHTING**

The major challenges faced in OLED lighting are stable blue emitters, efficient light extraction, and cost reduction. This talk will discuss whether these challenges can be met through extensions of current R&D, or whether radically new approaches are needed.

STEVE FORREST, UNIVERSITY OF MICHIGAN

10:00 a.m.

*Refreshment Break*

## TRACK DISCUSSIONS

10:30 a.m.

### **LED TRACK DISCUSSION I: CHIP AND MATERIALS**

Expert panel leads technical discussion on LED chip and materials advances.

MODERATOR: MONICA HANSEN, LED LIGHTING ADVISORS

BERTHOLD HAHN, OSRAM OPTO SEMICONDUCTORS

JIM SPECK, UNIVERSITY OF CALIFORNIA, SANTA BARBARA

DANIELLE CHAMBERLIN, LUMILEDS

JUANITA KURTIN, OSRAM OPTO SEMICONDUCTORS

### **OLED TRACK DISCUSSION I: MATERIALS AND STACK**

Expert panel leads technical discussion on OLED materials and stack advances.

MODERATOR: LISA PATTISON, SSLS, INC.

MARK THOMPSON, UNIVERSITY OF SOUTHERN CALIFORNIA

CHRISTIAN KASPAREK, CYNORA

BERNARD KIPPELEN, GEORGIA TECH

12:15 p.m.

*Lunch*

## TRACK DISCUSSIONS

1:15 p.m.

### **LED TRACK DISCUSSION II: EFFICACY AND LUMINANCE**

Expert panel will discuss the increasingly wide range of (high and low) luminances of interest for various applications, and routes to maintaining high efficacy over that wide range.

MODERATOR: JEFF TSAO, SANDIA NATIONAL LABORATORIES

JON WIERER, LEHIGH UNIVERSITY

WOUTER SOER, LUMILEDS

ANDY ARMSTRONG, SANDIA NATIONAL LABORATORIES

DAN FEEZELL, UNIVERSITY OF NEW MEXICO

### **OLED TRACK DISCUSSION II: LIGHT EXTRACTION**

Expert panel leads technical discussion on advances in OLED light extraction.

MODERATOR: LISA PATTISON, SSLS, INC.

STEVE FORREST, UNIVERSITY OF MICHIGAN

FRANKY SO, NORTH CAROLINA STATE UNIVERSITY

SELINA MONICKAM, PIXELLIGENT

3:00 p.m.

*Refreshment Break*

3:30–5:30 p.m. **POSTER SESSION**

Project posters will be presented by research team representatives, providing an opportunity for one-on-one discussions with SSL's leading scientists.

Columbia University	PhosphorTech
Electroninks	Pixelligent
Georgia Tech	RTI International
Hazen Research	Sandia National Laboratories
InnoSense	Sinovia Technologies
Lucent Optics	Solution Deposition Systems
Lumenari	South Dakota School of Mines and Technology
Lumileds	Tetramer Technologies
Luminit	University of California, Santa Barbara
Lumisyn	University of Michigan
National Renewable Energy Laboratory	University of New Mexico
North Carolina State University	University of Southern California
OLEDWorks	Virginia Tech
Penn State University	

**STUDENT POSTER COMPETITION WINNERS**

Caicai Zhang, University of Central Florida  
Ya Zhuo, University of Houston

**WEDNESDAY, JANUARY 30**

7:00 a.m. *Continental Breakfast*

**PLENARY SESSIONS**

8:00 a.m.

**PLENARY 3: TRENDS IN LIGHTING TECHNOLOGY AND APPLICATIONS**

LEDVANCE is a leading global supplier of LED lighting products, selling a wide range of lamps, luminaires, and smart lighting systems in over 140 countries. This talk will outline the challenges in the transformation of the global lighting industry and identify R&D opportunities to increase the benefits of solid-state lighting.

LAWRENCE LIN, LEDVANCE

8:45 a.m.

**PLENARY 4: INNOVATIONS IN SOLID-STATE LIGHTING**

The pace of innovation in today’s lighting industry shows no sign of slowing. New products with advanced features continue to broaden the appeal and energy-saving impact of SSL. As LED efficiencies continue to climb, other features including quality of light, unique spectrums, and light density continue to be important research areas. Beyond the performance levels, the lifetime of LEDs and system quality will be discussed.

ERIK SWENSON, NICHIA

9:30 a.m.

*Refreshment Break*

10:00 a.m.

**PANEL 1: NEW DIRECTIONS IN RELIABILITY AND STANDARDS**

New directions in LED technology—including tunable sources and new applications—combined with the use of OLEDs have resulted in new considerations for SSL reliability. This panel will cover new elements of SSL system reliability and updates to previous considerations.

MODERATOR: MORGAN PATTISON, SSLS, INC.

ERIC BRETSCHNEIDER, EB DESIGNS AND TECHNOLOGY

JIM GAINES, SIGNIFY

LYNN DAVIS, RTI INTERNATIONAL

CAMERON MILLER, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

11:30 a.m.

*Lunch*

**TRACK DISCUSSIONS**

12:30 p.m.

**LED TRACK DISCUSSION III: LUMINAIRE CONCEPTS**

Expert panel leads technical discussion on LED luminaire concepts focused on dynamic lighting.

MODERATOR: MONICA HANSEN, LED LIGHTING ADVISORS

MICHAEL GODWIN, OSRAM OPTO SEMICONDUCTORS

PAUL PICKARD, ECOSENSE LIGHTING

STEVE PAOLINI, TELELUMEN

WENDY LUEDTKE, ETC

**OLED TRACK DISCUSSION III: INTEGRATED SUBSTRATES**

Expert panel leads technical discussion on advances in OLED integrated substrates.

MODERATOR: NORMAN BARDSLEY, BARDSLEY CONSULTING

JEFF SPINDLER, OLEDWORKS

MARK TAYLOR, CORNING

WHITNEY GAYNOR, SINOVIA TECHNOLOGIES

PAUL LEU, UNIVERSITY OF PITTSBURGH

2:15 p.m.

*Refreshment Break*

2:45 p.m.

**LED TRACK DISCUSSION IV: LUMINAIRE CONCEPTS (continued)**

A second expert panel continues technical discussion on advances in LED luminaire concepts.

MODERATOR: MORGAN PATTISON, SSSL, INC.  
ROBERT DAVIS, PACIFIC NORTHWEST NATIONAL LABORATORY  
ARUN DUTTA, LEDVANCE  
PETER KOZODOY, GLINT PHOTONICS  
MARCELO SCHUPBACH, WOLFSPEED

**OLED TRACK DISCUSSION IV: ENCAPSULATION AND BACK-END PROCESSES**

Expert panel leads technical discussion on advances in OLED encapsulation and back-end processes.

MODERATOR: NORMAN BARDSLEY, BARDSLEY CONSULTING  
MICHAEL BOROSON, OLEDWORKS  
OFER SNEH, SUNDEW TECHNOLOGIES  
LARRY SADWICK, INNOSYS

**OPEN DISCUSSIONS AND Q&A**

4:30 p.m.

Informal discussions on multiple lighting science topics enable attendees to learn the latest updates, ask questions, and provide input to DOE on emerging areas of lighting science.

**Lighting Application Efficiency**

Open discussion to explore ideas for developing a common framework for characterizing sub-efficiencies for different lighting applications and systems, and for developing ideal target spectrum and intensity levels for various lighted activities.

**Lighting for Vision and Well-Being**

Group discussion with physiologists, technology developers, and implementers to examine the current understanding and disconnects between these groups, and to identify best practices and future research needs.

**Connected Lighting**

Group discussion to share lessons learned related to data collection, energy reporting, interoperability, and value assessment.

**Working with the DOE SSL Program**

Open discussion and Q&A regarding the DOE SSL FOA process, the SBIR grant process, and the collaborative OLED testing opportunity.

6:00 p.m.

*Adjourn*

## THURSDAY, JANUARY 31

7:00 a.m. *Continental Breakfast*

### PLENARY SESSIONS

8:00 a.m. **PLENARY TALK 5: DESIGNING LED LIGHTING SOLUTIONS FOR NEW APPLICATIONS**

LEDs enable entirely new lighting applications, which require entirely new designs that employ the latest lighting science. This talk will examine the process of developing an efficient lighting solution for an entirely new application. Considerations include spectrum, optical distribution, intensity, reliability, and cost. Application barriers and R&D opportunities will also be covered.

ROGER BUELOW, AEROFARMS

8:30 a.m. **PANEL 2: RETHINKING LIGHTING APPLICATION EFFICIENCY**

This expert panel will consider the efficiency of the holistic lighting system, including optical delivery efficiency, spectral efficiency, intensity suitability, and source efficiency. Participants will discuss a new methodology to evaluate trade-offs between all elements of lighting application efficiency.

MODERATOR: JEFF TSAO, SANDIA NATIONAL LABORATORIES

KEVIN HOUSER, PENN STATE UNIVERSITY

MORGAN PATTISON, SSLS, INC.

ROBERT SOLER, BIOS LIGHTING

10:00 a.m. *Refreshment Break*

10:30 a.m. **PANEL 3: EFFICACY AND SAFETY WITH SSL**

A better understanding of the safety impacts of lighting will enable development of lighting solutions that are both safe and efficient. This panel will discuss how lighting affects safety and where more research is needed.

MODERATOR: MONICA HANSEN, LED LIGHTING ADVISORS

JOE CHEUNG, U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION

MAX MARTELL, CENTERS FOR DISEASE CONTROL

DON McLEAN, DMD & ASSOCIATES

Noon *Lunch*

## PLENARY SESSIONS

1:00 p.m.

### **PANEL 4: UNDERSTANDING AND DESIGNING EFFICIENT LIGHTING FOR VISION AND WELL-BEING**

This discussion will begin by examining the generally agreed-upon scientific findings related to lighting for vision and well-being, including the potential for positive and negative outcomes, and we will consider how existing knowledge can be embodied into design standards. The second part of the session will examine the challenges in designing, installing, and evaluating lighting systems for vision and well-being. The overall objective is to identify the best practices to employ today and the future research needs to ensure lighting is optimized for both energy efficiency and human response.

MODERATOR: ROBERT DAVIS, PACIFIC NORTHWEST NATIONAL LABORATORY

#### PART 1:

SHADAB RAHMAN, HARVARD MEDICAL SCHOOL

DAVID SLINEY, INDEPENDENT CONSULTANT

BRIAN LIEBEL, ILLUMINATING ENGINEERING SOCIETY

#### PART 2:

ROBERT DAVIS, PACIFIC NORTHWEST NATIONAL LABORATORY

RON GIBBONS, VIRGINIA TECH TRANSPORTATION INSTITUTE

GENA GLICKMAN, UNIVERSITY OF CALIFORNIA, SAN DIEGO

3:30 p.m.

*Adjourn*