Hydroxyl radical formation and removal efficiency of sulfonamide antibiotics from real water matrices using UV-LED irradiated TiO_2 and ZnO photocatalysts

M. Náfrádi*, T. Alapi**

University of Szeged, Department of Inorganic and Analytical Chemistry, Dóm tér 7, H-6720 Szeged, Hungary

*Email: nafradim@chem.u-szeged.hu
**Email: alapi@chem.u-szeged.hu

Advanced Oxidation Processes (AOPs) may offer a way to remove several non-biodegradable pollutants released to wastewaters, like antibiotics and other pharmaceuticals [1, 2]. Heterogeneous photocatalysis is a widely researched AOP thanks to its efficient degradation and mineralization of most organic pollutants, but its widespread application is not yet solved. UV-LED light sources can prove to be a highly efficient solution for the excitation of wide bandgap semiconductors like TiO_2 and ZnO [3]. This work aims to compare different UV-LEDs emitting in the UV-A region to fluorescent mercury vapor lamps (MVL) for the excitation of commercial TiO_2 and ZnO photocatalysts. Cheap, commercial LEDs emitting at 398 nm ($P_{electric}$=76 mW), high power UV-LEDs emitting at 365 nm ($P_{electric}$=2.0 W), and a MVL emitting in the 300-400 nm range ($P_{electric}$=15.0 W) has been used.

The photon flux of the light sources and electric efficiency were compared based on iron-oxalate actinometry performed at different electric power input. Coumarin was employed to compare the formation rate of hydroxyl radicals ($^{\bullet}$OH), and the removal rate and mineralization efficiency of two sulfonamide antibiotics was also investigated. The comparison was based on the removal and mineralization rates, photonic efficiencies, and electric power consumption. For practical application, experiments were also performed in two real water matrices (drinking water, biologically treated wastewater).

In the case of $TiO_{2,}$ a significantly higher $^{\bullet}$OH formation and mineralization rate were determined compared to ZnO. On the other hand, ZnO was slightly more effective at transforming both coumarin and sulfonamide antibiotics. The LEDs emitting at 398 nm were the least efficient during photocatalysis, but the UV-LEDs emitting at 365 nm were more effective and consumed less electric power than the MVL, especially in the case of ZnO. During photocatalytic experiments with the LED light sources, the photonic efficiencies were reduced with increasing the light intensity. In real water matrices, ZnO proved to be significantly more effective than TiO_2, as some components of the matrices even increased the production of $^{\bullet}$OH.

References

[1] M.De Liguoro, B.Fioretto, C.Polronieri, G.Gallina, Chemosphere, 75, 1519-1524 (2019)
[2] M.Biosic, M.Mitrevski, S.Babic, Environ Sci Pollut Res Int, 24, 9802-9812 (2017)
[3] O.Tokode, R.Prabhu, L.A.Lawton, P.K.J.Robertson, Handb Environ Chem, 35, 159–179 (2015)

This work was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences and the new national excellence program of the Ministry for Innovation and Technology (ÚNKP-20-5-SZTE 639). This work was sponsored by the National Research, Development and Innovation Office-NKFIH OTKA, project number FK132742.

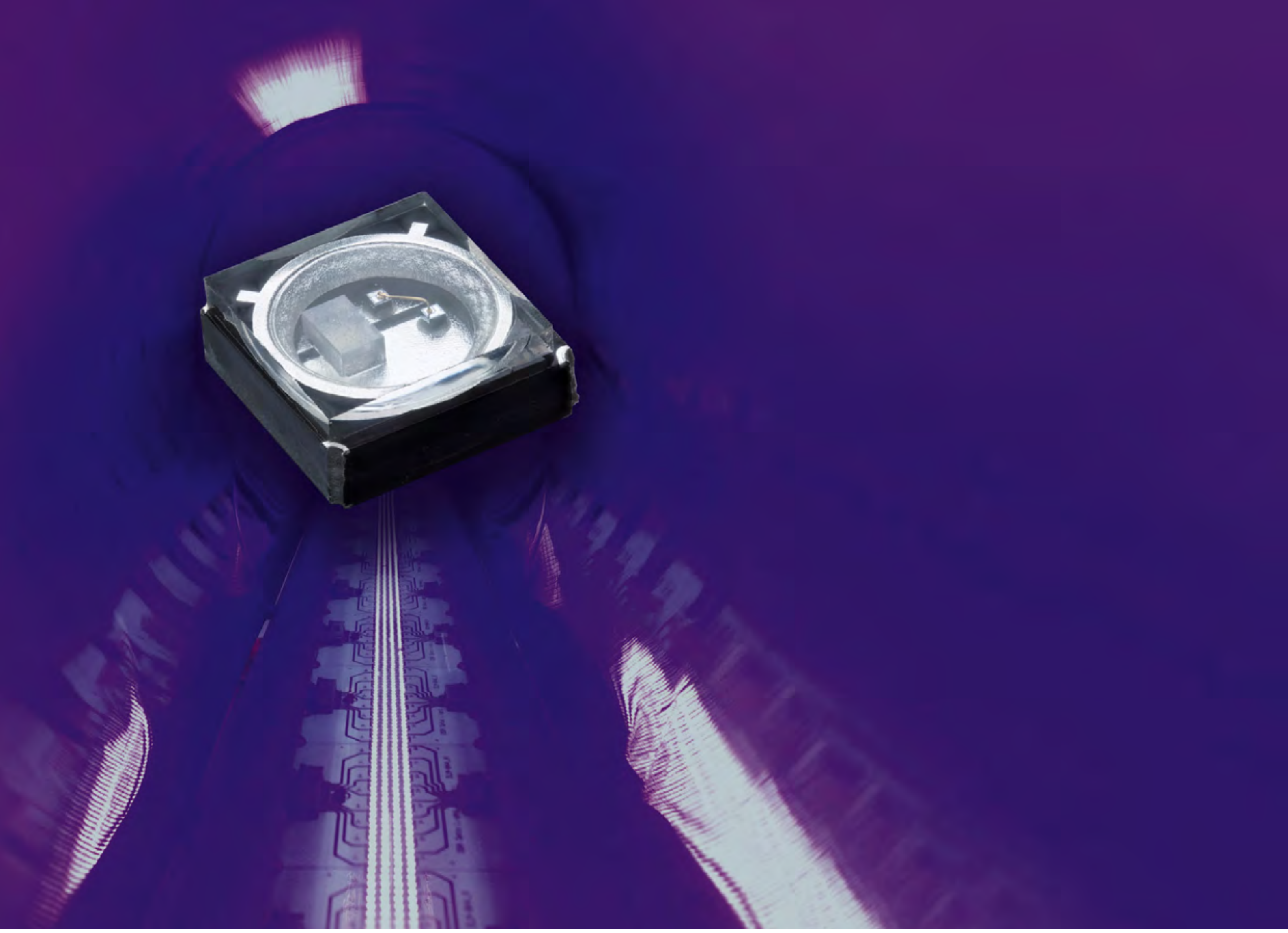
ICULTA

2021

The 2nd International Conference on

UV LED Technologies & Applications

April 19 – 20, 2021



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2nd International Conference on
UV LED Technologies & Applications

Welcome to ICULTA 2021

April 19 - 20, 2021
Virtual event

The inaugural ICULTA conference in 2018 was an outstanding success. With over 260 participants from 23 countries gathered together to educate, discuss, learn, connect and arrange business, specifically centered around UV LED technology and their multiple applications. At the time, we commented that “The great success of ICULTA demonstrates the rapid advancement of UV LEDs, and wide range of solutions the technology has to offer.” Now in a world reeling from the impact of a global pandemic, the need for robust disinfection technologies has become highlighted in a way not imaginable three years ago.

So as we enter this 2021 conference we can be both proud of the progress we have made in developing this technology into life-saving applications, and also excited about the future developments still to be achieved. Of course the application in UV-LED technology is wide ranging and this conference will really highlight the amazing breath of work being completed.

Sessions have been organized along key topics, including “LED Technology”, “Disinfection & Purification”, “Medical Applications”, “SARS-CoV-2”, “Food & Biotech Applications”, “Analytics”, “Measurement Technology”, “UV Curing”, and “Standardization”. The virtual event will feature oral talks, a panel discussion, poster sessions, and an accompanying exhibition.

ICULTA is organized jointly by the German consortium “Advanced UV for Life” (www.advanced-uv.de) and the “International Ultraviolet Association” (IUVA | www.iuva.org). On behalf of everyone involved, the many that have providing organizational support, thank-you for spending your time here with us.

We look forward to the stimulating content and encourage everyone to engage fully in the program and discussion available.

Your conference chairs

Sven Einfeldt
Ferdinand-Braun-Institute, Germany
Representative of the ‘Advanced UV for Life’ consortium

Oliver Lawal
AquiSense Technologies, USA
Past-President of the International Ultraviolet Association

Conference Program

Monday, April 19, 2021

Time in CET – Central European Time (UTC +1)

08:15-08:30

Welcome & Opening Remarks

08:30

Exhibition Open

08:30-09:00

Plenary Session Mo-AB1

UV-LEDs for Water Disinfection: The Forefront of Research and Applications

Kumiko Oguma | *University of Tokyo*

Chair: Tim Wernicke | Technische Universität Berlin

09:00-10:10

Session: Mo-A2
Analytics

Chair: Humberto M. Foronada | OSRAM

09:00-09:20 | Mo-A2.1 (Invited)

Characteristics of UV-LED sources for spectroscopic applications

C. Söller, L. Schäfer, A. Schnabl, O. Deppert, T. Jenek

Heraeus Noblelight GmbH, Germany

09:20-09:40 | Mo-A2.2 (Invited)

Development of LED based diffuse reflectance spectroscopy device for the non-invasive in vivo measurement of UVA-PF and SPF

G. Wiora[2], C. Throm[1], C. Reble[2], S. Schanzer[1], S. Kobylinski[1], J. Schleusener[1], H. Karrer[3], L. Kolbe[4], I. Gersonde[5], N. Lobo-Ploch[6], G. Khazaka[2], M. Meinke[1], J. Lademann[1]

[1]Charité - Universitätsmedizin Berlin, [2]Courage + Khazaka electronic GmbH, [3]Hans Karrer GmbH, [4]Beiersdorf AG, [5]University of Potsdam, [6]Ferdinand-Braun-Institut

09:40-09:55 | Mo-A2.3

Construction and characterization of a high-power UV-LED module as radiation source for goniometric spectral radiance factor measurements

I. Santourian[1], S. Teichert[1], A. Schirmacher[1], T. Quast[1], K.-O. Hauer[1]

[1]Physikalisch-Technische Bundesanstalt (PTB)

09:55-10:10 | Mo-A2.4

DNA analysis with UV LEDs

C. Möller[1], M. Hentschel[2], M. Weizmann[3], Th. Ortlepp[1]

[1]CiS Forschungsinstitut für Mikrosensorik GmbH, [2]Analytik Jena AG, [3] OSA Opto Light GmbH

09:00-10:10

Session: Mo-B2
Food & Biotech Applications

Chair: Tim Wernicke | Technische Universität Berlin

09:00-09:20 | Mo-B2.1 (Invited)

Peach flesh metabolome is modulated by UV-B radiation although UV-B does not penetrate the peach skin

A. Ranieri[1]*, M. Santin[1], A. Castagna[1], M.-T. Hauser[2], M. B. M. Moreno[3], L. Lucini[4]

[1]University of Pisa, [2]University of Natural Resources and Life Sciences,
[3]Università Cattolica del Sacro

09:20-09:40 | Mo-B2.2 (Invited)

UV-C LED usage for bacterial decontamination of technical surfaces in food processing

S. Fleischmann[1], S. Opherden[1], P. Rotsch[2], G. Wiese[3], T. Alter[1]

[1]Freie Universität Berlin, [2]OSA Opto Light GmbH, [3]SKS Sondermaschinen- und Fördertechnikvertriebs-GmbH

09:40-09:55 | Mo-B2.3

LED technology for decontamination of dried food ingredients

L. Hinds[1,2] , C. O'Donnell[2] Brijesh, K. Tiwari[1,2]

[1]Teagasc Food Research Centre, [2]University College Dublin

09:55-10:10 | Mo-B2.4

Extracts from UVB treated plants do not provoke cytotoxicity, genotoxicity or oxidative stress in vitro

M.Wiesner-Reinhold[1], C. Herz[2], S. Neugart[1,3], S. Baldermann[1,4], T. Filler[5], K. Czajkowski[5], M. Schreiner[1], E. Lamy [2]

[1]Leibniz Institute of Vegetable and Ornamental Crops e.V., [2]University of Freiburg, [3]Georg-August-Universität Göttingen, [4]University of Potsdam, [5]Ferdinand-Braun-Institut

10:10-11:30

Break

11:30-12:50

Session: Mo-A3
LED Technology

Chair: Humberto M. Foronada | OSRAM

11:30-11:50 | Mo-A3.1 (Invited)

Characterization of AlGaN deep-ultraviolet light-emitting diodes grown on AlN/sapphire templates with dense macro-steps and its application of high-speed solar-blind optical wireless communications

K. Kojima[1], A. Hirano[2], Y. Nagasawa2, Y. Honda[3], H. Amano[3], Y. Yoshida[4], M. Shiraiwa4, Y. Awaji[4], A. Kanno[4], N. Yamamoto[4], and S. F. Chichibu[1,3]
[1]Tohoku University, [2]UV craftory Co., Ltd., [3]Nagoya University, [4]National Institute of Information and Communications Technologies (NICT)

11:50-12:10 | Mo-A3.2 (Invited)

Understanding the degradation mechanisms of UVB and UVC LEDs to improve their reliability

J. Glaab[1,], J. Ruschel[1], J. Rass[1, 2], H.-K. Cho[1], N. Lobo Ploch[1, 2], T. Kolbe[1, 2], A. Knauer1, S. Walde[1], S. Hagedorn[1], C. Stölmacker[1], K. Hilbrich[1], N. Susilo[3], L. Sulmoni[3], M. Guttmann[3], F. Mehnke[3], T. Wernicke[3], M. Weyers[1], M. Kneissl[1, 3], S.Einfeldt[1]
[1]Ferdinand-Braun-Institut,Leibniz-Institut für Höchstfrequenztechnik, [2]UVphotonics NT GmbH, [3]Technische Universität Berlin

12:10-12:35 | Mo-A3.3

Enhanced Light Extraction for UV-LEDs by SMD-Packaging with Integrated Reflectors

U. Hansen[1], S. Maus[1], O. Gyenge[1], X. Hu[1], M. Queisser[2], S. Marx[2]
[1]MSG Lithoglas GmbH
[2]Technical University of Berlin

12:35-12:50 | Mo-A3.4

Fabrication of Aluminum-Coated Plastic Reflectors with an Innovative Metallic Intermediate Layer for High-power UV LED Modules

M. Weizman[1], A. Ruhe[1], S. Cinque[1], P. Rotsch[1], W. Arnold[1], S. Nieland[2]
[1]OSA Opto Light GmbH,
[2]GMBU e.V.

11:30-12:50

Session: Mo-B3
Medical Applications

Chair: Elliot M. Kreitenberg | Dimer

11:30-11:50 | Mo-B3.1 (Invited)

233 nm UVC LED irradiation for MRSA and MSSA eradication and risk assessment of skin damage ex vivo

M. Meinke[1*,] P. Zwicker[2], J. Schleusener[1], S. B. Lohan[1], L. Busch[1,3], C. Sicher[2], A. A. Kühl[4], C. Keck[3], J. Glaab[5], N. Lobo-Ploch[5], H: Kyong Cho[5], T. Filler[5], S. Hagedorn[5], L. Wittenbecher[5], M. Weyers[5], S. Einfeldt[5], M. Kneissl[6], C. Witzel[1], U. Winterwerber[5], A. Kramer[2]
[1]Charité – Universitätsmedizin Berlin,
[2]Universitätsmedizin Greifswald
[3]Universität Marburg, [4]iPATH.Berlin
[5]Ferdinand-Braun-Institut gGmbH, Leibniz-Institut für Höchstfrequenztechnik,
[6]Technische Universität

11:50-12:10 | Mo-B3.2 (Invited)

Applications of Ultraviolet Light in Healthcare

R. Martinello[1,2]
[1]Yale School of Medicine,
[2]Yale New Haven Health

12:10-12:35 | Mo-B3.3

Preventing hospital-acquired infections with UVC LEDs

M. Ruffin
Excelitas Technologies

12:35-12:50 | Mo-B3.4

UV-activated prevention of biofilm spreading in siphons

L. Steinhäußer[1*,] G. Gotzmann[1], F. Fietzke[1], J.-M. Albrecht[2], U. König[1]
[1]Fraunhofer *Institut Organische Elektronik,*
[2]MoveoMed GmbH

12:50-14:30

Break

14:30-15:30

Poster Session

15:30-16:00

Plenary Session Mo-AB4

Thinking outside the treatment plant: UV LEDs for distributed disinfection applications

K. Linden[*1], N. Hull[2] and V. Speight[3]
[1]*University of Colorado Boulder*
[2]*The Ohio State University*
[3]*University of Sheffield*

Chair: David Rubin | Healthe

16:00-17:10

Session: Mo-A5
Disinfection & Purification I

Chair: David Rubin | Healthe

16:00-16:20 | Mo-A5.1 (Invited)
Defining a Figure of Merit for UVC Radiation Efficiency in a Water Disinfection Reactor and the Impact of UVT, Reflectivity and Size
L. Schowalter[1], A. Miller[1]
[1]*Crystal IS*

16:20-16:40 | Mo-A5.2
Comparing UV-LED and UV lamps for micropollutant degradation with free chlorine advanced oxidation process in different water matrices
A. Kheyrandish, M. Mohseni
University of British Columbia

16:40-16:55 | Mo-A5.3
Selection, Evaluation and Integration of UV-LED Water Disinfection Modules
B. Adeli, M. Keshavarzfathy, A. Babaie
Acuva Technologies

16:55-17:10 | Mo-A5.4
Fundamentals of Design for UV-C LED Surface Disinfection Applications
R.M. Simons, J. Pagan
AquiSense Technologies LLC

16:00-17:10

Session: Mo-B5
SARS-CoV-2

Chair: Elliot M. Kreitenberg | Dimer

16:00-16:20 | Mo-B5.1 (Invited)
Factors affecting UV device validation in air and surface disinfection
C. A. Bernardy, N. M. Elardo, A. M. Trautz, J. P. Malley
University of New Hampshire

16:20-16:40 | Mo-B5.2 (Invited)
Is far-UVC radiation a promising approach to prevent airborne infections in regard to the ongoing SARS-CoV-2 pandemic?
Axel Kramer und Paula Zwicker

16:40-16:55 | Mo-B5.3
Disinfection of coronavirus by UVC LEDs: a line of defense to contain pandemics
Hadas Mamane[1], Yoram Gerchman[2], Nehemya Friedman[3,1], Michal Mandelboim[3,1]
[1]*Tel Aviv University,* [2]*University of Haifa and Oranim College ,* [3]*Central Virology Laboratory, Ministry of Health*

16:55-17:10 | Mo-B5.4
UV Inactivation Kinetics of SARS-CoV-2 and HCoV-229E using UV-LEDs
B. Adeli[1*], M. Raeiszadeh[1], M. Keshavarzfathy[1], E. Espid[1]
[1]*Acuva Technologies*

17:10

End of Conference Day & Exhibition

Tuesday, April 20, 2021

Time in CET – Central European Time (UTC +1)

08:30

Exhibition Open

08:30-09:00

Plenary Session [TU-AB1]

UV LEDs: Recent advances and future prospects of this versatile technology

N. Lobo Ploch | *UVphotonics NT GmbH*

Chair: Tim Wernicke | Technische Universität Berlin

09:00-10:05

Session: Tu-A2
Disinfection & Purification II

Chair: Marc P. Hoffmann | OSRAM Opto Semiconductors

09:00-09:20 | Tu-A2.1 (Invited)

UV LED system put to the test: a diary of a test center

T. Schwarzenberger, K.-H. Schön, J. Eggers

TZW: DVGW – Technologiezentrum Wasser

09:20-09:35 | Tu-A2.2

Hydroxyl radical formation and removal efficiency of sulfonamide antibiotics from real water matrices using UV-LED irradiated TiO2 and ZnO photocatalysts

M. Náfrádi, T. Alapi

University of Szeged

09:35-09:50 | Tu-A2.3

Enhanced bacterial inactivation through sequential irradiation with UV-LEDs at specific wavelengths

K. Song[1,2], F. Taghipour[1], M. Mohseni[1]

[1]The University of British Columbia, [2]Nanjing Forestry University

09:50-10:05 | Tu-A2.4

UV LED Validation Per USEPA UVDGM and Innovative Approaches

T. Brooks[1], H. Wright[1], M. Heath[1], M. Simpson[2], O. Autin[2], A. Renton[2], T. Schwarzenberger[3], K. Schoen3

[1]Carollo Engineers, [2]Typhon Treatment Systems Ltd., [3]TZW: DVGW - Technologiezentrum Wasser

09:00-10:05

Session: Tu-B2
UV Curing

Chair: Tim Wernicke | Technische Universität Berlin

09:00-09:20 | Tu-B2.1 (Invited)

Characteristics of UV-LEDs for Industrial Curing Solutions

P. Burger

Dr. Hönle AG, Gräfelfing

09:20-09:35 | Tu-B2.2

Continuous nap-core production process including UV-LED curing

M. Köhler[1], C. Dreyer[1,2], T. Förster1, A. Bernaschek[2,3], A. Bauer[3]

[1]Fraunhofer-Institute for Applied Polymer Research IAP, [2]Technische Hochschule Wildau, [3]InnoMat GmbH

09:35-09:50 | Tu-B2.3

UV-LED-curing – A next-generation technology for textile industry

R. Lungwitz

Sächsisches Textilforschungsinstitut e.V.

09:50-10:05 | Tu-B2.4

Innovative UV LED Curable Polymer Coatings for Glass Fibers

J. Rosenkranz[1], M. Köhler[2], Jan. Klein[3], C. Dreyer[2,4]

[1]j-fiber GmbH, [2]Fraunhofer-Institute for Applied Polymer Research IAP,[3]micro resist technology GmbH, [4]Technische Hochschule Wildau

10:05-11:30

Break

11:30-11:55

Plenary Session TU-AB3

Exploring the wavelength & efficiency limits of deep UV LEDs

Michael Kneissl1,2

1Institute of Solid State Physics, Technische Universität Berlin, 10623 Berlin, Germany

2Ferdinand-Braun-Institut gGmbH, Leibniz-Institut für Höchstfrequenztechnik, 12489 Berlin, Germany

Chair: Martin Guttmann | Technische Universität Berlin

12:00-13:15

Session: Tu-A4
Measurement Technology

Chair: Martin Guttmann | Technische Universität Berlin

12:00-12:15 | Tu-A4.1

Optical internal quantum efficiency determination of UVC LEDs – towards a standardization of experimental conditions

C. Frankerl[1,2], M. P. Hoffmann[1], F. Nippert[2], H. Wang[1], C. Brandl[1], N. Tillner[1,3], H.-J. Lugauer[1], R. Zeisel[1], A. Hoffmann[2], M. J. Davies[1]

[1]OSRAM Opto Semiconductors GmbH,
[2]Technische Universität Berlin,
[3]TU Braunschweig

12:15-12:30 | Tu-A4.2

Accurate UV-C LED measurement techniques include the removal of fluorescence effects

M. Clark, R. Zuber, M. Ribnitzky

Gigahertz-Optik

12:30-12:45 | Tu-A4.3

Advances in in-situ metrology of UV-LED structures in MOCVD

K. Haberland[1], A. Knauer[2], M. Weyers[2], J.-T. Zettler[1]

[1]LayTec AG, [2]Ferdinand-Braun-Institut

12:45-13:00 | Tu-A4.4

UV-LED activated semiconductor biosensor for lactate monitoring in sweat

N. Taleghani, F. Taghipour

The University of British Columbia

13:00-13:15 | Tu-A4.5

Measurement systems and calibrations for UV radiation

D. Konjhodzic, B. Eder, W. Beloglazov

Instrument Systems GmbH

12:00-13:15

Session: Tu-B4
UV Applications

Chair: Marc P. Hoffmann | OSRAM Opto Semiconductors

12:00-12:15 | Tu-B4.1

UVC-LED based pretreatment for biofouling control in desalination processes with thin-film composite membranes

P. Sperle, C. Wurzbacher, J.E. Drewes, B. Skibinski

Technical University of Munich

12:15-12:30 | Tu-B4.2

Impact of irradiation frequencies and duty intervals on UV-LEDs photoreactor performance used in Advanced Oxidation Processes

M.H. Rasoulifard, M. Ganjkhanloo, M.R. Eskandarian

University of Zanjan

12:30-12:45 | Tu-B4.3

Effect of Wavelength and Intensity on E. coli Inactivation Kinetics

H. Mamane[1], D. Pousty[1,2], Y. Gerchman[1], R. Hofmann[2]

[1]School of Mechanical Engineering,
[2]University of Toronto

12:45-13:00 | Tu-B4.4

UV-C LED – challenges, status quo & outlook A perspective from an LED manufacturer

J.Klee

Nichia Chemical Europe GmbH

13:00-13:15 | Tu-B4.5

UV-C LEDs and their advantages in various system designs

A. Wilm

OSRAM Opto Semiconductors

13:15-15:00

Break

15:00-16:00

Poster Session – Voting for the best poster ends at 15:30.

16:00-16:10

Closing Remarks

16:10-18:15

Joint Plenary on
Standardization of UV LED (Systems) Characterization Tu-AB5

Chair: Tim Wernicke | Technische Universität Berlin

16:10 | AB5.1

UV radiometry for LED-based systems
Peter Sperfeld and Thorsten Gerloff | *PTB, Germany*

16:35 | AB5.2

The need for standards in UV-LED water disinfection systems, and challenges for application to a world market
Gordon Knight | *International Ultraviolet Association, USA*

16:55 | AB5.3

New alternative UV test method in NSF/ANSI 55 – Ultraviolet microbiological water treatment systems
Mike Blumenstein | *NSF International, USA*

17:10 | AB5.4

UV LED disinfection for public water supply: Preparation of a test protocol in Germany
D. Warschke[1], K.-H. Schön[2], J. Eggers[2]
[1]*Gelsenwasser AG, Willy-Brandt-Allee 26, 45891 Gelsenkirchen, Germany*
[2]*TZW: DVGW-Technologiezentrum Wasser, Karlsruher Straße 84, 76139 Karlsruhe, Germany*

17:25 | AB5.5

Raising the standard: The case for holistic guidelines for UV-C LED based water treatment systems
Oliver Lawal | *AquiSense Technologies, USA*

17:40-18:15

Panel Discussion
Standardization: What is needed and what is in the pipeline?

Chair: Ian Mayor Smith | University of Brighton

18:15

End of Conference & Exhibition

Poster Session

Mo-P1

Adsorption of selenate on activated carbon by UV light

S. Aguilar C., J. Alejandre, M. Ortíz G., N. Dasgupta-Schubert
Universidad Michoacana de San Nicolás de Hidalgo

Mo-P2

How the UVC LED industry is organizing to reach high power and new applications

P. Boulay
Yole Développement

Mo-P3

Triggering the release of drugs from nanocarriers in hair follicles by the application of UV-LEDs

L. Busch[1,4], Y. Avlasevich[2], G. Thiede[1], K. Landfester[2], A. Kramer[3], G. Müller[3], P. Zwicker[3], M. E. Darvin[1], M. C. Meinke[1], C. M. Keck[4], J. Lademann[1], A. Patzelt[1]
[1]Charité – Universitätsmedizin Berlin, [2]Max Planck Institute for Polymer Research
[3]University Medicine Greifswald, [4]Philipps University Marburg

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Mo-P4

Some parameters for technological migration from Hg lamps to LEDs in the UV range for germicidal dose applications

P. Fredes[1,2*], U. Raff[1]
[1]Univ. de Santiago de Chile, [2]Hydraluvx Spa

Mo-P5

Electro-optical properties of deep UV LEDs with an emission wavelength near 230 nm

M. Guttmann[1]*, L. Sulmoni[1], N. Lobo-Ploch[2,3], F. Mehnke[1], P. Gupta[1], J. Glaab[2], J. Ruschel[2], H. Kyong Cho[2], J. Rass[2,3], S. Hagedorn[2], T. Wernicke[1], S. Einfeldt[2], M. Weyers[2], M. Kneissl[1,2]
[1]Technische Universität Berlin, [2]Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik,
[3]UVphotonics NT GmbH

Mo-P6

Rapid Integration of LEDs for UVC surface treatment driven by pandemic requirements

Y. Haj-Hmeidi1
[1]LUMITRONIX® LED-Technik GmbH

Mo-P7

UVC LEDs Promise a Giant Leap in Decontamination Efficiency

A. Hedrick, D. Georgeson, Dr. M. Hardwick, Dr. R. Louis
Crystal IS, Cleanbox Technology, Hoag Memorial Hospital

Mo-P8

Integrated digitally adjustable step down converter to control one individual or a series of UV-LED(s)

C. Heinze[2], M. Frisch[1], Th. Ortlepp[2]*, O. Brodersen[2]
[1]eesy-ic GmbH, [2]CiS Forschungsinstitut für Mikrosensorik GmbH

Mo-P9

Flexible and cost effective UVC LED system design using packageless WICOP LED Technology

M.Hofmann, JR.Kim, JH.Jeong
Seoul Viosys Co. LTD. Ansan

Mo-P10

Factors influencing the emission characteristics of UV LED chips - A modular system for customized design

I. Käpplinger[1]*, D. Mitrenga[1], G. Leibeling[2], F. Gindele[3], Y. Kikuchi[4], O. Brodersen[1], T. Ortlepp[1]
[1]CiS Forschungsinstitut für Mikrosensorik GmbH, [2]JenCAPS Technology GmbH, [3]Schott AG, [4]NGK Insulators, LTD

Mo-P11

Integrated dose simulation tool for UV-LED reactors

M. Keshavarzfathy, B. Adeli, A. Babaie
ACUVA Technologies Inc.

Mo-P12

Emergence of UV-LED as a new technology

S. Kumar, C. Ruckstuhl, H. Maiweg
ACUVA Technologies Inc.

Mo-P13

Stress responds measurements in skin induced by UV-LEDs

S. Lohan[1], D. Ivanov[1], N. Schüler[2], B. Berger[2], J. Lademann[1], M. Meinke[1]
[1]Charité – Universitätsmedizin Berlin, [2]Freiberg Instruments GmbH

Mo-P14

Application of UV LEDs for Tender Coconut Water Processing

M. RaJ Kumar, Y. Sudheer Kuma
CSIR-Central Food Technological Research Institute

Mo-P15

Combination of UV-LED and membrane filtration to treat surface water

A.P. Marques[1,2], J. Bernardo[2], R. Huertas[1,2], J.G. Crespo[1,2], V.J. Pereira[1,2]
[1]iBET, [2]Universidade NOVA de Lisboa

Mo-P16

UV-C LED Systems Verse Low Pressure: A Five-Year Cost Comparison

M. McManus, O. Lawal
Aquisense

Mo-P17

Employment of computational tools for optimization of high flow UV-LED water disinfection systems

M. Mohaghegh Montazeri, F. Taghipour
University of British Columbia

Mo-P18

A multi-wavelength tunable LED source covering UV-B and UV-A from 280nm to 405nm

A.P. Morrison, N. Molnar
University College Cork

Mo-P19

COVID-19 pandemic: The spark for UVC LED to become a multi-billion dollar business in the next 5 years?

P. Mukish, P. Boulay
Yole Développement

Mo-P20

Efficacy of UV-C irradiation emitted by mercury vapor lamp and LED on the bacterial load of eggshells

S. Opherden1, S. Fleischmann1, T. Alter1, C. Robé1, I. Szabo2, S. Hadziabdic2, A. Gensch3, P. Rotsch4, G. Wiese5, U. Roesler1
[1]Freie Universität Berlin, [2]German Federal Institute for Risk Assessment (BfR),
[3]Löwendorfer Geflügelhof GmbH (LGH),
[4]OSA Opto Light GmbH, [5]SKS Sondermaschinen- und Fördertechnikvertriebs- GmbH

Mo-P21

Visible blind SiC-based UV spectrometer - Development and characteristics

N. Papathanasiou[1], S. Langer[1,2], T. Weiss[1], D. Prasai[2]
[1]sglux GmbH, [2]Ferdinand-Braun-Institut gGmbH, Leibniz-Institut für Höchstfrequenztechnik

Mo-P22

A Protocol for Design and Validation of UV-LED Devices for Air and Surface Disinfection

M. Raeiszadeh, B. Adeli, M. Keshavarzfathy, E. Espid
Acuva Technologies

Mo-P23

UV-LED Air Purifier for Degradation of Volatile Organic Compounds in Indoor Air

S. Rouhani, F. Taghipour*
University of British Columbia

Mo-P24

Ceramic-based UV-LED photocatalytic membrane reactor development, evaluation, and optimization

S. Sakhaie, F. Taghipour
University of British Columbia

Mo-P25

UV LEDs: Improving lifetimes by optimal thermal management

P. Sharma, P. Chen, S. Han, P. Chung, C. Han
Violumas Inc

Mo-P26

Ultraviolet light decontamination in chicken breast meat

A. B. Soro[1], P. Whyte[2], D. J. Bolton[1], B. K. Tiwari[1]
[1]Teagasc Ashtown Research Centre, [2]University College Dublin

Mo-P27

Aluminium Nitride substrates for epitaxial AlGaN layers with low dislocation density

T. Straubinger[1], M. Bickermann[1], C. Hartmann[1], L. Matiwe[1], J. Wollweber[1], A. Knauer[2], M. Weyers[2], T. Wernicke[3], M. Kneissl[3]
[1]Leibniz-Institut für Kristallzüchtung,[2]Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik,
[3]Technische Universität Berlin

Mo-P28

On the road to direct, optical, on-line germ detection

F. Stüpmann[1], M. Sarcander[1], M. Moschall[1], D. Röll[2], O. Talkenberg[2], S. Hartmann[1], R. König[2]
[1]Silicann Systems GmbH, [2]Center for Sepsis Control & Care

Mo-P29

Optic concepts for UV LED lamps at long working distances

T. Vehoff, J. Grade, A. Stahl
Heraeus Noblelight GmbH

Mo-P30

Light extraction efficiency enhancement of UVC and UVB LEDs via encapsulation with UV-transparent silicone resins (Deep UV200)

S. Wu[1], M. Guttmann[1], N. Lobo-Ploch[2], N. Susilo[1], F. Gindele[3], A. Knauer[2], T. Kolbe[2], J. Raß[2], H. K. Cho[2], K. Hilbrich[2], S. Einfeldt[2], T. Wernicke[1], M. Weyers[2], and M. Kneissl[1,2]
[1]*Universität Berlin,* [2]*Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik*
[3]*Schott AG*

Mo-P31

Disruptive GLED devices and Disinfection Solutions

L. Zhou
Bolb Inc