PROCEEDINGS OF SPIE

Organic Light Emitting Materials and Devices XVIII

Franky So Editor

17–20 August 2014 San Diego, California, United States

Sponsored and Published by SPIE

Volume 9183

Proceedings of SPIE 0277-786X, V. 9183

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Organic Light Emitting Materials and Devices XVIII, edited by Franky So, Proc. of SPIE Vol. 9183, 918301 © 2014 SPIE · CCC code: 0277-786X/14/\$18 · doi: 10.1117/12.2176717

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in Organic Light Emitting Materials and Devices XVIII, edited by Franky So, Proceedings of SPIE Vol. 9183 (SPIE, Bellingham, WA, 2014) Article CID Number.

ISSN: 0277-786X ISBN: 9781628412109

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445 SPIE.org

Copyright © 2014, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/14/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

∨ii ix	Authors Conference Committee
	ORGANIC PHOTONICS + ELECTRONICS PLENARY SESSION
9183 02	Direct electronic probing of biological complexes formation (Plenary Paper) [9183-402]
	NOVEL MATERIALS I
9183 03	Concepts for the material development of phosphorescent organic materials processable from solution and their application in OLEDs [9183-1]
	NOVEL MATERIALS II
9183 09	Bright coppertunities: efficient OLED devices with copper(I)iodide-NHetPHOS-emitters (Invited Paper) [9183-7]
	MECHANISMS AND PHYSICS I
9183 OF	Molecular orientation, thermal behavior and density of electron and hole transport layers and the implication on device performance for OLEDs [9183-13]
	MECHANISMS AND PHYSICS II
9183 OH	Degradation of blue phosphorescent organic LEDs analyzed by solution NMR spectroscopy (Invited Paper) [9183-15]
9183 OJ	Theoretical investigation of the degradation mechanisms in host and guest molecules used in OLED active layers [9183-17]
	MECHANISMS AND PHYSICS III
9183 ON	TADF for singlet harvesting: next generation OLED materials based on brightly green and blue emitting Cu(I) and Ag(I) compounds (Invited Paper) [9183-22]

-	MECHANISMS AND PHYSICS IV
9183 0Q	Device design for optimal exciton harvesting (Invited Paper) [9183-25]
	SOLUTION-PROCESSED OLEDs II
9183 11	Towards fully spray coated organic light emitting devices [9183-36]
	NOVEL APPLICATIONS
9183 16	Electrospun conjugated polymer nanofibers as miniaturized light sources: control of morphology, optical properties, and assembly (Invited Paper) [9183-41]
	SOLID STATE LIGHTING I
9183 19	Concentration effect on the optical absorption and luminescence properties of disperse red-13 in silica spheres [9183-44]
	SOLID STATE LIGHTING II
9183 1F	High performance hybrid white OLEDs based on new platinum complexes and new blue fluorescence host (Invited Paper) [9183-50]
	SOLID STATE LIGHTING III
9183 1H	Light management in flexible OLEDs (Invited Paper) [9183-52]
	POSTER SESSION
9183 10	The application of high efficient yellow phosphorescent material to white OLEDs [9183-60]
9183 1P	The profiling of planar illuminative patterns using multiple white organic light-emitting diodes [9183-61]
9183 1Q	Two-color emission in three-layer heterostructure OLETs [9183-62]
9183 1U	Interplay between ambient and exciton-induced degradation in organic light-emitting devices [9183-66]
9183 1Z	Surface plasmon polariton modification in top-emitting organic light-emitting diodes for enhanced light outcoupling [9183-71]
9183 24	Synthesis and characterization of heteroatom-bridged bisspirobifluorenes for the application of organic light-emitting diodes [9183-76]

9183 25	High barrier properties of transparent thin-film encapsulations for top-emission organic light-emitting diodes $[9183-77]$
9183 26	Extremely high efficiency phosphorescent organic light-emitting diodes with horizontal emitting dipoles (Organic Photonics + Electronics Best Student Paper Award) [9183-78]
9183 2C	To enhance light extraction of OLED devices by multi-optic layers including a micro lens array [9183-84]
9183 2G	Virtual screening for OLED materials [9183-88]
9183 21	Sensitized fluorescence in organic light emitting diodes [9]83-90]

Proc. of SPIE Vol. 9183 918301-6

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Aziz, Hany, 1U Baumann, Thomas, 09 Bräse, Stefan, 09 Brédas, Jean-Luc, OJ Bykov, A., 1Q Camposeo, A., 16 Cao, Yixiang, 2G Chang, Meng-Hao, 10 Chang, Wen-Cheng, 1P Chen, Chao-Tsen, 1F, 24 Chen, Chin-Ti, 1F, 24 Chen, Lih-Jeih, 1P Cheng, Yu-Hen, 1P Chien, Chao-Heng, 2C Chiu, Chuang-Hung, 2C Czerwieniec, Rafal, 0N Deferme, Wim, 11 Devore, David, 0F De Vries, Timothy, OF Di Camillo, D., 16 Duan, Yu, 25 Fabritius, T., 1Q Fasano, V., 16 Fléchon, Charlotte, 09 Froese, Robert D., OF Fuchs, Cornelius, 1Z Fukushima, Tatsuya, OH Gather, Malte C., 1Z Gavartin, Jacob, 2G Geurts, Christian G.C., 1H Giesen, David J., 2G Gilissen, Koen, 11 Giordano, Francesco, 02 Goldberg, Alexander, 2G Halls, Mathew D., 2G Harkema, Stephan, 1H Helgers, Paul L.J., 1H Hiyama, Kunimasa, OH Hofmann, Simone, 1Z Hong, Liang, OF Hong, Minki, 0J Huang, Pang-Chi, 10 Hughes, Thomas F., 2G Ingram, G.L., 0Q, 2I Ito, Hiroto, OH Janietz, S., 03 Jokinen, K., 1Q Kaji, Hironori, 0H

Kang, Kwang-Sun, 19

Kearns, Kenneth L., OF Kim, Jang-Joo, 26 Kim, Kwon-Hyeon, 26 Kita, Hiroshi, OH Krueger, H., 03 Ku, Chun-Nena, 10 Kuo, Yu-Xaong, 2C Kwak, H. Shaun, 2G Lee, Jen-Chi, 2C Lee, Jeong-Hwan, 26 Leitl, Markus J., 0N Leo, Karl, 1Z Levell, Jack W., 1H Li, Hui-Ying, 25 Lin, Chiao-Wen, 1F Lin, Jin-Sheng, 10 Liou, Jia-Lun, 10 Lozzi, L., 16 Lu, Z. H., 0Q, 2I Macchia, Eleonora, 02 MacKerron, Duncan, 1H Magliulo, Maria, 02 Manca, Jean, 11 Manoli, Kyriaki, 02 Moffa, M., 16 Moon, Chang-Ki, 26 Mukhopadhyay, Sukrit, OF Myllylä, R., 1Q Na, Hong-Yeop, OF Nguyen, C., 2l Ootsu, Shinya, OH Palazzo, Gerardo, 02 Pendyala, Raghu K., 1H Persano, L., 16 Pisignano, D., 16 Polini, A., 16 Poloek, Anurach, 1F Ruggieri, F., 16 Salert, B., 03 Santucci, S., 16 Scholz, Reinhard, 1Z Schwab, Tobias, 1Z Stryckers, Jeroen, 11 Suzuki, Hajime, 0H Thesen, M., 03 Torsi, Luisa, 02 Trefonas, Peter, OF Tseng, Mei-Rurng, 10 Volz, Daniel, 09

Wallesch, Manuela, 09 Wang, Chieh, 1F Wang, Qi, 1U Wedel, A., 03 Welsh, Dean, 0F Wieczorek, Martin, 1Z Wilson, Joanne S., 1H Winget, Paul, 0J Woodward, Hunter, 0F Wu, Cheng-An, 1O Wu, Cheng-Lung, 24 Yang, Henglong, 1P Yersin, Hartmut, 0N Zhang, Yingjie, 1U Zink, Daniel M., 09

Conference Committee

Symposium Chair

Zakya H. Kafafi, National Science Foundation, ret (United States)

Conference Chair

Franky So, University of Florida (United States)

Conference Co-chair

Chihaya Adachi, Kyushu University (Japan)

Conference Program Committee

Malte C. Gather, Technische Universität Dresden (Germany)

Hisao Ishii, Chiba University (Japan)

Hironori Kaji, Kyoto University (Japan)

Jang-Joo Kim, Seoul National University (Korea, Republic of)

Jaewon Lee, LG Display (Korea, Republic of)

Mathew K. Mathai, Apple Inc. (United States)

Jongwook Park, The Catholic University of Korea (Korea, Republic of)

Yong-Jin Pu, Yamagata University (Japan)

Ifor D. W. Samuel, University of St. Andrews (United Kingdom)

Joseph Shinar, Iowa State University (United States)

Session Chairs

Novel Materials I

Mathew K. Mathai, Apple Inc. (United States)

Jang-Joo Kim, Seoul National University (Korea, Republic of)

2 Novel Materials II

Mathew K. Mathai, Apple Inc. (United States)

Jang-Joo Kim, Seoul National University (Korea, Republic of)

3 Mechanisms and Physics I

Russell J. Holmes, University of Minnesota, Twin Cities (United States) **Jongwook Park**, The Catholic University of Korea (Korea, Republic of)

4 Mechanisms and Physics II

Russell J. Holmes, University of Minnesota, Twin Cities (United States) **Jongwook Park**, The Catholic University of Korea (Korea, Republic of)

Mechanisms and Physics III
 Malte C. Gather, University of St. Andrews (United Kingdom)
 Dongge Ma, Changchun Institute of Applied Chemistry (China)

Mechanisms and Physics IV
 Malte C. Gather, University of St. Andrews (United Kingdom)
 Dongge Ma, Changchun Institute of Applied Chemistry (China)

7 Solution-Processed OLEDs I Daisuke Yokoyama, Yamagata University (Japan) Hany Aziz, University of Waterloo (Canada)

8 Solution-Processed OLEDs II Daisuke Yokoyama, Yamagata University (Japan) Hany Aziz, University of Waterloo (Canada)

9 Novel Applications Jian Li, Arizona State University (United States)

10 Solid State Lighting IJian Li, Arizona State University (United States)

11 Solid State Lighting II
Noel C. Giebink, The Pennsylvania State University (United States)
Tae-Woo Lee, Pohang University of Science and Technology (Korea, Republic of)

Solid State Lighting III
Noel C. Giebink, The Pennsylvania State University (United States)
Tae-Woo Lee, Pohang University of Science and Technology (Korea, Republic of)

Х