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:


ISSN 0277-786X
ISBN 9780819481955

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 © 2010, 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/10/$18.00.

Printed in the United States of America.

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

SPIEDigitalLibrary.org

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 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

ix Conference Committee

OLED DEVICES AND APPLICATIONS I

7722 02 White OLED devices and processes for lighting applications (Invited Paper) [7722-01]
N. Ide, H. Tsuji, N. Ito, Y. Matsuhsia, S. Houzumi, T. Nishimori, Panasonic Electric Works Co., Ltd. (Japan)

ORGANIC LASERS

7722 07 Complementary pumping mechanisms of lambda-half organic microcavities [7722-06]
R. Brückner, M. Sudzius, V. G. Lyssenko, H. Fröb, K. Leo, Technische Univ. Dresden (Germany)

7722 08 Oblique angle lasing in a periodically pumped organic microcavity [7722-07]
S. I. Hintschich, V. G. Lyssenko, M. Sudzius, B. Schütte, H. Fröb, K. Leo, Technische Univ. Dresden (Germany)

OLED PHYSICS AND MODELLING I

7722 0C Fundamental processes governing operation and degradation in state of the art P-OLEDs (Invited Paper) [7722-11]
M. Roberts, Cambridge Display Technology Ltd. (United Kingdom); K. Asada, Sumitomo Chemical Co., Ltd. (Japan); M. Cass, C. Coward, S. King, A. Lee, M. Pintani, M. Ramon, C. Foden, Cambridge Display Technology Ltd. (United Kingdom)

7722 0D Measuring the dipole orientation in OLEDs [7722-12]
M. Flämmich, S. Roth, N. Danz, D. Michaelis, A. H. Bräuer, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); M. C. Gather, K. Meerholz, Univ. zu Köln (Germany)

7722 0F The influence of the optical environment on the shape of the emission profile and methods of its determination [7722-14]
B. Perucco, FLUXiM AG (Switzerland); N. A. Reinke, Zurich Univ. of Applied Sciences (Switzerland); F. Müller, D. Rezzonico, FLUXiM AG (Switzerland); B. Ruhstaller, FLUXiM AG (Switzerland) and Zurich Univ. of Applied Sciences (Switzerland)

OPV DEVICES

7722 0G Efficient and long-term stable organic vacuum deposited tandem solar cells (Invited Paper) [7722-15]
C. L. Uhrich, G. Schwartz, B. Maennig, W. M. Gnhr, S. Sonntag, O. Erfurth, E. Wolrab, K. Walzer, J. Foerster, A. Weiss, O. Tsaryova, heliatek GmbH (Germany); K. Leo, M. K. Riede, Technische Univ. Dresden (Germany); M. Pfeiffer, heliatek GmbH (Germany)
Comparison of different conditions for accelerated ageing of small molecule organic solar cells [7722-19]
M. Hermenau, K. Leo, M. Riede, Technische Univ. Dresden (Germany)

OLED DEVICES AND APPLICATIONS II

Towards efficient next generation light sources: combined solution processed and evaporated layers for OLEDs (Invited Paper) [7722-24]
D. Hartmann, W. Sarfert, Siemens AG (Germany); S. Meier, Siemens AG (Germany) and Univ. Erlangen-Nuremberg (Germany); H. Bolink, S. García Santamaria, Univ. de Valencia (Spain); J. Wecker, Siemens AG (Germany)

Highly efficient inverted top-emitting organic electroluminescent devices with doped charge transport layers [7722-26]
M. Thomschke, M. Furno, B. Lüssem, K. Leo, Technische Univ. Dresden (Germany)

OPV PHYSICS AND MODELLING II

Charge carrier mobility in disordered organic blends [7722-28]
L. J. A. Koster, Eindhoven Univ. of Technology (Netherlands)

Transient photocurrent response of organic bulk heterojunction solar cells [7722-30]
M. T. Neukom, N. A. Reinke, K. A. Brossi, Zurich Univ. of Applied Sciences (Switzerland); B. Ruhstaller, Zurich Univ. of Applied Sciences (Switzerland) and FLUXiM AG (Switzerland)

MATERIALS AND PHOTONIC-ENHANCED MATERIALS I

Photoluminescence enhancement of semiconducting-carbon-nanotubes-based thin films [7722-33]
E. Gautres, N. Izard, X. Le Roux, D. Marris-Morini, Institut d'Électronique Fondamentale, CNRS, Univ. Paris-Sud (France); S. Kazaoui, National Institute of Advanced Industrial Science and Technology (Japan); E. Cassan, L. Vivien, Institut d'Électronique Fondamentale, CNRS, Univ. Paris-Sud (France)

OPV PHYSICS AND MODELLING II

Modelling exciton diffusion in disordered conjugated polymers [7722-39]
S. Athanasopoulos, E. V. Emelianova, Univ. de Mons-Hainaut (Belgium); A. B. Walker, Univ. of Bath (United Kingdom); D. Beljonne, Univ. de Mons-Hainaut (Belgium)

POSTER SESSION: ORGANIC LIGHT EMITTING DIODES

Device history dependent effects in dark injection transient current measurements of charge mobility in organic light-emitting diodes [7722-43]
S. Knox, National Physical Lab. (United Kingdom); H. Jones, Univ. of Southampton (United Kingdom); T. Esward, National Physical Lab. (United Kingdom)
IR studies on the interaction of Ca and Mg with the blue emitter material Ir(cn-pmbic)₃
T. Glaser, M. Binder, A. Pucci, Ruprecht-Karls-Univ. Heidelberg (Germany); C. Schildknecht, C. Lennartz, BASF SE (Germany)

White organic light-emitting diodes with top-emitting structure for high color quality and forward-directed light emission
P. Freitag, S. Reineke, M. Furno, B. Lüssem, K. Leo, Technische Univ. Dresden (Germany)

Second-order distributed feedback lasers based on films containing perylenediimide derivatives
V. Navarro-Fuster, P. G. Boj, J. M. Villalvilla, J. A. Quintana, M. A. Diaz-García, Univ. de Alicante (Spain); V. Trabadelo, EMPA-Swiss Federal Labs. for Materials Testing and Research (Switzerland) and Tekniker (Spain); A. Juarros, A. Retolaza, S. Merino, Tekniker (Spain)

Azobenzene-based surface relief gratings for thin film distributed feedback lasers
S. Döring, T. Rabe, R. Rosenhauer, O. Kulikovska, N. Hildebrandt, J. Stumpe, Fraunhofer-Institut für Angewandte Polymerforschung (Germany)

Optical spectroscopy with organic semiconductor lasers (Best Student Paper Award)
S. Klinkhammer, T. Woggon, C. Vannahme, Karlsruhe Institute of Technology (Germany); U. Geyer, Karlsruhe Institute of Technology (Germany) and Christian-Albrechts-Univ. Kiel (Germany); T. Mappes, U. Lemmer, Karlsruhe Institute of Technology (Germany)

Nano-structure control in the bulk heterojunction layer for organic solar cells
D. Yamanaka, S. Watanabe, T. Mizutani, K. Kojima, S. Ochiai, Aichi Institute of Technology (Japan)

Fabrication and performance of organic thin film solar cells using a painting method
S. Ochiai, H. Ishihara, T. Mizutani, K. Kojima, Aichi Institute of Technology (Japan)

Organic solar cell performance and nano-morphology of poly(3-hexylthiophene-2,5-diyl) (P3HT)/PCBM thin film using poly(3-octylthiophene)
K. Sakai, K. Kojima, T. Mizutani, S. Ochiai, Aichi Institute of Technology (Japan)

Island size effects in organic optoelectronic devices
M. Nguyen, A. Z. Turak, F. Maye, J. Heidkamp, Max-Planck-Institut für Metallforschung (Germany); J. Wrachtrup, Univ. Stuttgart (Germany); H. Dosch, Deutsches Elektronen-Synchrotron (Germany)

The appropriateness of organic solar cells for indoor lighting conditions
B. Minnaert, P. Veelaert, Univ. College Ghent (Belgium)
### POSTER SESSION: MATERIALS

**7722 1U** Photo-induced processes in new materials for electro-optical applications [7722-67]
R. Siebert, Friedrich-Schiller-Univ. Jena (Germany); A. Winter, Eindhoven Univ. of Technology (Netherlands); U. S. Schubert, Eindhoven Univ. of Technology (Netherlands) and Friedrich-Schiller-Univ. Jena (Germany); M. Schmitt, Friedrich-Schiller-Univ. Jena (Germany); B. Dietzek, J. Popp, Friedrich-Schiller-Univ. Jena (Germany) and Institut für Photonische Technologien e.V. (Germany)

**7722 20** Influence of particle plasmon resonance on the photoluminescence of organic semiconductor blend [7722-73]
F. Dou, C. Peng, H. Liu, J. Wang, S. Feng, X. Zhang, Beijing Univ. of Technology (China)

### POSTER SESSION: NONLINEAR OPTICS, HOLOGRAPHY, AND OPTICAL STORAGE

**7722 21** Polymer composites containing photochromic dye solution [7722-74]
M. Saito, K. Sakiyama, R. Mochizuki, K. Ohashi, Ryukoku Univ. (Japan)

**7722 22** Initiator system in holographic photopolymer materials [7722-75]
M. Ortuño, E. Fernández, R. Fuentes, S. Gallego, A. Márquez, Univ. de Alicante (Spain)

**7722 24** Towards a unifying theory for the first-, second-, and third-order molecular (non)linear optical response [7722-77]
J. Pérez-Moreno, Katholieke Univ. Leuven (Belgium); K. Clays, Katholieke Univ. Leuven (Belgium) and Washington State Univ. (United States); M. G. Kuzyk, Washington State Univ. (United States)

**7722 25** Light-sensitive organic systems and multilayer polymer structures for optical recording media [7722-78]
V. A. Barachevsky, O. I. Kobeleva, T. M. Valova, A. O. Ait, A. A. Dunaev, A. M. Gorelik, Photochemistry Ctr. (Russian Federation); M. M. Krayushkin, K. S. Levchenko, V. N. Yarovenko, Zelinsky Institute of Organic Chemistry (Russian Federation); V. V. Kyiko, Prokhorov General Physics Institute (Russian Federation); E. H. Grebennikov, Technomash, Ltd. (Russian Federation)

**7722 26** Multiphoton absorption in polydiacetylenes adsorbed on metal nanostructures [7722-79]
R. Pilot, R. Bazio, Consorzio ISTM (Italy) and Univ. degli Studi di Padova (Italy); A. Demartini, M. Alloisio, G. Dellepiane, Consorzio ISTM (Italy) and Univ. degli Studi di Genova (Italy); E. Giorgetti, Consorzio ISTM (Italy) and ISC-CNR (Italy)

**7722 28** Second-order nonlinear optical properties of zwitterionic chromophores [7722-81]
A. Teshome, I. Asselberghs, Katholieke Univ. Leuven (Belgium); D. J. Clarke, Industrial Research Ltd. (New Zealand); A. P. Middleton, Victoria Univ. of Wellington (New Zealand); M. D. H. Bhuiyan, Industrial Research Ltd. (New Zealand); G. J. Smith, Victoria Univ. of Wellington (New Zealand); A. J. Kay, Industrial Research Ltd. (New Zealand); K. Clays, Katholieke Univ. Leuven (Belgium)

**7722 29** Low polymerization-shrinkage nanoparticle-polymer composite films based on thiol-ene photopolymerization for holographic data storage [7722-82]
Y. Tomita, E. Hata, K. Omura, S. Yasui, The Univ. of Electro-Communications (Japan)
Z-scan characterization of nonlinear optical effects in polymer films incorporating hyperbranched polymer-metallic nanoparticle complex [7722-83]
X. Liu, Y. Tomita, The Univ. of Electro-Communications (Japan); K. Yasui, K. Kojima, K. Chikama, Nissan Chemical Industries, Ltd. (Japan)

Author Index
Conference Committee

Symposium Chairs
Francis Berghmans, Vrije Universiteit Brussel (Belgium)
Ronan Burgess, European Commission (Belgium)
Jürgen Popp, Institut für Photonische Technologien e.V. (Germany)
Peter Hartmann, SCHOTT AG (Germany)
Hugo Thienpont, Vrije Universiteit Brussel (Belgium)

Conference Chairs
Paul L. Heremans, IMEC (Belgium)
Reinder Coehoorn, Philips Research Nederland B.V. (Netherlands)
Chihaya Adachi, Kyushu University (Japan)

Program Committee
Heinrich Becker, Merck OLED Materials GmbH (Germany)
David Beljonne, Université de Mons-Hainaut (Belgium)
Paul W. M. Blom, TNO Science and Industry (Netherlands)
Herbert F. Boerner, Philips Research (Germany)
Donal D. C. Bradley, Imperial College London (United Kingdom)
Franco Cacialli, University College London (United Kingdom)
Gunther Haas, MicroOLED (France)
Alan J. Heeger, University of California, Santa Barbara (United States)
Richard H. Friend, University of Cambridge (United Kingdom)
Rene A. Janssen, Technische Universiteit Eindhoven (Netherlands)
Junji Kido, Yamagata University (Japan)
Guglielmo Lanzani, Politecnico di Milano (Italy)
Uli Lemmer, Universität Karlsruhe (Germany)
Karl Leo, Technische Universität Dresden (Germany)
Rainer F. Mahrt, IBM Zürich Research Laboratory (Switzerland)
William R. Salaneck, Linköping Universität (Sweden)
Niyazi Serdar Sariciftci, Johannes Kepler Universität Linz (Austria)
Paul van der Schaaf, Ciba Specialty Chemicals Holding, Inc.
(Switzerland)

Session Chairs
1 OLED Devices and Applications I
Paul L. Heremans, IMEC (Belgium)

2 Organic Lasers
Chihaya Adachi, Kyushu University (Japan)
3  OLED Physics and Modelling I  
Reinder Coehoorn, Philips Research Nederland B.V. (Netherlands) 

4  OPV Devices  
David Hartmann, Siemens AG (Germany) 

5  OLED Physics and Modelling II  
Matthew Roberts, Cambridge Display Technology Ltd. (United Kingdom) 

6  OLED Devices and Applications II  
Lambert Jan Anton Koster, Technische Universiteit Eindhoven (Netherlands) 

7  OPV Physics and Modelling II  
Wolfgang Brütting, Universität Augsburg (Germany) 

8  Materials and Photonic-Enhanced Materials I  
Michele Muccini, Istituto per lo Studio dei Materiali Nanostrutturati (Italy) 

9  Materials and Photonic-Enhanced Materials II  
Antonio F. Facchetti, Polyera Corporation (United States) 

10 OPV Physics and Modelling II  
Paul L. Heremans, IMEC (Belgium)