Advance Program

Organic Photonic Media, Devices & Applications

Monday, 23 July 2007

ALL SESSIONS WILL BE HELD IN ERIC HAUSER

9:00 AM - 10:00 AM

Session MD1: BINARY CHROMOPHORE GLASSES AND E-O POLYMERS
Session Chair: Iam Choon Khoo, *Pennsylvania State University, University Park, PA, USA*

MD1.1 9:00 AM - 9:30 AM (Invited)

An Extraordinary New Class of Electro-Optic Materials: Binary Chromophore Glasses, L. R. Dalton*, University of Washington, Seattle, WA, USA*

Binary chromophore organic glasses exhibit electro-optic activities of 300-500 pm/V together with optical loss of 2 dB/cm and glass transition temperatures of 200˚C. A theoretical analysis of intermolecular interactions leading to these properties is given.

MD1.2 9:30 AM - 10:00 AM (Invited)

Hybrid Electro-Optic Polymer Devices: Beating the Drive Voltage/Insertion Loss Trade-Off, R. A. Norwood*, University of Arizona, Tucson, AZ, USA*

We have developed a solution to the voltage/insertion loss tradeoff in electro-optic polymer modulators by adopting a hybrid geometry. We will discuss recent results in these devices, notably the achievement of r33 = 170pm/V in a phase modulator using an optimized sol-gel cladding.

10:00 AM – 10:30AM **COFFEE BREAK**

10:30 AM - 11:45 AM

Session MD2: LIQUID CRYSTALS FOR OPTICAL SWITCHING AND LASERS
Session Chair: Koen Clays, *Catholic University of Leuven, Leuven, Belgium*

MD2.1 10:30 AM - 11:00 AM (Invited)

Enhanced Band-Edge and Defect-Mode Effects of Laser Action in Chiral Liquid Crystals, M. Ozaki, Y. Matsuhisa, H. Yoshida, A. Fujii*, Osaka University, Suita, Osaka, Japan*, Y. Huang, Y. Zhou and S.-T. Wu*, University of Central Florida, Orlando, FL, USA*

Laser action and photon localization in chiral liquid crystal having a helicoidal periodic structure have been studied. Enhanced band-edge and defect-mode effects for laser action are also discussed.

MD2.2 11:00 AM - 11:30 AM (Invited)

Systematic Investigation of Nematic Liquid Crystal Mixtures at 30 GHz, F. Goelden, A. Lapanik, A. Gaebler, S. Mueller, W. Haase and R. Jakoby*, Technical University Darmstadt, Darmstadt, Germany*

In this paper various nematic liquid crystal mixtures are investigated at 30 GHz. The used cavity perturbation characterization method is capable to extract the permittivity and the dielectric losses precisely. Results are shown for this precision measurement scheme.

MD2.3 11:30 AM - 11:45 AM

Nanosecond – cw Visible-IR All-Optical Switching and Nonlinear Transmission with a Nonlinear Organic Optical Liquid in Bulk and Guided Wave Geometry, I. C. Khoo, A. Diaz, J. Liou, J. H. Park, M. Stinger*, Pennsylvania State University, University Park, PA, USA*, S. Wenster and E. W. Van Stryland*, University of Central Florida, Orlando, FL, USA*

We present the theoretical basis and experimental observations of multiple-time-scales all-optical switching operations enabled by an unusually versatile nonlinear organic liquid in bulk or guided wave devices designed for visible – infrared applications.

11:45 AM – 1:30PM **LUNCH BREAK**

1:30 PM - 3:00 PM

Session MD3: POLYMERIC THIN FILM TRANSISTOR, DATA STORAGE AND DISPLAY LASERS
Session Chair: Joseph W. Perry, *Georgia Institute of Technology, Atlanta, GA, USA*

MD3.1 1:30 PM - 2:00 PM (Invited)

Microstructure, Charge Transport and Trapping in Anisotropic Polymeric Thin Film Transistors, A. Salleo, L. H. Jimison, J. Rivnay*, Stanford University, Stanford, CA, USA* and M. F. Toney*, Stanford Synchrotron Radiation Laboratory, Menlo Park, CA, USA*

The performance of polymeric semiconductors is strongly dependent on their microstructure. We will use X-ray diffraction to correlate microstructure and charge transport in different polythiophenes. Modeling coupled with characterization indicates that transport is limited by intragap states.

MD3.2 2:00 PM - 2:15 PM

PQ-based Derivatives Doped PMMA Photopolymers for Holographic Data Storage, S.-H. Lin, Y.-N. Hsiao, and K. Y. Hsu, *National Chiao Tung University, Hsin-Chu, Taiwan, R.O.C.*

We report our investigation on several poly(methyl methacrylate)(PMMA) photopolymers doped with different 9,10-phenanthrenequinone based derivatives for holographic data storage. By introducing different kinds of the functional groups on the doped elements, we could tailor the holographic characteristics of the materials.

MD3.3 2:15 PM - 2:45 PM (Invited)

Polymeric Composite Materials for Optical Data Storage and Processing, F. Simoni, *Università Politecnica delle Marche, Ancona, Italy*, R. Castagna, *CNISM, Ancona, Italy*, L. Criante, O. Francescangeli, D. E. Lucchetta and F. Vita, *Università Politecnica delle Marche, Ancona, Italy*

Holographic patterning and optical characterization of one and two-dimensional periodic structures in novel composite materials is reported. Applications to devices for optical data storage and processing is envisaged.

MD3.4 2:45 PM - 3:00 PM

Self-Healing in Polymer Lasers and Two-Photon Absorbers, M. G. Kuzyk, Y. Zhu, J. Zhou and N. Embaye, *Washington State University, Pullman, WA, USA*

When most polymeric materials are exposed to intense light, they photo-degrade. We have observed that some materials recover their nonlinear-optical properties after a period of rest. In some cases, after this self-healing process, the material's optical performance is better and the resistance to photo-damage improved.

3:00 PM – 3:30 PM COFFEE BREAK

3:30 PM - 4:30 PM

Session MD4: PHOTOVOLTAIC, LIGHT EMITTING DIODE AND LASERS
Session Chair: Robert A. Norwood, *University of Arizona, Tucson, AZ, USA*

MD4.1 3:30 PM - 4:00 PM (Invited)

High-Performance Light-Emitting Diodes through Molecular Design and Interface Engineering, A. K.-Y. Jen, *University of Washington, Seattle, WA, USA*

ABSTRACT NOT AVAILABLE

MD4.2 4:00 PM - 4:30 PM (Invited)

Photodetection and Photovoltaic Properties of Polymer Composite Materials based on Pentacene and Carbon Nanotube, N. Cho, W. J. Kim, K.-S. Lee, *Hannam University, Daejon, Korea*, K. R. Choudhury, Y. Sahoo, T. Ohulchanskyy and P. N. Prasad, *State University of New York at Buffalo, Buffalo, NY, USA*

An IR active photodetector device consisting of poly(vinyl carbazole)(PVK), PbSe quantum dot and single-walled carbon nanotubes (SWCNT) has been constructed. Efficient collection of IR photons in our devices followed by fast charge transfer and enhanced conduction in the polymer and SWNT networks results in a maximum EQE of ~2.6%.

6:30 PM – 8:00 PM WELCOME RECEPTION - QUEEN MARIE BALLROOM

Tuesday, 24 July 2007

9:00 AM - 10:00 AM

Session TuD1: POLYMER RESONATORS, MICROFABRICATION AND OPTICAL PROCESSING
Session Chair: Theodore Goodson, *University of Michigan, Ann Arbor, MI, USA*

TuD1.1 9:00 AM - 9:30 AM (Invited)

Organic Materials for Optical Signal Processing and 3D Micro/Nanofabrication, J. W. Perry, J. M. Hales, S.-H. Chi, V. Chen, W. Haske, W. Dong, S. Zheng, Q. Zhang, S. Odom, S. Barlow and S. R. Marder, *Georgia Institute of Technology, Atlanta, GA, USA*

Organic materials with very large third-order nonlinearities, that are promising for all-optical switching, have been developed. Additionally, advances in multiphoton lithography have allowed the fabrication of 3D structures with linewidths as small as 65 nm.

TuD1.2 9:30 AM - 9:45 AM

High 'Intrinsic' First Hyperpolarizability by Modulating the Conjugation Path between Donor and Acceptor, K. Clays, J. Pérez-Moreno, *Catholic University of Leuven, Leuven, Belgium*, Y. Zhao, *Chinese Academy of Sciences, Beijing, Beijing, China* and M. G. Kuzyk, *Washington State University, Pullman, WA, USA*

We report on a series of chromophores that have been synthesized with a modulated conjugation path betweendonor and acceptor. Hyper-Rayleigh scattering measurements of the best molecule show an enhanced intrinsic hyperpolarizability that breaches the apparent limit of all previously studied molecules.

TuD1.3 9:45 AM - 10:00 AM

Systematic Design and Simulation of Polymer Microring Resonators with the Combination of Beam Propagation Method and Matrix Model, H. Sun, L. R. Dalton, and A. Chen, *University of Washington, Seattle, WA, USA*

A general design and simulation methodology for microring resonator devices is proposed. The coupler and ring regions are characterized by transfer matrix model and the matrix elements are extracted with beam propagation method simulations.

10:00 AM – 10:30 AM COFFEE BREAK

10:30 AM - 11:30 AM

Session TuD2: Molecular Wire, Two-Photon Absorption and Photonic Superlattices and Integrated Optics
Session Chair: Iam Choon Khoo, *Pennsylvania State University, University Park, PA, USA*

TuD2.1 10:30 AM - 10:45 AM

Entangled and Correlated Two-Photon Absorption Effects of an Organic Material, D.-I. Lee and T. Goodson, *University of Michigan, Ann Arbor, MI, USA*

Quantum two-photon absorption effect of an organic material, porphyrin dendrimer, is demonstrated by using entangled photon pairs with comparison to the property of quantum correlated photons that are produced from the spontaneous parametric down-conversion process.

TuD2.2 10:45 AM - 11:15 AM (Invited)

Porphyrin-Based Molecular Wires, H. L. Anderson, *University of Oxford, Oxford, UK*

Conjugated porphyrin oligomers exhibit extraordinary nonlinear optical properties, such as strong two-photon absorption, non-linear refraction and reverse-saturable absorption. This presentation will illustrate how supramolecular self-assembly can be used to control the photophysics of these pi-systems.

TuD2.3 11:15 AM - 11:30 AM

Spectral Narrowing of Emission in Self-Assembled Colloidal Photonic Superlattices, K. Clays, K. Baert and R. A. L. Vallée, *Catholic University of Leuven, Leuven, Belgium*

We report on the influence of a well-designed passband in the stopband of a suitably engineered self-assembled colloidal photonic superlattice on the steady-state and time-resolved emission properties of infiltrated fluorophores.

Attendees are encouraged to go to **Colonel Lindbergh** for the conclusion of the **Joint Session on Imprinting and Biophotonics: Nano-Bio-Integrated Optics**

TuB2.4 11:30 AM - 11:45 AM

Combined Nanoimprint and Photolithography of Integrated Polymer Optics, M. B. Christiansen, M. Schøler, M. Gersborg-Hansen and A. Kristensen, *Technical University of Denmark, Lyngby, Denmark*

We demonstrate wafer-scale fabrication of integrated polymer optics, combining active and passive polymer optical components with nm to mm features, by combined nanoimprint and photolithography (CNP) in SU-8 resist. Distributed feed-back (DFB) polymer dye lasers are integrated with polymer waveguides.

TuB2.5 11:45 AM - 12:00 PM

Fabrication and Characterization of Organic Solid-State Lasers using Imprint Technologies, M. Punke, M. Stroisch, T. Woggon, A. Pütz, M. P. Heinrich, M. Gerken, U. Lemmer, *University of Karlsruhe, Karlsruhe, Germany*, M. Bruendel, *Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany*, D. G. Rabus, *University of California - Santa Cruz, Santa Cruz, CA, USA*, J. Wang and T. Weimann, *Physikalisch-Technische Bundesanstalt, Braunschweig, Germany*

The fabrication of organic solid-state lasers by means of thermal and UV nanoimprint technologies is demonstrated.In combination with the deep-UV modification of PMMA the coupling of organic laser light into polymer waveguides is shown.

TuB2.6 12:00 PM - 12:30 PM (Invited)

Photonic Integrated Circuits Fabricated by Deep UV and Hot Embossing, M. Bruendel, Y. Ichihashi, J. Mohr, *Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany*, M. Punke, *University of Karlsruhe, Karlsruhe, Germany*, D. G. Rabus, *University of California - Santa Cruz, Santa Cruz, CA, USA*, M. Worgull and V. Saile, *Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany*

We review our work in the field of deep UV modification of methacrylate-based polymers. Planar and rib waveguide structures are presented. A method of integrating polymer waveguides with organic light sources into all-polymer systems is shown.

12:30 PM – 1:30 PM LUNCH BREAK

1:30 PM - 3:00 PM

Session TuB3: Joint Session on Imprinting and Biophotonics and OPM: Polymer Waveguides
Session Chair: TBD

TuB3.1 1:30 PM - 2:00 PM (Invited)

Micro/Nano-Imprinting of Polymer Optical Waveguides for Optical Printed Circuit Board (O-PCB) Fabrication, E.-H. Lee*, Inha University, Nam-ku, Incheon City, Korea*

We report on the thermal and ultraviolet imprinting of micro/nano-scale polymer optical waveguides for the fabrication of optical printed circuit board (O-PCB) in hard and flexible forms of generic and application-specific nature.

TuB3.2 2:00 PM - 2:30 PM (Invited)

Fabrication of Replicated Polymer Optical Waveguide, Y. Tatara and H. Hosokawa*, OMRON Co., Ltd., Kizugawa-city, Kyoto, Japan*

The manufacturing technology of polymer optical waveguide called SPICA(Stacked Polymer optical IC/Advanced) utilizing our unique replication process and the results of the applications(single-mode waveguide and film waveguide) are presented.

TuB3.3 2:30 PM - 2:45 PM

UV-Embossed Polymer Optical Bench for Integration of Polymer Waveguide Devices, J.-T. Kim, J. J. Ju, S. Park, S. K. Park, M.-S. Kim, *Electronics & Telecommunications Research Institute, Daejeon, Korea* and M.-H. Lee*, Sungkyunkwan University, Suwon, Korea*

For optical-electrical (O/E) integration of polymer waveguide devices, a polymer optical bench with embedded-electric-circuits was developed and realized by using the UV-embossing technology. An upside-down mounted polymer waveguide device showed not only more efficient fiber-chip coupling but also a good electrical contact.

TuB3.4 2:45 PM - 3:00 PM

Monitoring Fluorescence in Cultured Neural Networks using Polymer Waveguide Excitation, R. A. Seger, D. G. Rabus*, University of California - Santa Cruz, Santa Cruz, CA, USA*, Y. Ichihashi, M. Bruendel*, Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany*, J. Hieb and M. S. Isaacson*, University of California - Santa Cruz, Santa Cruz, CA, USA*

We present fluorescence excitation of cultured living neural cells using integrated optical waveguides. The waveguides (width 5, 7, 9 μm) are fabricated in polymethylmethacrylate (PMMA) using deep ultraviolet radiation. The excitation wavelength is 473 nm.

3:00 PM – 3:30 PM **COFFEE BREAK**

End of Program