

Prof. Seunghyup Yoo

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Education

University of Arizona / College of Optical Sciences August 1999 – August 2005
Tucson, AZ, USA **Ph.D.***
Dissertation title: Organic Solar Cells Based on Liquid Crystalline and Polycrystalline Thin Films
* MS in Optical Sciences awarded on Dec. 2001. (Thesis not required)

Seoul National University (SNU) / Physics March 1996 – February 1998
Seoul, Korea **Master of Science**
Thesis title: Spectroscopic Velocimetry for Cold ⁸⁵Rb Atoms Using Stimulated Optical Compton Scattering

Seoul National University (SNU) / Physics March 1990 – February 1996
Seoul, Korea **Bachelor of Science**

Employment

Korea Advanced Institute of Science and Technology (KAIST)/Electrical Engineering* August 2006 – Present†
Daejeon, South Korea **Associate Professor**

* Adjunct professor in Dept. of Chemistry, and in KI- NanoCentury
* Visiting professor, IAPP, TU Dresden, Germany (Aug. 2011-Aug. 2012)
† **Promoted from Assistant Prof. in March, 2010.**

Georgia Institute of Technology / Electrical & Computer Engineering August 2003 – July 2006
Atlanta, GA, USA **Research Scientist**

Research under the guidance of Prof. Bernard Kippelen, in the area of organic electronics. Work focused on the fabrication, characterization, and modeling of optical and electronic devices based on thin films of organic small molecules and polymers with emphasis on organic solar cells *

* **Part of the work (2003-2005) overlaps with Ph. D education. The whole research group migrated from U. of Arizona to Georgia Tech on 2003.**

Lumoflex, LLC October 2004 – July 2006
Atlanta, GA, USA **Research Engineer**

Work focused on commercialization aspects of organic electronic devices.

Professional Activities

- Director, **Samsung Display Corp. (SDC) KAIST Display Research Center** (2011 – present)
- Associate Editor, **Optics Express/ Energy Express** (2012 – present)
- Member, **OSA / IEEE / MRS / SPIE/ KIDS/ KSOE**
- Secretary of Academic Affairs, **Korean Society of Optoelectronics (KSOE)**
- Committee member of **Korea Information Display Society (KIDS)**, International Relations

Awards

- **Outstanding scholar award** (KAIST, 2012. 2)
- **Best lecturer award** (KAIST, 2007. 2)
- **Best/outstanding paper award** (by advisee)
 - KIDS Gold Award (IMID, Daegu, Korea, 2013)
 - '12 International Workshop on Flexible and Printed Electronics (IWFPE, Muju, Korea, 2012)
 - 10th Flexible Electronics & Displays Conference (2011 Flex, Phoenix, Arizona, USA, 2011)
 - '10 International Workshop on Flexible and Printed Electronics (IWFPE, Muju, Korea, 2010)

- '10 International Display Workshop (IDW, Fukuoka, Japan, 2010)
- '09 International Workshop on Flexible and Printed Electronics (IWFPE, Muju, Korea, 2009)
- '09 International Meeting on Information Displays (IMID, Ilsan, Korea, 2009)
- The 19th International Photovoltaic Sci. and Eng. Conference (PVSEC-19, Jeju, Korea, 2009)

Teaching Efforts

- New Courses Developed :
 1. **Introduction to Organic Electronics** [Graduate/Undergrad.]
 2. **Green Energy Electronics** [Undergrad.]
 3. **Display Optics** (Special topics in Physical Electronics) [Graduate]
- Senior Undergrad Experiment/Design Topic Developed: **OLED Optical Design**

Selected Publications

Journals

- H. Moon, H. Cho, M. Kim, K. Takimiya, S. Yoo,* "Towards Colorless Transparent Organic Transistors: Potential of Benzothieno[3,2-b]benzothiophene based Wide-gap Semiconductors", **Adv. Mater.** 26 (2014) (In Press, Available online at : <http://dx.doi.org/10.1002/adma.201305440>)
- H. Kim, S. Lee, D. Han, S. Yoo, "High-density organic photovoltaic modules: Mask-free fabrication using nozzle jet printing and oblique deposition", **Sol. Ener. Mat. Sol. Cells**, 120, 561-565, (2014)
- S. Lee, J. Lee, H. Lee, Y.J. Yuk, M. Kim, H. Moon, J. Seo, Y. Park, J. Y. Park, S. H. Ko, S. Yoo,* "Overcoming the "retention vs. voltage" trade-off in nonvolatile organic memory: Ag nanoparticles covered with dipolar self-assembled monolayers as robust charge storage nodes", **Org. Elect.**, 14 (12), pp.3260-3266, (2013)
- H. W. Chang, J. Lee, T. W. Koh, S. Hofmann, S. Yoo,* C.C. Wu,* K. Leo,* M.C. Gather,* B. Luessem, "Bi-directional organic light-emitting diodes with nanoparticle-enhanced light outcoupling", **Laser & Phot. Reviews**, 7 (6), 1079-1087, (2013)
- Changsoon Cho, Hoyeon Kim (Co-first), Seonju Jeong, Se-Woong Baek, Ji-Won Seo, Donggeon Han, Kyoo Hyun Kim, YongKeun Park, Seunghyup Yoo,* Jung-Yong Lee,* "Random and V-groove texturing for efficient light trapping in organic photovoltaic cells," **Sol. Ener. Mat. Sol. Cells**. 115, 36-41 (2013).
- Hanul Moon, Dongmo Im, Seunghyup Yoo, "Controlling the Threshold Voltage of Organic Thin-Film Transistors by Transition Metal Oxides," **IEEE Electron Dev. Lett.** 34(8), 1014-1016 (27-Jun-2013)
- Chung Sock Choi, Dong-Young Kim, Sung-Min Lee, Myung Sub Lim, Kyung Cheol Choi,* Hyunsu Cho, Tae-Wook Koh, Seunghyup Yoo, "Blur-Free Outcoupling Enhancement in Transparent Organic Light Emitting Diodes: A Nanostructure Extracting Surface Plasmon Modes," **Adv. Opt. Mater.** 1(10), 687-691 (2013)
- Jeongho Yeon, Tae-Wook Koh (Co-first), Hyunsu Cho, Jin Chung, Seunghyup Yoo,* Jun-Bo Yoon,* "Actively transparent display with enhanced legibility based on an organic light-emitting diode and a cholesteric liquid crystal blind panel," **Opt. Express** 21 (8), 10358-10366 (2013)
- Donggeon Han, Soohyun Lee, Hoyeon Kim, Seonju Jeong, Seunghyup Yoo,* "Cathodic multilayer transparent electrodes for ITO-free inverted organic solar cells," **Org. Electron.** 14 (6), 1477-1482 (2013)
- Ju Min Lee, Byoung-Hwa Kwon, Hyung Il Park, Hoyeon Kim, Min Gyu Kim, Ji Sun Park, E Su Kim, Seunghyup Yoo, Duk Young Jeon, and Sang Ouk Kim, "Exciton Dissociation and Charge Transport Enhancement in Organic Solar Cells with Quantum Dot/N-doped CNT Hybrid Nanomaterials," **Adv. Mater.** 25 (14), 2011-2017 (Back Cover) (2013)
- Changhun Yun, Jungmin Choi, Hyun Wook Kang, Mincheol Kim, Hanul Moon, Hyung Jin Sung, and Seunghyup Yoo,* "Digital-mode organic vapor-jet printing (D-OVJP): advanced jet-on-demand control of organic thin-film deposition," **Adv. Mater.** 24 (21), 2857-2861 (2012).
- Tae-Wook Koh , Hyunsu Cho, Changhun Yun, Seunghyup Yoo,* "ITO-free down-conversion white organic light-emitting diodes with structured color conversion layers for enhanced optical efficiency and color rendering," **Org. Electron.** 13 (12), 3145-3153 (2012).
- Jungmin Choi, Tae-Wook Koh, Soohyun Lee, and Seunghyup Yoo,* "Enhanced light extraction in organic light-emitting devices: using conductive low-index layers and micropatterned indium tin oxide electrodes with optimal taper angle," **App. Phys. Lett.** 100, 233303 (2012)
- Jun Ha Park, Tae-Wook Koh, Youngkyu Do,* Min Hyung Lee,* Seunghyup Yoo,* "Soluble polynorbornenes with pendant carbazole derivatives as host materials for highly efficient blue phosphorescent organic light-emitting diodes," **J. Pol. Sci. Part A: Pol. Chem.** 50 (12), 2356-2365 (2012, June 15) [selected as an inner cover article]

- Sooyeon Lim, Donggeon Han, Hoyeon Kim, Soohyun Lee, and Seunghyup Yoo,* "Cu-based multilayer transparent electrodes: A low-cost alternative to ITO electrodes in organic solar cells," **Sol. Ener. Mater. & Sol. Cells** 101, 170-175 (2012)
- Hyunsu Cho and Seunghyup Yoo,* "Polarizer-free, high-contrast inverted top-emitting organic light emitting diodes: effect of the electrode structure," **Optics Express** 20(2), 1816-1824 (Jan-16-2012)
- Dongmo Im, Hanul Moon, Minchul Shin, Joung-ho Kim, and Seunghyup Yoo,* "Towards gigahertz operation: ultrafast low turn-on organic diodes and rectifiers based on C₆₀ and tungsten oxide," **Adv. Mater.** 23 (5), 644-648 (Feb-1-2011)
- Ju Min Lee, Ji Sun Park, Sun Hwa Lee, Hoyeon Kim, Seunghyup Yoo,* and Sang Ouk Kim,* "Selective Electron- or Hole-Transport Enhancement in Bulk-Heterojunction Organic Solar Cells with N- or B-Doped Carbon Nanotubes," **Adv. Mater.** 23 (5), 629-633 (Feb-1-2011)
- H. Cho, J. Choi, and S. Yoo,* "Highly transparent organic light-emitting diodes with a metallic top electrode: the dual role of a Cs₂CO₃ layer," **Optics Express** 19(2), 1131-1121 (Jan-17-2011)
- C. Yun, M. Kim, S. W. Lee, H. Moon, S. Park, J. B. Koo, J. W. Kim, I.-K. You, and S. Yoo,* "High-performance pentacene thin-film transistors fabricated by printing technology," **IEEE Elec. Dev. Lett.** 32 (10) 1454-1456 (Oct. 2011)
- T.-W. Koh, J.-M. Choi, S. Lee, and S. Yoo,* "Optical outcoupling enhancement in organic light-emitting diodes: highly conductive polymer as a low-index layer on microstructured ITO electrodes," **Adv. Mater.** 22, 1849-1853 (2010)
- H. Cho, C. Yun, and S. Yoo,* "Multilayer transparent electrode for organic light-emitting diodes: tuning its optical characteristics," **Optics Express**, 18 (4), 3404-3414 (2010)
- C. Yun, H. Moon, H. W. Kang, M. Kim, H. J. Sung, and S. Yoo,* "High Performance Pentacene Thin-Film Transistors Fabricated by Organic Vapor-Jet Printing," **IEEE Electron. Dev. Lett.** 31 (11), 1305-1307 (2010)
- D. Han, H. Kim, S. Lee, M. Seo, and S. Yoo,* "Realization of efficient semitransparent organic photovoltaic cells with metallic top electrodes: utilizing the tunable absorption asymmetry," **Optics Express**, 18 (104), A513-A521 (2010)
- S. Han, S. Lim, H. Kim, H. Cho, and S. Yoo,* "Versatile multilayer transparent electrodes for ITO-free and flexible organic solar cells," **IEEE J. Sel. Topics in Quant. Elect.** 16 (6) 1656-1664 (2010)
- H. Cho, C. Yun, J.-W. Park, and S. Yoo,* "Highly flexible organic light-emitting diodes based on ZnS/Ag/WO₃ multilayer transparent electrodes," **Org. Electron.** 10, 1163-1169 (2009)
- C. Yun, H. Cho, H. Kang, Y. M. Lee, Y. Park, and S. Yoo,* "Electron injection via pentacene thin films for efficient inverted organic light-emitting diodes," **Appl. Phys. Lett.** 95, 053391 (2009)
- S. Han, W. S. Shin, M. Seo, D. Gupta, S.-J. Moon, and S. Yoo,* "Improving performance of organic solar cells using amorphous tungsten oxides as an interfacial buffer layer on transparent anodes," **Org. Electron.** 10, 791-797 (2009)
- Dipti Gupta*, Namho Jeon, and Seunghyup Yoo,* "Modeling the electrical characteristics of TIPS-pentacene thin-film transistors: Effect of contact barriers, field-dependent mobility, and traps," **Org. Electron.** 9, 1026-1031 (2008)
- Dipti Gupta, Manish Anand, Seong-Wan Ryu, Yang-Kyu Choi,* and Seunghyup Yoo,* "Non-volatile memory based on sol-gel ZnO TFTs with Ag nanoparticles embedded in the ZnO/ gate insulator interface," **Appl. Phys. Lett.** 93, 224106 (2008)
- Seunghyup Yoo, William J. Potscavage Jr., Benoit Domercq et al. , "Analysis of improved photovoltaic properties of pentacene/C₆₀ organic solar cells: Effects of exciton blocking layer thickness and thermal annealing," **Sol.-State Electronics.**, 51(10), 1367, 2007
- W. J. Potscavage, S. Yoo, B. Domercq, and B. Kippelen,* "Encapsulation of pentacene/C₆₀ organic solar cells with Al₂O₃ deposited by atomic layer deposition," **Appl. Phys. Lett.** 90, 253511 (2007)
- S. Yoo, W. J. Potscavage, B. Domercq, J. Kim, J. Holt, and B. Kippelen,* "Integrated organic photovoltaic modules with a scalable voltage output," **Appl. Phys. Lett.** 89, 233516 (2006).
- S. Yoo, B. Domercq, and B. Kippelen,* "Intensity-dependent equivalent circuit parameters of organic solar cells based on pentacene and C₆₀," **J. Appl. Phys.** 97, 103706 (2005).
- S. Yoo, B. Domercq, and B. Kippelen,* "Efficient thin-film organic solar cells based on pentacene/C₆₀ heterojunctions," **Appl. Phys. Lett.** 85, 5427 (2004).

Book Chapter

- S. Yoo, J.-Y. Lee, and H. Kim, "Electrodes in Organic Solar Cells," in **Handbook of Organic Solar Cells: Materials, Design, and Production** edited by B. P. Rand and Henning Richter (to be published)
- B. Kippelen, S. Yoo, J. A. Haddock, B. Domercq, S. Barlow, B. Minch, W. Xia, S. R. Marder, and N. R. Armstrong, "Liquid-Crystal Approaches to Organic Photovoltaics," in **Organic Photovoltaics: Mechanism, Materials, And Devices** edited by S.-S. Sun and N. S. Sariciftci, CRC Press (June 30, 2005)

Invited Talks and Lectures (Selected)

- "Solvent-free, Jet-on-demand Printing of Organic Materials: Digital-mode Organic Vapor-jet Printing," International Conference on Advanced Electromaterials (**ICAE 2013**) (2013. 11, Jeju, Korea)
- "Light management toward efficient organic solar cells," **Renewable Energy and the Environment 2013** (Optical Instrumentation for Energy and Environmental Applications by OSA) (2013. 11, Tucson, AZ, USA)
- "Device Architecture for Outcoupling Enhancement in Organic Light-Emitting Diodes," **ADMD 2013** (2013. 6. Shanghai, China)
- "Organic electronic devices: from device engineering to solvent-free digital printing of organic patterns," **A-COE 2012** (2012. 12, Yamagata, Japan)
- "Outcoupling enhancement in OLEDs enabled by microstructured ITO covered with a conductive low-index layer," **IWFPE 2012** (2012. 11. 14-16, Muju, Korea)
- "Efficient ITO-free down-conversion white OLEDs with a good color rendering property," (**OSA SOLED 2012**, Eindhoven, Netherland 2012.11.14)
- "Light management for enhanced characteristics of organic devices," (International Discussion & Conference on Nano Interface Controlled Electronic Devices (**IDC-NICE 2012**), Kyungju, 2012.10.24-27)
- "Fullerene C60-based organic electronics: application to high-speed rectifier and non-volatile memory," **ENGE 2012** (Jeju, 2012. 9. 17)
- "Transparent electrode engineering: application to white OLEDs," **SPIE Annual Meeting**, San Diego, US (2012. 8.)
- "Enhancing outcoupling efficiency of OLEDs: opportunities from conductive low-index layers," (Large-area, Organic & Printed Electronics Convention (**LOPE-C**), Munich, Germany, 2012. 6. 19-21)
- "Research activities in Integrated Organic Electronics Lab (IOEL)," **U. Augsburg** (Augsburg, Germany, 2012. 6. 19)
- "Dielectric-metal-dielectric multilayer transparent electrodes for versatile transparent organic electronics," (**Photonics Europe**, Brussels, Belgium 2012. 4. 16-19)
- "Organic solar cells: from fundamentals to practical issues" (**ICAMD 2011**, Jeju, Korea, 2011. 12. 7)
- "Polarizer-free high-contrast organic light-emitting diodes" (**SPIE Annual Meeting**, San Diego, US 2011. 8.)
- "Conductive Low-Index Layer: A New Opportunity For Outcoupling Enhancement In OLEDs," (**OSA SOLED 2011**, Austin, TX, USA 2011.11.2-3)
- "Strategies toward efficient see-through organic solar cells Based on metal-based multilayer transparent electrodes," (**ICSGCE 2011**, Chendu, China, 2011.9.28-29)
- "Solvent-free printing of organic semiconductors for high-performance organic electronics with a good scalability" (**KCS** (대한화학회) Meeting, 2011. 4. 28-29, Jeju, Korea)
- "Ultrafast organic rectifier with a very low voltage drop," **A-COE 2010** (2010. 11, Seoul, Korea)
- "Electrode engineering for efficient, versatile organic electronics," **Georgia Institute of Technology** (Atlanta, GA, 2010. 10. 22)
- "A novel anode structure based on a conductive low-index layer for outcoupling enhancement in OLEDs," (**IMID**, Ilsan, Korea, 2010. 10)
- "Conductive low-index layer: a new opportunity for outcoupling enhancement in OLEDs," **ADMD** (2010.6.24-25, Daegu, Korea)
- "Multilayer transparent electrodes for organic photovoltaics," **IWFPE 2010** (2010. 9, Muju, Korea)
- "Optimized dielectric-metal-dielectric transparent electrodes for highly flexible and ITO-free organic devices," Workshop on thin films and plasma processes for flexible electronics in **AEPSE 2009** (2009. 9. 20-25, Busan, Korea)
- "Toward flexible and ITO-free organic solar cells," **International Workshop on EEWs 2009** (2009. 9. 22-23, Daejeon Conv. Ctr., Korea)
- "A novel electron injection layer and multilayer top anodes for efficient top-emitting inverted organic light-emitting diodes," **The Polymer Society of Korea Fall Meeting** (2009. 10. 7-9, GIST, Gwang-Ju, Korea; Domestic Conf.)
- "Versatile multilayer electrodes for flexible / ITO-free organic light-emitting diodes (OLEDs) and photovoltaic cells (OPVs)," **University of Arizona** (Feb. 2, 2009, Tucson, AZ, USA)
- "Multilayer transparent electrodes for flexible and inverted-geometry OLEDs," **IMID '08** (Oct.16, 2008, Ilsan, Korea)
- "Research trends in organic photovoltaic cells: from the perspectives of improving efficiencies and commercial viability," **KI-Eco Energy, KAIST** (May 28, 2008)
- Seunghyup Yoo (Invited), "Organic Electronics: Viable Alternatives," **Dept. of Material Sciences, KAIST** (Apr. 8, 2008)

- Seunghyup Yoo (Invited), "Key Engineering Factors in Organic Solar Cells: Examples of Pentacene/C₆₀ and P3HT:PCBM- Cells," **ETRI** (Aug. 23, 2007, Daejeon, Korea)
- "Key Engineering Factors in Organic Solar Cells: Towards Real-World Applications," **Chonnam Nat'l Univ.** (Apr. 26, 2007, Kwangju, Korea)
- "High voltage-output organic photovoltaic modules based P3HT:PCBM cells," **Forum on Molecular Electronics Materials and Devices** (Workshop on molecular electronic materials and devices) (Jan 31, 2007, Jeju, Korea)
- "Organic Solar Cells: Towards Real-World Applications," **POSTECH Univ.** (Nov. 3, 2006, Pohang, Korea)
- "Organic photovoltaic cells containing discotic liquid crystalline phthalocyanines," **SPIE Annual Meeting** (2004, 8. San Diego).

Registered Patents (selected)

- Seunghyup Yoo, Hanul Moon, "Organic Thin-Film Transistor and Manufacturing Method thereof," 10-1363255 (Korea, 2014.02.06)
- Seunghyup Yoo, Hyunsu Cho, Jungmin Choi, "Organic light emitting device and display apparatus comprising the organic light emitting device," 10-1331973(Korea, 2013. 11.15)
- Sung-Hun Lee, Chang-Woong Chu, Gwan-Hyoung Lee, Seunghyup Yoo, Tae-Wook Koh, Jung-Min Choi, "Organic light emitting device and display apparatus comprising the organic light emitting device," 08410477 (USA, 2013. 4. 2), 10-1074804 (Korea, 2011.10.12)
- Seunghyup Yoo, Hoyeon Kim, DongGeon Han, "Organic Solar Cell Module using Metal-Based Multilayer Transparent Electrode and Manufacturing the same," 10-1160984 (Korea, 2012.06.22)
- Seunghyup Yoo, Myungsu Seo, DongGeon Han, Sooyeon Lim, Soohyun Lee, Hoyeon Kim, "Tandem type solar cell comprising organic photoelectric conversion material," 10-1113007 (Korea, 2012.01.31)
- Seunghyup Yoo, Seungchan Han, Myungsoo Seo, "Multi-functional electronic device based on transparent organic light emitting diode (OLED) display placed on top of solar cells and the manufacturing method thereof," 10-1036356 (Korea, 2011. 5. 23)
- Seunghyup Yoo, Changhun Yun, Hyunsu Cho, "Highly flexible transparent conductive film, and transparent electrodes and organic electronic device using the same," 10-1051662 (Korea, 2011.07.19)
- Seunghyup Yoo, Changhun Yun, Hyunsu Cho, "Organic dry jet printing head, and printing device and method using the same," 10-1055606 (Korea, 2011.08.03) ; 2180079 (Europe, 2012. 2. 8); 5000680 (Japan, 2012. 5. 25)
- Sang Ouk Kim, Seunghyup Yoo, Ju Min Lee, "Optoelectronic devices, solar cells containing nano-structured materials and fabrication methods thereof," 1187630 (Korea, 2012. 09.26)
- Sung-Hun Lee, Chang-Woong Chu, Gwan-Hyoung Lee, Seunghyup Yoo, Tae-Wook Koh, "Organic light emitting device and display apparatus comprising the organic light emitting device," 10-1084178 (Korea, 2011.11.10)
- Seunghyup Yoo, Dongmo Im, Hanul Moon, "Organic diode," 10-1087702 (Korea, 2011. 11. 22)
- Kyung-Cheol Choi, Seong-Min Lee, and Seunghyup Yoo et al., "Display apparatus," 0956979, (Korea, 2010. 5. 3)
- J.-W Park, Seunghyup Yoo, "Thin Film Transistor Including Titanium Oxides as Active Layer and Method of Manufacturing the Same", 7768042, (USA, 2010. 8. 3); 0930057 (Korea, 2007. 11. 27)
- Seunghyup Yoo, Tae-Wook Koh, and Sunghee Park, "Transparent organic light emitting diode backlight unit and transparent full color liquid crystal display using thereof," 0932239, (Korea, 2009. 12. 8)