

more than printing

**Digital Fabrication
and Digital Printing**

NIP30

September 7 - 11, 2014
Philadelphia, Pennsylvania

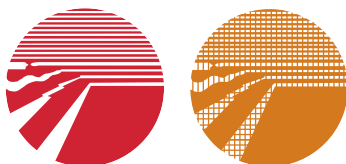


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General Chair: Branka Lozo, University of Zagreb

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Technical and Social Program

All papers are oral unless marked as focal or interactive. Program is subject to change.

See page 11 for details on Sunday's Short Course Program, which runs from 8:00 AM to 5:45 PM and offers 15 classes in a wide range of topics.

SPECIAL EVENT: WELCOME RECEPTION

Kick off the conference by meeting friends and colleagues Sunday evening.

Sunday, September 7th

5:45 – 7:00 PM

Sheraton Philadelphia Downtown

Monday September 8, 2014

ALL TRACKS

OPENING CEREMONY AND KEYNOTE

Session Chair: Masahiko Fujii, Fuji Xerox Co., Ltd.

9:00 – 10:10 AM

Super-Fine Ink-Jet Printing as a Novel Direct

Patterning Process, Kazuhiro Murata,

SIJTechnology, Inc. (Japan)

PRINTING TECHNOLOGY I

INK JET: THE HEAD

Session Chairs: Abu Islam, Xerox Corporation; Werner

Zapka; Xaarjet AB; and Mineo Kaneko, Canon, Inc.

10:45 AM – 12:45 PM

High Quality, High Speed, Next-Generation Inkjet Technology with Scalability from Serial Printheads to Lineheads (Focal), Shunsuke Watanabe, Satoshi Oguchi, Shunya Fukuda, Yuma Fukuzawa, and Satoru Hosono, Seiko Epson Corporation (Japan)

Development of New Inkjet Head Applying MEMS Technology and Thin Film Actuator, Kenji Mawatari, Koich Sameshima, Mitsuyoshi Miyai, and Shinya Matsuda, Konica Minolta, Inc. (Japan)
New Print Head Technology for High Productivity and Stability, Yoshinori Domaie, Yuki Yamamura, Satoshi Horiguchi, and Masao Tachibana, SII Printek Incorporated (Japan)

A Novel Method for Stable Control of Drop Volume with Constant Nozzle Radius in Thermal Inkjet Systems, Aaron Fulton, J. William Boley, Nikhil Bajaj, and George T.-C. Chiu, Purdue University (USA)
A New "Edge-Shooter" Actuator: A New Compact Design (Focal), Angus Condie, James Arnold, Phil Mead, and Ian Starling, Xaar plc (UK)

MONDAY KEYNOTE

Super-Fine Ink-Jet Printing as a Novel Direct Patterning Process, Kazuhiro Murata, SIJTechnology, Inc. (Japan)

The ink jet method is an effective process for depositing functional material in a required place. But normal ink jet technology has a resolution limitation of a few tenths of a micrometer. We have developed a super-fine ink-jet technology (SIJ) that enables the ejection of a fine dot, less than 1 μm in diameter. By using a wide variety of inks—for example, nano-metals, semiconductors, light emitting polymers, and bio-materials—direct fabrication of circuits and three-dimensional structures having a feature size of just a few microns is achieved. The potential of SIJ technology and its application to cutting-edge areas, such as flexible electronics, printed electronics, fine interconnect, and others, is discussed.

INK JET PROCESS AND SIMULATION I

Sponsored by Xaar plc

Session Chairs: Frits Dijkman, University of Twente, and

Kye-Si Kwon, Soonchunhyang University

2:00 – 3:30 PM

Jetting Complex Fluids Containing Pigments and Resins (Focal), Steve Hoath,^{1,2} Tri Tuladhar,⁴ Damien Vadillo,² Simon Butler,¹ Malcolm Mackley,¹ Claire McIlroy,³ Oliver Harlen,³ Wen-Kai Hsiao,¹ and Ian Hutchings¹; ¹University of Cambridge, ²AkzoNobel RDI, ³University of Leeds, and ⁴Trijet Ltd (UK)

Relationship between Jetting Performance and Surface Tension in Micro Second Order on Water based Inkjet Ink, Kaname Mitsuyoshi, Isao Tsuru, and Daisuke Hamada, Kao Corporation (Japan)
Meniscus Shape Effect on Multiple Drop Speed in Piezo Ink Jet, Megumi Takada, Dainippon Screen Manufacturing Company, Ltd. (Japan)
Inkjet Investigation of Interaction between Droplet Jets and Couette Flow, Dan Barnett, FUJIFILM Dimatix, Inc. (USA)

COLLEAGUE CONNECTIONS: MONDAY ROUNDTABLE DISCUSSIONS

4:15 – 5:45 PM

see details, page 3

PRINTING TECHNOLOGY II ELECTROPHOTOGRAPHY PROCESS AND DEVICES *Sponsored by Ricoh Company, Ltd.*

Session Chairs: Ligia Bejat, Lexmark International, Inc.;

Lode Deprez, Xeikon Manufacturing NV; Nobuyuki Nakayama, Fuji Xerox Co., Ltd.; and Yoshihiro Hattori, Konica Minolta Business Technologies, Inc.

10:45 AM – 2:50 PM

Xeikon Trillium: The Next Generation of High Quality, High Speed, and Low Cost Sustainable Digital Printing (Focal), *Lode Deprez, Werner Op de Beeck, Wim Libaers, Mathias Van Remortel, and Dirk Gijsbrechts, Xeikon Manufacturing NV (Belgium)*

The Unified Fuser Simulator for Development of High Performance Fusing System in the Laser Printer, *Wonho Lee, Soohwan Bae, Yoonhan Kim, Jinhoon Kim, Younghoon Han, Joontae Kim, Jaehyeuk Jeong, and Changbae Park, Samsung Electronics Company, Ltd. (Korea)*

A Numerical Study for Geometric Paper Stripping Mechanism in Fusing System with Cohesive Traction-Separation Law for Toner Sticking, *Soohwan Bae and Dongwoo Lee, Samsung Electronics Company, Ltd. (Korea)*

Measurement Technique of Micro Region Discharge Current for Analysis of Discharge Mode of Charging Roller, *Minoru Ohshima, Masao Ohmori, Satoru Tsuto, and Nobuhide Inaba, Fuji Xerox Company, Ltd. (Japan)*

The Development of the Low Heat Capacity Pressure Roller, *Akira Kato, Yuuki Nishizawa, Jun Hara, Hisashi Nakahara, and Toshihiko Ochiai, Canon, Inc. (Japan)*

Hot Offset Simulation in Fuser Process (Focal), *Kyohei Kato, Takuma Onishi, Masaki Kouno, Hiroki Eguchi, Yasunari Kobaru, and Yasuo Yoda, Canon, Inc. (Japan)*

Roller Type Surface Heating Fuser Structure, *Ohyun Baek, Keon Kuk, and Heemoon Jung, Samsung Electronics Company, Ltd. (Korea)*

THERMAL PRINTING

Session Chair: Hiroto Terao, Alps Electric Co., Ltd.

2:50 – 3:30 PM

Improvement on Heating Head Performance, *Hideo Taniguchi, Shigemasa Sunada, and Masakatsu Tatsuya, HIT Devices Ltd. (Japan); and Jiro Oi, HIT Devices Ltd. (USA)*

Analytical Investigation of Effects of Thermophysical Properties on Transient Temperature Response of Papers in Thermal Printer, *Takashi Fukue,¹ Hiroto Terao,² Koichi Hirose,¹ Tomoko Wauke,² and Hisashi Hoshino²; ¹Iwate University and ²ALPS Electronic Company, Ltd. (Japan)*

COLLEAGUE CONNECTIONS: MONDAY ROUNDTABLE DISCUSSIONS

4:15 – 5:45 PM

[see details, page 3](#)

STATE-OF-THE-ART INVITED TALK: TEXTILE PRINTING

State-of-the-Art Digital Textile Printing Status 2014, *Hitoshi Ujiie, Philadelphia University*

Since the introduction of production digital printing systems in the early 2000s, digital textile printing has emerged as a production textile printing process. However, current use of digital printing technologies in the industrial textile printing sector is still small in contrast with conventional textile printing systems. Does this offer opportunities for those in the digital printing supply chain? The current state of digital textile printing in terms of engineering, business, and design based on empirical research, including international case studies and field trips during the past 10 years is discussed in this invited talk. The supply chains from the engineering to the user standpoints (mills, printing service operations) are investigated. At the same time, the emerging new field of "surface imaging," is explored.

IMAGE SCIENCE AND TECHNIQUES IMAGE PERMANENCE

Session Chair: Wolfgang Schmidt, Felix Schoeller Group

10:45 – 11:35 AM

ISO 18930 – A New Standard Test Method for Accelerated Weathering (Focal), *Bruce M. Klemann, Electronics for Imaging, Inc., and Paul Landrum, Hewlett-Packard Company (USA)*

The Determination of Humidity Limits to Prevent Colorant Bleed in Inkjet Prints, *Eugene Salesin and Daniel Burge, Image Permanence Institute (USA)*

UV CURABLE INK JET

Session Chairs: Henry Wilhelm, Wilhelm Imaging Research; Jürgen Volkmann, Marabu GmbH & Co. KG; and Atsushi Tomotake, Konica Minolta Inc.

11:35 AM – 12:40 PM

The Long-Term Permanence of Photographs and Fine Art Prints Made with Large-Format Flat-Bed UV-Curable Ink Printers, *Henry Wilhelm, Barbara C. Stahl, Kabenla Armah, and Carol Brower Wilhelm, The Center for the Image with Wilhelm Imaging Research, Inc. (USA)*

Development of Filterability Test Method for Gel Retention Performance for UV Curable Ink Jet Inks, *Masato Sumiya and Katsuhisa Yamada, Nihon Pall Ltd. (Japan)*

Analysis of UV-Cured and Thermally-Cured Inkjet Printed PLA Fabrics, *Mohammad Nazmul Karim, Muriel Rigout, and Stephen G. Yeates, University of Manchester; and Chris Carr, University of Leeds (UK)*

Advancements in UV LED Curing Performance for Digital Printing (Interactive), *Michael Beck, Phoseon Technology (USA)*

STATE-OF-THE-ART INVITED TALK: TEXTILE PRINTING

Session Chair: Branka Lozo, University of Zagreb

1:45 – 2:25 PM

State of the Art of Digital Textile Printing Status 2014, Hitoshi Ujiie, Philadelphia University (USA)

IMAGE PROCESSING AND COLOR MANAGEMENT

Session Chairs: Yu-Ju Wu, Appalachian State University,
and Shuichi Maeda, Tokai University

2:30 – 4:05 PM

Reducing Inkjet Ink Consumption with RIP Software for Display Media, Yu Ju Wu, Appalachian State University (USA)

Layout to Bitmap: An Automatic Layout Design Compensator and Bitmap Converter for Inkjet Printed Electronics, Francesc Vila,¹ Jofre Pallarès,¹ Eloi Ramon,¹ Carme Martínez-Domingo,² Jordi Carrabina,² and Lluís Terés^{1,2}; ¹Institut de Microelectrònica de Barcelona, IMB-CNM (CSIC) and ²Universitat Autònoma de Barcelona (Spain)

Comparative Study on the Resolution Effect Difference between Hardcopy (Printed Image) and Softcopy (Displayed Image), Yasushi Hoshino,¹ Aran Hansuebsai,² and Nobuji Tetsutani¹; ¹Tokyo Denki University (Japan) and ²Chulalongkorn University (Thailand)

Color Change Mechanism of Metal Films: Silver and Niobium, Isao Komatsu, Hayata Aoki, Youhei Ito, and Shuichi Maeda, Tokai University (Japan)

Printing Quality Enhancement by Detection of Printhead Defects In Single-pass Inkjet Printing (Interactive), Yongtai Zhang, Zhihong Liu, and Shihong Deng, Peking University (China)

Intelligent Designing Model of Harmonious Color (Interactive), Ruizhi Shi, Xiao Zhou, and Chao Sheng, Zhengzhou Institute of Surveying and Mapping (China)

Research on FM Screening Algorithm of Psuedo Random Function based on Dot Gathering Model (Interactive), Xiao Zhou, Ruizhi Shi, and Da Li, Zhengzhou Institute of Surveying and Mapping (China)

COLLEAGUE CONNECTIONS: MONDAY ROUNDTABLE DISCUSSIONS

4:15 – 5:45 PM

see details, at right

CONFERENCE REGISTRATION + MEMBERSHIP OPTION

Non-member conference registration rates are the same as registration + membership. Choose the registration with complimentary membership option.

See details, page 20.

MONDAY ROUNDTABLES

Recyclability and Deinking of Digital Prints – Ecolabels and Testing

Moderator: Axel Fischer, INGEDE e.V.

Deinkability is becoming not only more accepted, but a required sustainability feature for printed products. Technical questions on how to evaluate recyclability/deinkability and how test results relate to “real life” in a mill remain—and perceptions are different in the US and Europe/Japan. After the establishment of the European Ecolabel for Printed Products, rules for acquiring German Blue Angels labels for printed paper have been updated to require proof of deinkability starting in 2015. People are beginning to ask for deinkability and printers see it as an issue relevant to long-term investment. Participants are invited to discuss the role/relevance of recyclability and customer demand for it in their respective countries.

UV-Curable Printing for High-End Reflective and Backlit Photography, Fine Art, and “Viewed Up Close” Retail Markets

Moderator: Henry Wilhelm, Wilhelm Imaging Research, Inc.

Major advances in the image quality provided by large-format flatbed and roll-fed inkjet printers using high-stability UV-curable pigment inks have opened up whole new markets in the high-end photography and fine art world. Very-large-format prints are selling for more than \$100,000 each. LED illuminated frames provide a new, lightweight, low-cost way to display brilliant backlit acrylic images. This focus on high image quality has created new opportunities in the retail and commercial sectors as well, with images backprinted on the glass tops of cosmetic counters, on a variety of materials for POP displays, and for other applications where prints are frequently viewed at a very close distance. In these markets, print speed plays a secondary role to superb photographic quality. Printer and ink manufacturers, print providers, and those in the art world discuss the newest technologies and emerging opportunities.

Colleague Connections: Industry/Academia Partnerships to Solve Print Industry Challenges

Moderator: Jim Mirvos, Lexmark International, Inc.

Join colleagues to discuss the biggest technical issues facing the printing industry in a forum designed to explore collaboration and cooperation opportunities for companies and academia that might help solve issues of common interest. Solutions to obstacles that inhibit collaboration, such as intellectual property and nondisclosure agreements, will be explored.

Tuesday September 9, 2014

ALL TRACKS

TUESDAY KEYNOTE

Session Chair: Christopher Tuck, University of Nottingham

9:00 – 10:00 AM

High Viscosity Printing, David Rosen, Georgia Institute of Technology (USA)

PRINTING TECHNOLOGY I

INK JET PROCESS AND SIMULATION II

Sponsored by Xaar plc.

Session Chairs: Frits Dijkman, University of Twente, and Kye-Si Kwon, Soonchunhyang University

10:00 AM – 3:00 PM

DoD Inkjet Printing of Weakly Elastic Polymer Solutions, Stephen D. Hoath,¹ Damien C. Vadillo,² Oliver G. Harlen,³ Claire McIlroy,³ Neil F. Morrison,³ Wen-Kai Hsiao,¹ Tri R. Tuladhar,⁴ Sungjune Jung,⁵ Graham D. Martin,¹ and Ian M. Hutchings¹;

¹University of Cambridge (UK), ²AkzoNobel RDI (UK),

³University of Leeds (UK), ⁴Trijet Ltd. (UK), and

⁵Pohang University (Korea)

Colloidal Suspension Rheology and Inkjet Printing, Steve Hoath,¹ Wen-Kai Hsiao,¹ Huai Yow,² Simon Biggs,² Simon Butler,¹ Malcolm Mackley,¹ and Ian Hutchings¹; ¹University of Cambridge and ²University of Leeds (UK)

Towards Satellite-Free Drop-on-Demand Printing of Complex Fluids (Focal), Neil F. Morrison and Oliver G. Harlen, University of Leeds, and Stephen D. Hoath, University of Cambridge (UK)

Evaluation of Methods for Jetting High Viscosity Large Particle Materials, Vince Cahill,¹ Dene Taylor,² and Patrice Giraud¹; ¹VCE Solutions and ²SPF, Inc. (USA)

Tracking based Inkjet Measurement for Evaluating High Frequency Ink Jetting, Kye-Si Kwon, Soonchunhyang University (Korea)

Ink-Particle Flight Simulation for Continuous Inkjet Type Printer, Masato Ikegawa and Eiji Ishii, Hitachi Ltd.; and Nobuhiro Harada and Toshiaki Takagishi, Hitachi Industrial Equipment Systems Company, Ltd. (Japan)

Numerical Analysis of Drop Dynamics of Acrylate Resin in Piezoelectric Inkjet Three Dimensional Printers, Kun Joong Park, Ohyun Baek, Yongtaek Hong, Changbae Park, and Keon Kuk, Samsung Electronics (Korea)

Simulation Experiments to Model the Inkjet Printing Behavior of Functional Inks, Adarsh Anand, Paul D. Fleming III, and Margaret K. Joyce, Western Michigan University (USA)

TUESDAY KEYNOTE

High Viscosity Printing, David Rosen, Georgia Institute of Technology (USA)

Typical commercial ink-jet print heads can eject fluids with viscosities up to 30-40 cP, however most polymers of interest for mechanical parts have viscosities that are orders of magnitude higher than this; hence the need for print heads that can eject high-viscosity fluids. After a brief survey, a high viscosity print head based on an ultrasonic atomizer technology developed at Georgia Institute of Technology is introduced. The development of two types of models—ultrasonic atomizer modeling and droplet impingement modeling—make up the bulk of the talk. In the first area, both high-fidelity and simplified electro-mechanical models are presented, with an objective of understanding and improving the pressure gradients in the atomizer nozzle. In the second area, a new Lattice-Boltzmann-based fluids model was developed to simulate droplet impact and droplet interactions in order to determine process conditions that enable the formation of planar films without splash. Implications of the research on printing process and ink developments are provided, as are some limits on how high is “high viscosity.”

INK JET: INK AND MEDIA I

Session Chairs: Alex Shaknovich, Cabot Corporation, and Stephen Hoath, University of Cambridge

3:00 – 4:00 PM

Ink-Jet Printed Copper Complex MOD Ink for Plastic Electronics, Yousef Farraj,¹ Michael Grouchko,¹ Shlomo Magdassi,¹ Mirko Wittkötter,¹ Ingo Reinhold,^{2,3} Maik Müller,² and Werner Zapka²; ¹The Hebrew University of Jerusalem (Israel), ²Xaarjet AB (Sweden), and ³KTH Royal Institute of Technology (Sweden)

Self-Disperse Carbon Black for Inkjet Printing Application (Interactive), Chien-Wen Lee and Hsiao-San Chen, Everlight Chemical Industrial Corporation (ECIC) (Taiwan)

Building/Architecture Fire Safety and Inkjet Printed Wallcovering Materials (Interactive), Patrick Le Galudec, Sihl AG (Switzerland) and Bruno Fouquet, Diatechnologies (France)

Effect of Particle Size on Properties and Droplet Formation of Disperse Dye Multiphase Fluid (Interactive), Shaohai Fu, Benjamin Tawiah, Anli Tian, Guifang Zhang, and Chaoxia Wang, Jiangnan University (China)

Properties and Application of Carbon Black/Latex Composite via Miniemulsion Polymerization (Interactive), Yu Guan, Chunxia Wang, Anli Tian, Shaohai Fu, and Chaoxia Wang, Jiangnan University (China)

Preparation of TiO₂/Latex Composite for Inkjet

White Ink (Interactive), Fushun Bai, Changsen Du, Anli Tian, Gguocheng Mei, and Shaohai Fu, Jiangnan University (China)

Preparation of Nanoscale TiO₂-Encapsulated C.I. Pigment Blue 15:3 via Sol-gel Method (Interactive), Shaohai Fu, Changsen Du, Anli Tian, and Chunxia Wang, Jiangnan University (China)

Modeling Ink Diffusion within Paper to Achieve a Raggedness Ruler for Print Quality Control (Interactive), Ali Azin,¹ Saeideh Gorji Kandi,^{1,2} and Atasheh Soleimani Gorgani¹; ¹Institute for Color Science and Technology and ²Amirkabir University of Technology (Iran)

INTERACTIVE PAPER AND DEMONSTRATION SESSION, WITH EXHIBIT HALL HAPPY HOUR

4:00 – 6:00 PM

PRINTING TECHNOLOGY II ELECTROPHOTOGRAPHY MATERIALS

Session Chairs: Heather J. Gulley-Stahl, Lexmark International, Inc.; Rainer Baur, Clariant; and Norio Nagayama, Ricoh Co., Ltd.
10:00 – 11:50 AM

Detecting and Evaluating Toner Property Changes after Exposure to Coating Materials, Heather J. Gulley-Stahl, Whitney Burruss, Jeremy Damm, Jim Doeltz, Connie Haberman, David MacMillan, Dale Massie, Jim Semler, and Robert Glenn Smith, Lexmark International (USA)

The Charge Properties and Durability of New Submicron Silica, Yusuke Tosaki, Yuki Amano, Naohiro Naito, and Yukiya Yamashita, Nippon Aerosil Company Ltd. (Japan); and Paul Brandl, Evonik Specialty Chemicals Company Ltd. (China)

The Improvement of Core-Shell Toner by Controlling the Interfacial Thickness between Core and Shell Polyesters, Tomohide Yoshida, Fukuri Norihiro, Eiji Shirai, and Katsutoshi Aoki, Kao Corporation (Japan)

Study of the Effect of External Additives on Toner Admix Performance, James Boswell, Hajime Kambara, Vivian Zhang, Geoffrey Moeser, and Dmitry Fomitchev, Cabot Corporation (USA)

Interpreting the Schedule

By knowing the amount of time allotted for each type of presentation, you can estimate when a particular presentation will occur. Order and times are subject to change; exact times will be published in the conference proceedings. Note there are 30-minute coffee breaks most mornings and afternoons, as well as daily lunch breaks. Presentation lengths include time for Q&A.

Keynote: 50 minutes **Focal:** 30 minutes

Oral: 20 minutes

Interactive preview: 5 minutes

SPECIAL EVENT: INTERACTIVE PAPER AND DEMONSTRATION SESSION, WITH EXHIBIT HALL HAPPY HOUR

Session Chair: Emma Talbot, University of Durham
4:00 – 6:00 PM

SECURITY AND FUNCTIONAL PRINTING/ PRINTING SYSTEM INTERACTIVE PREVIEWS

Session Chairs: Robert Ulichney, Hewlett-Packard Co., and Alan Hodgson, 3M UK PLC

2:00 – 3:40 PM

Fast Mobile Stegatone Detection using the Frequency Domain (Focal), Robert Ulichney, Matt Gaubatz, and Stephen Pollard, Hewlett-Packard Company (USA)

Digital Watermark for Printing Images: Application to Thermal Transfer Printing Method, Nobuki Nemoto, Takeo Miki, and Takashi Yamaguchi, Toshiba Corporation (Japan)

Toner Printing for Secure Documents, Alan Hodgson and Lesley A. Williams, 3M (UK)

Printed Paper based Glucose Sensor Manufactured in Pilot Scale, Liisa Hakola and Kaisa Lehtinen, VTT Technical Research Centre of Finland (Finland)

The Coming of Age of Industrial Printing (Interactive), Ron Gilboa, InfoTrends (USA)

Measuring Manufacturing Productivity (Interactive), David R. Spencer, Catherine Fiasconaro, and Vishal Sahay, Spencer & Associates Publishing, Ltd. (USA)

INTERACTIVE PAPER AND DEMONSTRATION SESSION, WITH EXHIBIT HALL HAPPY HOUR

4:00 – 6:00 PM

3D PRINTING 3D PRINTING PROCESSES AND MATERIALS I

Session Chairs: Steven Ready, Xerox Palo Alto Research Center; Christopher Tuck, University of Nottingham; and Shinri Sakai, University of Tokyo

10:00 AM – 3:10 PM

Multi-Functional 3D Printing (Focal), Christopher Tuck, University of Nottingham (UK)

Multi-Material 3D Printing (Focal), Steve Ready, Gregory Whiting, and Tse Nga Ng, Palo Alto Research Center (USA)

Further Developments in the 3D Printing of Self-Glazing Single Fire Ceramic Materials (Focal), David Huson and Katie Vaughan, University of the West of England (UK)

Hybrid Manufacturing Technologies for Electromagnetic Structures, Nicholas A. Charipar, Matthew A. Kirleis, Heungsoo Kim, Kristin M. Charipar, Ray C. Y. Auyeung, Scott A. Mathews, and Alberto Piqué, Naval Research Laboratory (USA)

A Hybrid Approach Combining 3D Printing and

Conductive Inkjet Printing for the Generation of Linear Ion Traps for Mass Spectrometry Applications (Focal), Ingo Reinhold,^{1,2} Robert Murcott,³ Mirko Wittkötter,¹ Fabrizio Siviero,⁴ Wolfgang Voit,¹ and Werner Zapka¹; ¹XaarJet, AB (Sweden), ²KTH Royal Institute of Technology, (Sweden), ³TW Ltd. (UK), and ⁴SAES Getters, S.p.A. (Italy)

The Optimisation of Conductive Inks for 3D Inkjet Printing, Ehab Saleh, Bochuan Liu, Javier Ledesma Fernandez, Christopher Tuck, Ricky Wildman, Ian Ashcroft, Richard Hague, and Phill Dickens, University of Nottingham (UK)

The Rheology of Dense Colloidal Pastes Used in 3D Printing, Michael Avery,¹ Susanne Klein,² Robert Richardson,¹ Paul Bartlett,¹ Guy Adams,² Fraser Dickin,² and Steve Simske³; ¹University of Bristol (UK), ²Hewlett-Packard Labs Bristol (UK), and ³Hewlett-Packard Labs (USA)

INTERACTIVE PAPER AND DEMONSTRATION SESSION, WITH EXHIBIT HALL HAPPY HOUR
4:00 – 6:00 PM

IMAGE SCIENCE AND TECHNIQUES

IMAGE MEASUREMENT: METHODS AND EQUIPMENT

Session Chairs: Wolfgang Schmidt, Felix Schoeller Group, and Takuroh Sone, Ricoh Co., Ltd.

10:00 AM – 12:20 PM

Latent Image Measurement for Dot Pattern Formed by Scanning Laser Beam (Focal), Hiroyuki Sahara, Masato Iio, and Hiroto Tachibana, Ricoh Company, Ltd. (Japan)

Friction Properties of Inkjet and Laser Prints, Simona Grigaliuniene, Jonas Sidaravicius, and Vytautas Turla, Vilnius Gediminas Technical University (Lithuania)

Analysing Banding Features for Classifying Print Processes Using Artificial Neural Networks, Shankhya Debnath and Jitamitra Bagchi, Jadavpur University (India)

An Evaluation Method for Microgloss Uniformity, Takuroh Sone and Makoto Hino, Ricoh Company, Ltd. (Japan)

New Craze Testing Method, Dirk Fiedler, PTS, and Wolfgang Schmidt, Felix Schoeller Group (Germany)

LOOKING FOR DEMONSTRATION SESSION PARTICIPANTS

Interested? Free space is available for authors to **show programs, products, and/or prints** related to presented papers. Others may also participate for a small fee. Contact nip_df@imaging.org for details.

SPECIAL EVENT: CONFERENCE EXHIBIT

Tuesday: 10:00 AM – 6:00 PM

Wednesday: 10:00 AM – 4:00 PM

Please visit our exhibitors! See list inside cover.

Innovations in Inkjet Analysis (Interactive), Paul Best, ImageXpert, Inc. (USA)

Introducing a New Method for Generating Test Targets to Evaluate Printing Mottle (Interactive), Ali Azin,¹ Saeideh Gorji Kandi,^{1,2} and Atasheh Soleimani Gorgani¹; ¹Institute for Color Science and Technology and ²Amirkabir University of Technology (Iran)

E-PAPER AND DISPLAY

Session Chair: Makoto Omodani, Tokai University

2:00 – 2:40 PM

Development of Rewritable Laser System (Focal), Yoshihiko Hotta, Tomomi Ishimi, Shinya Kawahara, Kazutaka Yamamoto, and Takahiro Furukawa, Ricoh Company, Ltd. (Japan)

Improvement of Particle Velocity of an Electrophoretic Display by Introducing Guide Blocks in a Display Cell (Interactive), Kotaro Sato and Makoto Omodani, Tokai University (Japan)

PRINTED ELECTRONICS

PRINTED ELECTRONICS MATERIALS / PROCESSES AND SYSTEMS INTERACTIVE PREVIEW

Session Chairs: Stan Farnsworth, NovaCentrix;

Jens Hammerschmidt, Chemnitz University of Technology; and Masaaki Oda, JAPERA

2:40 – 3:55 PM

Properties of PEDOT: PSS from Oscillating Drop Studies (Focal), Steve Hoath,¹ Wen-Kai Hsiao,¹

Sungjune Jung,² Lisong Yang,³ Colin Bain,³ Sid Wright,¹ Neil Morrison,⁴ Oliver Harlen,⁴ Graham Martin,¹ and Ian Hutchings¹; ¹University of Cambridge (UK), ²Pohang University (Korea), ³Durham University (UK), and ⁴University of Leeds (UK)

Noncrystallizable Molecular Glasses for Stable and Long-Lived OLED and Organic Electronics, Michel F. Molaire, Molaire Consulting LLC (USA)
Inkjet Printing Graphene Films for Transparent Conductors, Pei He and Brian Derby, University of Manchester (UK)

Direct Write (Maskless) Patterning of Flexible Backplanes Using MicroLEDs (Interactive),

Trevor P. Elworthy, LumeJet Limited (UK)

INTERACTIVE PAPER AND DEMONSTRATION SESSION, WITH EXHIBIT HALL HAPPY HOUR
4:00 – 6:00 PM

Wednesday September 10, 2014

ALL TRACKS

WEDNESDAY KEYNOTE AND AWARDS PRESENTATIONS

Session Chair: Branka Lozo, University of Zagreb

9:00 – 10:10 AM

Nanophotonics Over Macroscopic Scales and its Associated Fabrication Challenges, *Marin Soljacic, MIT (USA)*

PRINTING TECHNOLOGY I

INK JET: INK AND MEDIA II

Session Chairs: Alex Shakhovich, Cabot Corporation, and Stephen Hoath, University of Cambridge

10:40 AM – 2:40 PM

Polymer Degradation in Inkjet Printing and the Role of Polymer Architecture (Focal), *Joseph S. R. Wheeler,¹ Stuart W. Reynolds,² Steven Lancaster,² Veronica Sanchez Romanguera,¹ and Stephen G. Yeates¹; ¹University of Manchester and ²Domino Printing Sciences plc (UK)*

Color InkJet Dispersions Utilizing Synergists as Dispersants, *Alex Shakhovich, Cabot Corporation (USA)*

Electrical Measurement of Ink Sedimentation, *Andreas Rathjen, Nicki Grauert, and Klaus Krueger, Helmut Schmidt University/University of the Federal Armed Forces Hamburg, and Morten Mikolajek, Andreas Friederich, and Joachim R. Binder, Karlsruhe Institute of Technology (Germany)*

Aggregation of Inkjet Ink Components by Mg²⁺ and Ca²⁺ Salts in Relation to Inkjet Print Quality, *Asaf Oke,¹ Agne Swerin,^{1,2} Birgit D. Brandner,¹ Douglas Bugner,³ Wayne Cook,³ and Per M. Claesson^{1,2}; ¹SP Technical Research Institute of Sweden (Sweden), ²KTH Royal Institute of Technology (Sweden), and ³Eastman Kodak Company (USA)*

Particle based Inks for Inkjet Printing of Thin Catalytic Layers, *Danny Lehmann,¹ Klaus Krüger,¹ Iris Herrmann-Geppert,^{1,2} Mauricio Schieda,² and Thomas Klassen,^{1,2}; ¹University of the Federal Armed Forces and ²Helmholtz-Zentrum Geesthacht (Germany)*

Advanced Water-based Latex-Inks for Film Media, *Naohiro Toda, Tomohiro Nakagawa, Hidefumi Nagashima, Juichi Furukawa, and Kiyofumi Nagai, Ricoh Company, Ltd. (Japan)*

INK JET: INK-SUBSTRATE INTERACTION I

Sponsored by Tonejet Limited

Session Chairs: Hou T. Ng, Hewlett-Packard, Co.; Emma Talbot, University of Durham; and Takumi Suzuki, Canon, Inc.

2:40 – 3:20 PM

Tuning Liquid Absorption and Ink Spreading By Polyelectrolyte Multilayering on Substrates with Different Levels of Internal Sizing, *Katriina*

WEDNESDAY KEYNOTE

Nanophotonics Over Macroscopic Scales and its Associated Fabrication Challenges,

Marin Soljacic, MIT

In nanophotonics, we create material-systems that are structured at length-scales smaller than the wavelength of light. When light propagates inside such effective materials, numerous novel and exciting phenomena can emerge, enabling a variety of novel applications. However, in order to make use of these opportunities for many real-world applications of interest, one has to have the ability to implement nanophotonic structures over large scales. Printing techniques are often useful for implementation of such structures, especially when the wavelength of interest is sufficiently long. This talk presents recent theoretical and experimental progress in exploring these opportunities, as well as novel physics phenomena that emerges in this process.

Mielonen, Sami-Seppo Ovaska, and Kaj Backfolk, Lappeenranta University of Technology (Finland)

The Paper Chase: Understanding the Challenges of Inkjet Ink Interactions with Commercial Printing Papers in Single Pass Printing, *Martin E. Redding, E. I. DuPont de Nemours, Inc. (USA)*

COLLEAGUE CONNECTIONS:

WEDNESDAY ROUNDTABLE DISCUSSIONS

4:00 – 5:30 PM

see details, page 8

CONFERENCE RECEPTION

7:00 – 9:00 PM

PRINTING TECHNOLOGY II

PRINTING SYSTEMS

Session Chairs: Olivier Morel, Xennia, and Teruaki

Mitsuya, Ricoh Co., Ltd

10:40 AM – 2:40 PM

Embedded Scanning, Encryption and Certification Workflows on Multi-Function Printers (MFPs) (Focal), *Helen Balinsky and Nassir Mohammad, Hewlett-Packard Labs (UK)*

Development of the 23" X 29.5" Sheet-fed Inkjet Press KM-1, *Mitsuru Obata, Toyooki Sugaya, Toshiyuki Mizutani, Hideo Watanabe, Toshiyuki Takabayashi, and Hiroataka Iijima, Konica Minolta, Inc. (Japan)*

Failure Prediction Method for Long Life Photoconductor based on Statistical Machine Learning, *Yasushi Nakazato and Mikiko Imazeki, Ricoh Company, Ltd. (Japan), and Shinto Eguchi and Osamu Komori, Institute of Statistical Mathematics (Japan)*

Industrial Digital Manufacturing: Myth, Hype or Reality?, *J. R. Barritt, W. A. Kaimouz, O. J. X. Morel,*

WEDNESDAY ROUNDTABLES

3D Printing - The Hype and the Future

Moderator: Christopher Tuck, University of Nottingham

The roundtable discusses where 3D printing has come from, what the current capability of the technology is, how this is being discussed in the general media, and the mismatch between them. It also outlines potential future avenues for research and applications, as well as how 3D printing may change the future of manufacturing.

Digital Printing on Textiles

Moderator: Hitoshi Ujiie, Philadelphia University

Digital Textile Printing can be defined as "surface imaging" on textiles. Surface imaging refers to actualization of imagery for various physical forms using a variety of printing technologies, including direct surface imaging on diverse porous and non-porous substrates, as well as fabrication printing (material deposition and subtraction printing technologies—laser and enhanced 3D). A transdisciplinary approach for broader concepts of digital printing on textile substrates is the focus of this roundtable. Discussions are expected to move beyond the boundaries of existing traditional disciplines to bring new innovations and activities in product developments to the table.

What does it mean for Packaging to Go Digital?

Moderator: George Gibson, Xerox Corporation

Digital print is only just beginning to infiltrate the packaging market and demonstrate its true potential for seamless and personalized advertising, both on and offline. Digital print in packaging opens the door for the package to become more than the passive carrier of a valuable thing to an active component of value creation. One need only think of Coca-Cola's recent global "Share a Coke" campaign, which serves as the perfect success story to demonstrate the potential of digital printing for businesses. Originating in Australia and hitting Britain this summer, the campaign involves 375ml and 500ml PET bottles of Coke that feature 250 of the most common first names from around the world in multiple languages, allowing customers to "share a Coke" with friends, families, and loved ones. The campaign has been a huge success, seeing both sales and social media engagement with the brand increase. This roundtable explores the current state-of-the-art and imagines the future. Let's take the wraps off the future of digital print for packaging!

J. Tardrew, and R. A. Wilkinson, Xennia Technology Ltd. (UK)

Incorporation of Nano-Particle Carbon Black into Polyurethane Rollers and its Influence on Digital Electro-Photography Print Quality, Krishna Chaurasia, Fenner Precision (USA)
Mechanical Modeling of a Printing Machine Rubbery Parts, Nurith Schupper, Peter Forgacs, Yossi Shachak, and Wael Salalha, Hewlett-Packard Indigo (Israel)
Digital Creation of Hand Engraved Copper Plates to Secure a Historic Process, Stephen Hoskins, University of the West of England (UK)

COLLEAGUE CONNECTIONS: WEDNESDAY ROUNDTABLE DISCUSSIONS

4:00 – 5:30 PM

[see details at left](#)

CONFERENCE RECEPTION

7:00 – 9:00 PM

3D PRINTING

3D PRINTING PROCESSES AND MATERIALS II

Session Chair: Shinri Sakai, University of Tokyo

10:40 AM – 12:10 PM

Bionic Nano-Printing (Focal), Michael C.

McAlpine, Princeton University (USA)

Characterization of Fully Inkjet-Printed Microsieves and of Patterns for the Mechanical Reinforcement of Fragile Membranes, Jens

Hammerschmidt,¹ Peter Ueberfuhr,¹ Eva-Maria Eck,¹

Christian Zeiner,¹ Robert Thalheim,¹ and Reinhard

R. Baumann^{1,2}; ¹Technische Universität Chemnitz and ²Fraunhofer ENAS (Germany)

Self-Assembly Printer, Masayoshi Mitsui,¹ Atsushi Masumori,² and Hiroya Tanaka¹; ¹Keio University and ²The University of Tokyo (Japan)

3D Printing and Additive Manufacturing: 3D Systems Technology Overview and New Applications in Manufacturing, Education, Science, and Engineering, Trevor Snyder, 3D Systems (USA)

3D WORKFLOW AND APPLICATIONS I

Session Chairs: Vince Cahill, VCE Solutions; Adam Ellis, University of Sheffield; and Oh Hyun Baek, Samsung Electronics

2:00 – 3:10 PM

Direct Three-Dimensional Visualization and Characterization of Structures Formed by Printing Particles (Focal), Shu Chang, Vineeth R. Patil, Di Bai, and Marcos Esterman, Rochester Institute of Technology (USA)

Optimally Orient and Slice Solid Objects for 3D Printing, Jun Zeng and Gary Dispoto, Hewlett-Packard Co. (USA)

From Scan to Print: 3D Printing as a Means for Replication, Susanne Klein,¹ Michael Avery,² Guy Adams,¹ Stephen Pollard,¹ and Steve Simske³;

¹Hewlett-Packard Labs (UK), ² University of Bristol (UK); and ³Hewlett-Packard Labs (USA)

COLLEAGUE CONNECTIONS: WEDNESDAY ROUNDTABLE DISCUSSIONS

4:00 – 5:30 PM

[see details, page 8](#)

CONFERENCE RECEPTION

7:00 – 9:00 PM

PRINTED ELECTRONICS

PRINTED ELECTRONICS PROCESSES AND SYSTEMS I

Session Chairs: Jim Stasiak, Hewlett-Packard, Co.; Ingo Reinhold, Xaarjet AB; and Shinichi Nishi, Konica Minolta
10:40 AM – 3:30 PM

Inkjet Printing as a Roll-to-Roll Compatible Technology for the Production of Large Area Electronic Devices on a Pre-Industrial Scale (Focal), Pit Teunissen,¹ Eric Rubingh,¹ Tim van Lammeren,¹ Robert Abbel,¹ and Pim Groen^{1,2};

¹Holst Centre and ²Delft University of Technology (the Netherlands)

Roll-to-Roll Processes and Technologies for the Production of Flexible Electronics, Jens Haenel, 3D-Micromac AG (Germany)

Roll-to-Roll Infrared Sintering of Gravure Printed Silver Patterns in Applications of Back-Injection-Molded Functional Lightweight Structures, P. Ueberfuhr,¹ H. Kang,¹ M. Gaitzsch,¹ M. Heinrich,¹ T. D. Großmann,¹ S. Kurth,² L. Kroll,¹ T. Gessner,² R. R. Baumann^{1,2}; ¹Technische Universität Chemnitz and ²Fraunhofer ENAS (Germany)

Feature Resolution of High Speed Sintering, Adam Ellis, The University of Sheffield (UK)

High-Speed, Low-Volume Inkjet and its Role in Jet and Flash™ Imprint Lithography (Focal), Ingo Reinhold,¹ Matthew Shafran,² Van Truskett,² and Werner Zapka¹; ¹Xaarjet, AB (Sweden) and ²Molecular Imprints (USA)

Printed Monolithic Photovoltaic Interconnects (Focal), Maikel F.A.M. van Hest, Matthew S. Dabney, Vincent P. Bollinger, and Jeremy D. Fields, National Renewable Energy Laboratory (USA)

Automated Continuously-Manufacturing Line of All-Printed Organic TFT Array Flexible Film (Focal), Shinichi Nishi^{1,2} and Toshihide Kamata^{1,3}; ¹JAPERA, ²Konica Minolta, Inc., and ³AIST (Japan)

COLLEAGUE CONNECTIONS: WEDNESDAY ROUNDTABLE DISCUSSIONS

4:00 – 5:30 PM

[see details, page 8](#)

CONFERENCE RECEPTION

7:00 – 9:00 PM

Thursday September 11, 2014

ALL TRACKS

CLOSING KEYNOTE

Session Chair: Masahiko Fujii, Fuji Xerox Co., Ltd.

9:00 – 10:00 AM

Recent Technology and Business Developments in Printed Electronics, and Implications for Inkjet, Stan Farnsworth, NovaCentrix (USA)

THURSDAY KEYNOTE

Recent Technology and Business Developments in Printed Electronics, and Implications for Inkjet, Stan Farnsworth, NovaCentrix

Technology emphasis in the printed electronics community continues to expand from consideration of specific technologies—such as details of new materials or processing methods—to the integration of technologies. Examples include new developments in RFID, packaging, and automotive. This talk explores the current state of printed electronic and the implications for those working in inkjet.

PRINTING TECHNOLOGY I

INK JET: INK-SUBSTRATE INTERACTION II

Sponsored by Tonejet Limited

Session Chairs: Hou T. Ng, Hewlett-Packard, Co.; Emma Talbot, University of Durham; and Takumi Suzuki, Canon, Inc.

10:00 – 11:50 AM

A Novel Method to Study the Effect of Corona Treatment on Ink Wetting and Sorption Behavior, Sami-Seppo Ovaska,¹ Katriina Mielonen,¹ Esa Saukkonen,¹ Tadeusz Lozovksi,² Ringaudas Rinkunas,² Jonas Sidaravicius,^{2,3} and Kaj Backfolk¹; ¹Lappeenranta University of Technology (Finland), ²Vilnius University (Lithuania), and ³Vilnius Gediminas Technical University (Lithuania)

Objective Measurement of the Ink Wicking, Surface Topography (Roughness), and Show Through Properties of Papers Produced for Ink Jet Print, Roy R. Rosenberger, Verity IA, LLC (USA)

Ink -Media Interaction: Agglomeration of Color Pigments by Salt with Different Valency and Impact on Print Quality, Jonas Öertegren, Petru Niga, and Anna Lundberg, Mid Sweden University (Sweden)

Control of the Particle Deposition in Inkjet-Printed Droplets, Emma L. Talbot, Lisong Yang, Arganthaël Berson, and Colin D. Bain, Durham University (UK)

LATE BREAKING NEWS/SUCCESS STORIES

11:50 AM – 1:20 PM

[see details, page 10](#)

See also information on Center for Surface Imaging Tour (page 10) and OE-A Meeting (page 198)

3D PRINTING

3D WORKFLOW IN 3D AND APPLICATION II

Session Chairs: Vince Cahill, VCE Solutions; Adam Ellis, University of Sheffield; and Oh Hyun Baek, Samsung Electronics

10:00 – 11:50 AM

Voxel based Material Distribution with Probability for 3D Printing, Yusuke Tominaka and Hiroya Tanaka, Keio University (Japan)

RFID 3D Printer Printing Objects that Connote Information, Ken Fujiyoshi, Chihiro Fukai, Hiroya Tanaka, Jun Murai, and Jin Mitsugi, Keio University (Japan)

3D Printing – Lowering Barriers to Uptake, Diversifying Range of Application, Carrying Forward Legacy Processes, Philip Robbins and Keith Doyle, Emily Carr University (Canada)
Tacit Knowledge, 3D Printing for Artists, Designers and Makers, Stephen Hoskins, University of the West of England (UK)

LATE BREAKING NEWS/SUCCESS STORIES

11:50 AM – 1:20 PM

see details at right

See also information on Center for Surface Imaging Tour (below) and OE-A Meeting (page 18)

PRINTED ELECTRONICS

PRINTED ELECTRONICS: PROCESSES AND SYSTEMS II

Session Chairs: Jim Stasiak, Hewlett-Packard Co.; Ingo Reinhold, XaarJet AB; and Shinichi Nishi, Konica Minolta

10:00 – 11:50 AM

Variability and Mismatch in All-Inkjet Printed Organic Thin Film Transistors: A Quantitative Study (Focal), E. Ramon,^{1,2} A. Conde,¹ C. Martínez-Domingo,² J. Pallarès,¹ E. Sowade,³

LATE BREAKING NEWS/SUCCESS STORIES

Recent Developments and Successes in Printing Technology

Moderator: Werner Zapka, XaarJet AB

Call for Participation: Please send information on recent company news and/or success stories to be presented/discussed during this session to Werner.Zapka@Xaar.com.

K. Y. Mitra,³ J. Carrabina,² R. Baumann,^{3,4} I. Terés,^{1,2} and H. Gomes⁵; ¹IMB-CNM (Spain), ²Universitat Autònoma de Barcelona (Spain), ³Chemnitz University of Technology (Germany), ⁴Fraunhofer ENAS (Germany), and ⁵Instituto de Telecomunicações (Portugal)

Production Technologies for Large Area Flexible Electronics, Thomas Kolbusch and Klaus-Peter Crone, Coatema Coating Machinery GmbH (Germany)

Breaking the Limits of Line Width and Aspect Ratio for Inkjet Printed Conductive Lines by Controlling Post-Deposition Ink Contraction, Pit Teunissen,¹ Robert Abbel,¹ Jasper Michels,¹ and Pim Groen^{1,2}; ¹Holst Centre and ²Delft University of Technology (the Netherlands)

LED Wire Bond Replacement Using Aerosol Jet® Printing Technology, Andreas Rudorfer, Heinz Pichler, Christian Palfinger, Frank Reil, Franz Peter Wenzl, and Paul Hartmann, Joanneum Research (Austria)

LATE BREAKING NEWS/SUCCESS STORIES

11:50 AM – 1:20 PM

see details above

See also information on Center for Surface Imaging Tour (below) and OE-A Meeting (page 8)

Special Offsite Tour: Philadelphia University School of Design and Engineering

CENTER FOR EXCELLENCE IN SURFACE IMAGING

Tour time: 2:30 – 5:00 pm

Limit: 20 people

Philadelphia University—founded in 1884—is one of the oldest and most prestigious textile institutions in the US. It has trained many in the textile industry. The Center for Excellence in Surface Imaging endeavors to “conduct design, engineering, and business research,” as well as promote partnerships with industry. Lead by Professor Hitoshi Ujiie, director of the center, the tour provides an in-depth look at textile production machines, including those used for production weaving, knitting, and digital textile printing. In addition, participants visit the Material Evaluation Laboratory, used for all kinds of textile testing.

Registration is first-come, first-served as part of the conference registration process. There is no cost for the tour, however those who register for the tour, but either do not cancel by August 29 or are a “no show”, will be charged a \$50 cancellation fee. Transportation to/from the tour is the responsibility of participants. IS&T is working on economical options; details will be provided closer to the event to registrants. Round-trip costs should not exceed \$20, and likely will be less depending on how many people attend.

Register for tour on page 21.

Short Course Program

The conference Short Course Program offers a wide range of introductory and advanced classes in the fields of digital printing and fabrication given by internationally recognized experts. Attendees receive e-copies of the instructor's notes with course registration. We encourage you to sign up for short courses by the early registration deadline to ensure that a course runs.

Please Note: IS&T reserves the right to cancel short courses in the event of insufficient advance registration. Please indicate your interest early.

DRAMATICALLY REDUCED COURSE REG FEES

In celebration of 30 years of providing outstanding short courses to digital printing professionals, IS&T has reduced short course prices significantly for 2014.

Always wanted to take a course? Now's the time to do it. In fact, take four!

Sunday September 7, 2014

SC01-S1: An Introduction to Digital Fabrication: Methods, Materials, and Applications

Sunday 8:00 – 10:00 AM (2 hours)

Instructor: James W. Stasiak, Hewlett-Packard Company

During the past decade, there has been a remarkable convergence of two disparate technologies: digital printing of text and images and the fabrication of physical objects. This convergence, a blending of traditional printing methods with recent advances in materials science and with established manufacturing methods, has brought about the foundation of a new technology: digital fabrication. Already, digital fabrication approaches are enabling new discoveries at the laboratory bench and are beginning to provide new efficiencies and unprecedented product customization on the manufacturing floor. In the near future, digital fabrication methods—along with the development of “functional inks”—will make it possible to print complete electronic circuits, optical devices, mechanical structures, and even new biological materials. The objective of this short course is to provide an introduction to the rapidly emerging science and technology of digital fabrication. The course includes an up-to-date overview of the methods, materials, and processes that are reshaping manufacturing and enabling new commercial applications in electronics, MEMS, and the life sciences. Finally, the class examines factors that are moving digital fabrication from a niche technology toward a new manufacturing paradigm.

Benefits

This course enables an attendee to:

- Develop an understanding of different digital fabrication methods and materials.
- List and compare different applications that range from printed electronics to the life sciences.
- Evaluate the technological issues and challenges of digital fabrication.

Short Course Monitors are needed to help with classes. Monitors take courses for free. Interested? Contact Diana Gonzalez at nip_df@imaging.org. Priority given to students.

- Develop an understanding of the technology landscape, key players, and practitioners.
- Recognize the market opportunities addressed by this emerging technology.

Intended Audience: this is a survey course for engineers, scientists, and technical marketing professionals who are working or are interested in digital fabrication and printed electronics.

James Stasiak is currently a principal scientist in Hewlett-Packard's Technology Development Laboratory in Corvallis, Oregon. He is actively involved in developing new digital fabrication methods and applications. In a career spanning more than 30 years, he has made contributions in the fields of device physics, molecular electronics, non-impact printing technologies, and, more recently, the emerging fields of flexible electronics and digital fabrication. In 2005 and 2006, he served as the General Chair for the Digital Fabrication Conference and now serves on the Digital Fabrication Conference Advisory Committee. He holds more than 14 issued US patents and is the author or editor of numerous technical articles and proceedings.

SC02-S1: Role of Inkjet in Commercial and Industrial Printing

Sunday 8:00 AM – 10:00 AM (2 hours)

Instructor: Ronald Askeland, Hewlett-Packard Espanola, SL

Printing products from HP, Canon, Epson, Fuji-Film, Xaar, Kyocera, Memjet, and Kodak are scrutinized and compared. The suitability of ink jet print systems for markets beyond home and office is evaluated and contrasted with electrophotographic, offset, flexo, screen and roto gravure printing in those markets. Thermal, piezo, and continuous inkjet printhead performance parameters and ink/media interactions are examined for applications in large format,

publishing, direct mail, photographic, and package printing. Recent product introductions and future trends in commercial/industrial printing are discussed.

Benefits

This course enables an attendee to:

- Compare the pros and cons of electrophotographic, inkjet and analog printing technologies in commercial/industrial applications.
- Describe key differences in piezo, continuous and thermal inkjet printhead performance characteristics.
- Understand future directions in digital printing beyond home and office.

Intended Audience: those somewhat familiar with inkjet printing technology who would like a better understanding of inkjet's role in the analog to digital conversion process.

Ronald Askeland is a System Architect in the Large Format Production printer division of Hewlett Packard in Barcelona, Spain. He has 29 years of experience in thermal inkjet technology and has been awarded more than 50 US patents on inkjet inks and printing systems. Askeland received his PhD in analytical chemistry from Colorado State University and worked for HP in San Diego, CA from 1984-2011.

SC03-S1: Introduction to Toner Technology

Sunday 8:00 – 10:00 AM (2 hours)

Instructor: Jodi Lynn Walsh, Lexmark International, Inc.

This course is a general introduction to toner formulation. Formulation disciplines, material selection and function, and particle architecture implications are summarized. Various toner design criteria and performance requirements in multiple embodiments are also discussed. Analytical and measurement techniques are surveyed including size, shape, charge, flow, and rheological attributes. A glossary and bibliography for future reference are provided.

Benefits

This course enables an attendee to:

- Understand the various implementations of electrophotographic printing and the role that toner plays in each.
- Recognize the design criteria and performance requirements of toner in an electrophotographic printing subsystem.
- Comprehend toner manufacturing alternatives for commercial devices.
- Compare the market implementation of the various toner technologies, and the potential for future market domination.

Intended Audience: anyone seeking an introduction to electrophotography, electrophotographic printing, supplies technology, or related development activities; an interest in toner or carrier is helpful, but no working knowledge of electrophotography is presumed nor required.

Jodi Walsh is the CPT Engineering Manager in the Imaging Solutions and Services Division of Lexmark International. She has been involved broadly across the toner business for 18 years in toner manufacturing, support, and CPT Engineering. Walsh began her career as a formulator under the tutelage of George Marshall and was a technical leader in Lexmark's first color milled toner products and has published multiple toner related patents. Walsh received her PhD in physical organic chemistry from Northwestern University (1994).

SC04-S2: Introduction to 3D Ink Jet Printing

Sunday 10:15 AM – 12:15 PM (2 hours)

Instructor: Sascha de Peña, Hewlett-Packard Company

3D printing or additive manufacturing technologies in general, is an expected future growth area, with a wide variety of different technologies available. Some of the fundamental technologies have been around for a while but the latest enhancements in equipments, performance and materials are now making them a compelling alternative for a diverse range of applications, some of them unique. Also the emergence of low cost 3D printers is contributing to the popularity of the subject. This course provides an overview of the existing 3D printing technologies, materials, their fundamentals, current performance, relative strengths and weaknesses. An overview of the 3D printing overall ecosystem, market, players, applications, software, trends, and news is included.

Benefits

This course enables an attendee to:

- Get up to speed on 3D printing (additive manufacturing) fundamentals in a short time.
- Have a clear view of different existing approaches to create 3D parts by means of additive manufacturing.
- Understand the fundamentals of the underlying technologies and the materials used to work with each of those.
- Learn the pros and cons of each technology and the challenges ahead. Also, an overview of some public research projects being conducted in 3D around the world.
- Appreciate a broad view of the key players in the market, the verticals being addressed, a rough idea of the market potential, and thoughts on how the industry may evolve and the barriers to mass adoption.

Intended Audience: anyone interested in getting up to date in regards to 3D printing, with none or little previous exposure to it (this is where the gain/time is maximized).

Sascha de Peña is a physicist with an MBA, ESADE, and a PhD in plasma physics conducting research at the Max-Planck-Institute for Plasma Physics (IPP) concerned with the investigation of the physical basis of a fusion power plant. Currently, he is master technologist and R&D Chief Engineer at HP's Printing and Personal Systems Group, responsible for the technical direction of several large format printers and in charge of the evaluation and development of technologies for rapid prototyping.

SC05-S2: Digital Packaging

Sunday 10:15 AM – 12:15 PM (2 hours)

Instructor: George Gibson, Xerox Corporation

Increasingly the benefits of digital printing are being applied to the production of packaging. Conventional package printing techniques certainly produce the high quality demanded by brand owners but frequently this comes with significant inventory and waste. Additionally increasingly sophisticated approaches to market segmentation have shown that there is significant value to be had in tailoring offerings to an increasingly number of smaller niches. Key to unlocking this potential is the ability to produce packaging of appropriate quality and cost in a way that meets the scale and value chain requirements of the host industry.

This course covers the variety of liquid toner processes that are and have been used, including the strengths and limitations of each, and the major application areas in which these techniques are employed. The course includes an analysis of improvements of liquid toner systems found in recent technical literature and patents.

Benefits

This course enables an attendee to:

- Understand the forces driving adoption of digital print in various package printing segments and opportunities for market growth.
- Understand the applications and requirements for package printing in label, folding carton, corrugated packaging and flexible packaging.
- Map the technology characteristic onto the market requirements identifying the relative strengths, weaknesses, opportunities and threats of each technology in the context of packaging markets.
- Understand the current market offerings and their position to the market's "ideal points."

Intended Audience: technical professionals who want to become more knowledgeable about how digital printing is likely to fit into the package printing markets.

George A. Gibson is the program manager for New PIJ Platforms in the Xerox Research Center Webster of the Xerox Innovation Group. He has led research, development, and manufacturing organizations involved in non-impact printing for more than 20 years. Originally trained as a chemist, he did his undergraduate and graduate work at Binghamton University. He also holds an MBA from the University of Rochester's Simon Graduate School of Business. Gibson has 52 US patents and has written more than 20 published papers in imaging and colloid science and the management of research and development. He is a frequent lecturer in imaging technology, R&D productivity, portfolio management, and technology valuation. Recent invited lectures include "Good, Fast Cheap in New Product Development: Don't Settle for Just Two," and "Creative Destruction: Portfolio Renewal Rate and Returns Optimization." He is the author of a forthcoming book: Finding the Golden Eggs: An R&D Professional's Guide to Managing New Product Development Through Valuation.

SC06-S2: Fabrication Materials & Processes of Ink Jet Printheads

Sunday 10:15 AM – 12:15 PM (2 hours)

Instructor: Hue Le, Le Technologies Inc.

In recent years, enormous progress has been made in the design, fabrication, and commercialization of ink jet printing systems. This short course describes the materials and processes that have been used to produce various ink jet printheads, which are the core component of the printing systems. Methods of forming ink jet nozzle, anti-wetting coated nozzle surface, ink channel and chamber, and various bonding methods are then reviewed. Materials of thin film resistor (for thermal ink jet) and piezoelectric ceramic (for piezoelectric ink jet) are also reviewed. The course concludes with insights into the potential material interactions between the more complex jetting fluids and the printhead structures in several emerging applications such as bio-printing and printed electronics.

Benefits

This course enables attendees to:

- Understand the basic science and technology in manufacturing methods of various types of thermal and piezoelectric ink jet printheads.
- Assess the current development in fabrication materials and processes of ink jet printheads.
- Evaluate insights into the potentials and limitations of different types of printheads.

Intended Audience: scientist, engineers, product managers, and other charged with development or manufacture of ink jet printing systems.

Hue Le is an ink jet printing technologies consultant at Le Technologies Inc. From 1997 to 2011, he formed and worked at PicoJet Inc., Hillsboro, OR, which designed and manufactured fluid jetting devices and systems for industrial printing applications. Prior to PicoJet, Hue was Director of Technology Development for Tektronix, Inc.'s Printing and Imaging Division. He has more than 32 years of experience in developing and commercializing ink jet printing systems and holds 21 US patents. Le received a BS in chemistry, University of Iowa (1979) and MS in chemistry, New Mexico State University (1981).

SC07-S2: Fusing Technologies

Sunday 10:15 AM – 12:15 PM (2 hours)

Instructor: Dinesh Tyagi, Lexmark International, Inc.

Most conventional electrophotographic printing systems require a fusing sub-system that takes the discrete toner particles and both fuses (coalesces) them together and fixes them to the media. This process is required to produce an attractive, durable image that is bonded tightly to the substrate. This course reviews the fundamental functions of fusing and details past and current fusing technology trends in the electrophotographic industry. The physics of each fusing technology is discussed, with a specific focus on each technology's strengths and weaknesses. Physics and mathematical models of thermal fusing are described along with the critical parameters in fusing steps. In the later part of the course, the most common fusing technologies are discussed, covering the critical parameters and failure modes that govern each technology's operation, and the scientific and engineering challenges faced during both the technology and product-development cycles of a fuser. Common tests for image permanence are discussed along with the available options to enhance print physical performance.

Benefits

This course enables an attendee to:

- Identify and comprehend advantages and disadvantages of different fusing technologies that have been developed and used throughout the industry.
- Analyze the critical parameters that define the fusing process and latitude for common fusing technologies.
- Determine the critical failure modes, and the critical parameters that govern them, for conventional fusers.
- Measure image permanence and discuss available steps for improving fusing quality of images on various substrates.

Intended Audience: scientists, engineers and technicians who are directly or indirectly involved in the selection, analysis, and evaluation of the numerous fusing technologies used in today's electrophotographic engines. A basic understanding of the electrophotographic process will be assumed; familiarity with the basics of heat transfer, and mechanics will be beneficial, but is not required.

Dinesh Tyagi received his PhD degree from Virginia Tech (1985). He then joined Eastman Kodak Company as a Research Scientist where he specialized in the field of digital printing and polymer research. He was inducted into Kodak's Distinguished Inventors Gallery in 1994. In 1999, he joined NexPress Solutions, which was later acquired back by Kodak. Tyagi recently joined Lexmark International where he continues to work in the area of toners and electrophotography as he has done through most of his professional career. Tyagi has been granted more than 300 patents worldwide. In 2011, he was awarded the Chester F. Carlson Award for his innovations and broad contributions to electrophotographic toner technology.

SC08-S3: Introduction to 3D Printing of Metals

Sunday 1:30 – 3:30 PM (2 hours)

Instructor: Jason Jones, Hybrid Manufacturing Technologies

3D printing, also known as additive manufacturing, has recently emerged from niche engineering and hobbyist use, to be a mainstream strategic technology across a broad range of applications. Two recent developments have helped catalyse its recent growth: low cost polymer printers and high-end metal printers. The internet is saturated with information about low-cost printers; however, finding reliable information about metal printing is more difficult.

This course provides insight into the existing techniques for producing metal parts directly and indirectly using 3D printing technologies, including an assessment of their relative strengths, weaknesses and costs. Additionally, the fundamentals of material preparation, how oxidation is avoided, and post processing methods will be addressed. Key market players and applications (including aerospace, dental, medical, and printed electronics) are identified together with future growth directions and standards activities in the area.

Benefits

This course enables an attendee to:

- Understand the state-of-the-art in metal additive manufacturing processes.
- Become conversant with the fundamentals and issues of additive metal approaches.

- Appropriately match techniques (based on their pros and cons) with a variety of applications.
- Gain a sense of the direction of future development and potential for this technology.

Intended Audience: anyone interested in gaining early-intermediate exposure and understanding of the 3D printing of metals. Also those who want a frame of reference for comparing larger scale metal printing practices with conventional digital fabrication practices (for example comparing the production of aerospace parts with printing conductive tracks). There are no prerequisites for this course.

Jason Jones is co-founder and CEO of Hybrid Manufacturing Technologies, a 3D printing start-up equipping CNC machines for Additive Manufacturing. Jones has a PhD in 3D printing from the University of Warwick. During the past decade, Jones has investigated 3D printing/digital fabrication techniques for multi-material functional parts and hybrid processing approaches for metals. Jones serves as Task Group Chair for ASTM for 3D printing (including ISO 52921) and as advisor for SME's Rapid Technologies & Additive Manufacturing Community. This short course has been prepared with Associate Professor Greg Gibbons of the University of Warwick, a 20 year veteran in the field of Additive Manufacturing.

SC09-S3: Nanotechnology and Opportunities for Digital Printing

Sunday 1:30 –3:30 PM (2 hours)

Instructor: Kock-Yee Law, Research and Innovative Solutions

Nanotechnology is the frontier of science, engineering, and manufacturing technologies. This course provides an overview of this vast field. The course begins with a conversation on the history, evolution, and economic and social impacts of nanotechnology and moves on to a critical review of key research/technology areas, including carbon nanotubes, graphenes, nanoparticles, nanocomposites, and superhydrophilic and superhydrophobic surfaces. The research trends, potential applications, and outlook for nanomaterials and devices are summarized. The discussion covers opportunities to leverage recent advances in nanotechnology to fuel innovations in digital printing, examples on the uses of nanotechnology for next generation printer development, and digital printing with nanomaterials.

Benefits

This course enables an attendee to:

- Attendees who are not familiar with nanotechnology will benefit by seeing the entire

landscape of this field as well as an overview of the advanced research and social impact.

- For managers and executives, the broad scope will allow them to be familiar with the field, enabling them to apply this knowledge in the workplace.
- Scientists and engineers who are engaging research in a given nano area will broaden their knowledge base and may lead to the creation of cross-discipline research areas in the future.

Intended Audience: the course materials cover a wide range of topics, from a general survey of the entire field of nanotechnology to the latest advances in key research areas to a discussion of using nanotechnology to create new features in future printers, not accessible through continuous engineering. Scientists, engineers, managers and executives from both industry and university will all find it beneficial.

Kock-Yee Law is founder & CEO of Research and Innovative Solutions, a global provider of technical advices and education services to high-tech industry. He has published more than 120 papers in peer-reviewed journals and holds 101 US patents. Law is an associate editor for "Surface Innovations" (ICE Publishing) and has been a guest editor for Nanostructured Coatings, Surfaces and Films topics in 2013 and 2014. Law has been co-organizer and chair for the Nanostructured Coatings, Surfaces and Membranes Symposium at the Nanotech conferences since 2010. Earlier in his career, Law conducted research on a variety of topics at the Xerox Webster Research Center.

SC10-S3: Fluid Dynamics & Acoustics of Ink Jet Printing

Sunday 1:30 –3:30 PM (2 hours)

Instructor: J. Frits Dijkstra, University of Twente

Inkjet printing is a process of depositing small droplets of a specified volume, on demand at a precisely given location on a substrate. In the course we follow the ink all the way through the print head, through droplet formation, and through landing on the substrate. The course is restricted to piezo driven print heads. A piezo driven print head is a set of acoustic cavities, the characteristics of which will be presented in the time and frequency domain. Upon activation of the piezo a droplet is formed with a well-defined volume and speed. Droplet landing, spreading, and permeation are highly dynamic phenomena with their own timing issues. The aim of this course is to couple the characteristics of droplet formation and landing, spreading, and permeation, to the acoustics of the fluidics of the print head.

Benefits

This course enables an attendee to understand the interactions between the acoustics of the fluidics of the print head and the characteristics of piezo inkjet droplet formation, landing, spreading and permeation.

Intended Audience: engineers and scientists interested in piezo driven print heads, students in the area of print head physics, engineers and scientists working with biomedical applications of inkjet technology.

Frits Dijkman is professor in the field of biomedical applications of inkjet technology at the University of Twente, the Netherlands. He has worked with Philips Research for more than 30 years and his main area of interest has been inkjet technology for consumer and non-consumer applications, such as PolyLED display manufacturing and the printing of biomolecules.

SC11-S3: Toner Materials Relationship with Fusing

Sunday 1:30 –3:30 PM (2 hours)

Instructor: Dinesh Tyagi, Lexmark International, Inc.

Toners play a very critical role in establishing the value of an electrophotographic print. Their composition is often determined by the requirements of the finished print as well as the toner manufacturing process used to produce them. In this course, the influence of toner composition and components on fusing performance is described, including the underlying polymer architecture and viscoelasticity concepts that govern toner binder. Polymer concepts described in this course are equally applicable to polymeric substances used in other parts of the fuser, such as, elastomers and release fluids. Effect of toner additives, such as, pigments, surface treatment etc. on fusing and other toner properties are explained. The course also describes the influence of toner composition and the fusing technology employed, on the print physical and image permanence.

Benefits

This course enables an attendee to:

- Gain insight into toner component selection and their manufacturing processes along with the impact of each on toner properties, image fixing and, print physicals of a print.
- Understand the polymeric concepts that influence fusing and various considerations necessary in toner formulations.
- Comprehend viscoelastic behavior of toners and polymers. This knowledge can then be used to develop understanding of gloss control and other image requirements.

- Toner components selection criteria would be discussed along with the limitations imposed by toner manufacturing technologies.

Intended Audience: all individuals who are directly or indirectly involved in toner formulation development efforts in order to meet wide range of image requirements as well as the limitations imposed by each toner manufacturing method. The course is particularly useful for engineers and scientists who wish to gain insight into controlling image permanence, gloss and print physicals via toner component selection and design. A basic understanding of the electrophotographic process is assumed; but many underlying polymer concepts are described in the course.

Bio See SC07-S2: Fusing Technologies

SC12-S4: Surface Ink Interaction and Surface Characterization

Sunday 3:45 –5:45 PM (2 hours)

Instructor: Kock-Yee Law, Research and Innovative Solutions

Fundamental understanding of how inks wet, spread, de-wet and pin on a print surface is important not only to the quality of the print output, it is even more crucial to modern printed (flexible) electronics manufacturing, where print resolution and functional device performance are paramount. This short course starts with a tutorial on surface characterization and wetting fundamentals. Measurement tools for surfaces and coatings, wetting dynamics, and the meanings of these measurements are discussed, and the importance of understanding and controlling ink wetting, spreading and evaporation in digital manufacturing is illustrated. The mechanism for the formation of the “coffee ring” stain is overviewed and countermeasures are discussed. The course covers a wide range of topics, from surface fundamentals to the application of these basic concepts to solving problems in printing.

Benefits

This course enables an attendee to:

- Surface scientists/engineers and researchers in digital fabrication will benefit from the overview of the state-of-the-art wetting fundamentals and concepts as well as its applications in digital printing.
- Surfaces are usually characterized by contact angle measurements. While the procedures for these measurements are simple, the interpretation is NOT. The understanding from the course will allow surface scientists/

- engineers/managers and practitioners in digital fabrications and related fields to upgrade their measurement tools and procedures at work.
- The examples provided in the course will expand the working knowledge in ink-surface interactions and prepare practitioners and researchers for future challenges.

Intended Audience: This course will be particularly beneficial to surface scientists/ engineers/ managers and practitioners in digital fabrications and related fields. Managers and executives from both industry and university should also find it beneficial, with insights into problem-solving.

Bio: See SC09-S3: Nanotechnology and Opportunities for Digital Printing

SC13-S4: Liquid Toner Printing: Technology and Applications

Sunday 3:45 –5:45 PM (2 hours)

Instructor: George Gibson, Xerox Corporation

Liquid toner technologies have long been held as versatile methods for imaging in a variety of applications. Known for high image quality, especially high-quality color, liquid toners are undergoing a renaissance. Applications of current import include not only document printing, but a number of industrial printing, display, and fabrication applications. In spite of these demonstrated strengths, liquid toners are employed in a minority of printing systems today. Indeed at DRUPA2012 two new companies introduced new liquid toner based products and there was a considerable expansion of the total number of commercial offerings. This course explores how the fundamental strengths of these technologies have led to this current state and project where liquid toner will continue to be a vibrant force.

This course covers the variety of liquid toner processes that are and have been used, including the strengths and limitations of each, and the major application areas in which these techniques are employed. The course includes an analysis of improvements of liquid toner systems found in recent technical literature and patents.

Benefits

This course enables an attendee to:

- Recognize the fundamentals of five generations of liquid toner device architectures.
- Appreciate the composition and preparation methods for liquid toners.
- Describe how the components of the toner and characteristics of the process drive print properties.

- Identify the major market applications where liquid toners are used today.
- Have a vision of where liquid toner technologies are fundamentally advantaged.
- Learn about recent innovations in liquid toner technology.

Intended Audience: technical professionals who want to become more knowledgeable about liquid toner printing technology.

Bio: See SC05-S2: Digital Packaging

SC14-S4: Paper Recycling and Ecolabels, Deinking, and Deinkability

Sunday 3:45 –5:45 PM (2 hours)

Instructor: Axel Fischer, INGEDE e.V.

The paper recycling process has been developed to unlock the “urban forest”—the piles of read newspapers and magazines—as an inexpensive source for paper fibers. At the same time, the recycling cycle has proven to be an essential component of sustainable handling of resources. As a result, all members of the paper supply chain contribute to its conservation.

Digital printing has a number of environmental benefits. However, some print processes can result in severe problems in paper recycling. This short course will—supported by videos and other descriptive material—explain deinking in the industrial paper recycling process, how this process is simulated and evaluated in the lab, and how it is challenged by different printed products. A discussion of present and future European ecolabels and significant related tax regulations for printed products is included.

Benefits

This course enables an attendee to:

- Identify different printed products and printing technologies.
- Understand the environmental impact of printed products after leaving the shop.
- Understand the paper recycling process, and the importance and mechanism of deinking as the key of this process.
- Understand what European and US paper recycling have in common and how they differ.
- Learn about the different challenges of various printing processes.
- Comprehend the principles of deinking in the laboratory and how it relates to industrial practice.
- Learn how good deinkability can be achieved for different types of inks and printing processes.

Intended Audience: anyone interested in environmental issues and the impact related to printed products, such as product development engineers, product stewards, sales engineers, environmental regulatory managers, field application engineers, ink developers, and others.

Axel Fischer studied chemistry at Munich Technical University. Since 1994, he has been responsible for public relations for INGEDE, the International Association of the Deinking Industry. He represents INGEDE at international events and working groups dealing with recyclability, with digital printing technologies, and sustainability in the paper chain. He chairs the International Round Table on the Deinkability of Digital Prints and consults printers in Europe on the recyclability of printed products. His teaching experience includes composing and presenting a science television show for three years.

Monday September 8, 2014

SC15-M4: Security Printing Opportunities in Digital Print and Fabrication

Monday 3:00 –5:00 PM (2 hours)

Instructor: Alan Hodgson, 3M UK PLC

This short course highlights opportunities for printing and fabrication in the security printing arena. Specific opportunities in physics, chemistry, and material science technologies are discussed, as well as the ongoing market for new hardware and software applications for print inspection and verification. After a brief introduction to this market sector and an overview of the technical characteristics of the solutions, the course covers 3 main sections.

- The security printing ecosystem: including the relevant materials, printing processes, electronics and electro-optic hardware. This section also covers existing applications and current opportunities.
- The threat from new digital printing technologies: security features that have been used for years may be compromised by digital printing. Such threats are also opportunities for new printed and fabricated security features.
- Emerging opportunities for new features: printed electronics, mobile imaging and 3D printing are beginning to find application in this sector.

The course features a number of case studies addressing the relative attributes of toner and inkjet printing in this space and the potential impact of pagewide inkjet. Trial examples of printed electronics in security printing are also described.

Benefits

This course enables an attendee to:

- Understand the fundamentals driving security printing opportunities.
- Identify opportunities for materials, print engines, and electro-optic hardware.
- Gain an overview of how technologies such as printed electronics and mobile imaging can be used in the security print market sector.

Intended Audience: material scientists, print professionals, and engineers who are looking for applications of their technology in the field of security printing.

Alan Hodgson has 30 years of experience in print technology development and a background in photography and image science. In November 2008, he joined 3M Chadderton in the UK as Technical Development Manager, specialising in print solutions for high security documents such as passports and identity cards. He is active in printed electronics and serves as Chair of IEC TC119 (Printed Electronics). Hodgson has a BSc in colorant chemistry and a PhD in instrumentation, both from the University of Manchester. He has served as session chair, short course instructor, and presenter at a number of IS&T conferences; he was Short Course Chair for Archiving 2008. He is President of IS&T.

OE-A REGIONAL MEET-&-GREET

Organic & Printed Electronics Association (OE-A)

Through the IS&T/OE-A partnership, information and opportunities are shared with the greater NIP/Digital Fabrication community.

On September 11th, OE-A is hosting its Philadelphia Regional Meet-&-Greet on Printed Electronics. The informal event is designed to provide those working at innovative companies and institutions active in organic, flexible, and printed electronics the opportunity to network. Organizations will also have the option to introduce themselves and provide an update on their products and recent activities, as well as to learn more about the OE-A.

If you are interested in the OE-A and/or attending the Philadelphia Regional Meet-&-Greet, please contact Barbara Fisher, regional manager, OE-A in North America at barbara.fisher@oe-a-na.org for more information. Pre-registration is required for this event.

Hotel, Travel, and City Information

Philadelphia

NIP30/Digital Fabrication 2014 takes place at the Sheraton Philadelphia Downtown, located near “Museum Mile,” site of the Philadelphia Museum of Art and the Barnes Foundation, which houses one of the finest collections of impressionist, post-impressionist, and early modern paintings in the US.

Founded by William Penn in 1682, Philadelphia was a meeting place for the US Founding Fathers; is the site of the signing of the Declaration of Independence (1776) and of the US Constitution (1787); and is home to the US Liberty Bell. Because of its location at the confluence of the Delaware and Schuylkill rivers, the city evolved during the 19th century as a major industrial and transportation center, attracting numerous immigrants from Europe. This, along with it being a major destination for African Americans during the Great Migration, has shaped the exciting ethnic diversity it boasts today.

Beyond its roots in American history and excellent museums, the “City of Brotherly Love” is home to the largest landscaped urban park in the world, many institutes of higher learning, and a number of Fortune 500 companies. It is the fifth largest city in the US and is famous for its Philly cheese steak sandwiches, LOVE sculpture, iconic role in the movie Rocky, and the fact that it has more outdoor sculptures and murals than any other American city.

Historic and bustling Reading Terminal Market, in business for 122 years, is a short walk from the conference hotel. The Market houses a wide variety of restaurants for a quick lunch, as well as fresh local produce, meats, and authentic Amish foods.

Early September weather can range from 81F/27C to 62F/16C.

Sheraton Philadelphia Downtown Hotel

201 N. 17th Street Philadelphia, PA 19103
+1 215 448 2000

Rate: Single \$179 plus 15.5% tax / Double \$199 plus 15.5% tax

Rate availability: The discounted rate is available for 3 days prior to and 3 days after the conference dates of Sept. 7 – 11, 2014, based on availability. To guarantee a room, a credit card number or deposit equal to one night's housing must accompany the reservation request.

Reservations Deadline: August 13, 2014

Check in/out: 3:00 pm/noon

Online reservation link: www.starwoodmeeting.com/Book/NIP30DF2014

Phone reservations: +1 888 627 8178; meeting code is NIP30/Digital Fabrication 2014.

Cancellation Policy: less than 24 hours notice incurs a fee of one (1) room night + tax.

SAVE THE DATE!
Next year's meeting
Sept. 29 – Oct. 1, 2015
Portland, OR

Early Departure Fee: one night's room charge plus tax for departing one or more days early

Airline Info

Philadelphia International Airport (PHL) serves the area. For more information, visit www.phl.org.

Getting to Hotel from Airport (7 miles)

Via Train

- Take the SEPTA (<http://septa.org>) Regional Line (R1) to Suburban Station. At Suburban Station, take the 17th Street exit and walk 3 blocks to the Sheraton. The ride is about 35 min. Fare is \$8 (cash only).

Via Taxi

- Flat fee of \$28.50 to any downtown hotel (tip not included). Credit cards accepted.

Via Shuttle

- Lady Liberty (www.ladylibertyshuttle.com/): Fare is \$10. No online reservations available. Go to the Transportation Counter in the baggage area and use the free white phones (dial 27).
- Express Airport Shuttle (www.express-airportshuttle.com/): Fare is \$9. Reservations may be made online, or, from baggage claim, proceed to the ground transportation desk and ask for Express Airport Shuttle or use the free white phones (dial 36).

AMTRAK Info

Getting to Hotel from Amtrak 30th Street Station

After exiting your AMTRAK train, proceed to the other side of the train station to the SEPTA Regional Lines (<http://septa.org>) and take the next train that stops at the station (trains run every 5 minutes). There is no fee if you show your Amtrak ticket stub to the SEPTA ticket handler. Take the SEPTA train one stop to Suburban Station. Once at Suburban Station, take the 17th Street exit and walk 3 blocks to the Sheraton.

DIGITAL FABRICATION & DIGITAL PRINTING 2014 / NIP30 REGISTRATION

Register online at www.imaging.org/ist/conferences/nip

First/Given Name _____

Last/Family Name _____

Title/Position _____

Company _____

Complete Mailing Address _____

Telephone _____ Fax _____

Email _____

Conference registration includes: admission to all technical sessions; abstract book + CD proceedings; entrance to the exhibit hall; coffee breaks; and the Welcome and Conference Receptions. **Separate registration fees are required for short courses.**

I would like to reserve the following space for a print sample:* _____2' x 4' or _____4' x 4'

I would like a half-table to demonstrate a program/product related to the talk I am giving:*
(Session and Paper Title): _____

Conference Registration (CHECK ONE)	until 8/4	after 8/4	TOTAL
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Please check ALL that apply. I am a:

- ☐ speaker ☐ session chair ☐ committee member ☐ IS&T member ☐ ISJ member

Please note: To better serve your needs, IS&T is offering four conference registration options (+ student and one-day options). One for current IS&T/ISJ members; one for non-members that includes registration only; and two options for non-members that includes IS&T membership from now until Dec. 2015, plus an online subscription to the Journal of Imaging Science and Technology (JIST) or the Journal of Electronic Imaging (JEI).

___ Conference registration: IS&T/ISJ Member	\$775	\$850	\$ _____
___ Conference registration: non-member	\$875	\$950	\$ _____
___ Conference registration: non-member (with comp membership + JIST) **			
Membership begins within 2 weeks of registration and expires 12/31/15.	\$875	\$950	\$ _____
___ Conference registration: non-member (with comp membership + JEI) **			
Membership begins within 2 weeks of registration and expires 12/31/15.	\$875	\$950	\$ _____
___ IS&T/ISJ Student Member (ID required)	\$160	\$190	\$ _____
___ Student Non-member (ID required)	\$185	\$215	\$ _____
___ One-day: <input type="checkbox"/> Mon <input type="checkbox"/> Tues <input type="checkbox"/> Wed <input type="checkbox"/> Thurs	\$455	\$530	\$ _____
___ Short course only (check and proceed to short course selection area)			

Proceedings

Important change regarding proceedings: The conference registration fee includes the abstract book + CD version of the proceedings. If you want a hard copy, you must pay for it separately.

Hardcopy proceedings _____ @\$100/each \$ _____

Extra abstract book + CD proceedings _____ @\$140/each \$ _____

Extra CD _____ @\$100/each \$ _____

Page Subtotal \$ _____

continued on next page

* You will be contacted by the Demonstration Session chair with further details.

** If you choose this option, you may register for Short Courses at the Member rate.

DIGITAL FABRICATION & DIGITAL PRINTING 2014 / NIP30 REGISTRATION CONT'D.

We recognize that changes in the imaging industry have put some of our loyal attendees in strained financial situations. If you are currently unemployed, but would still like to attend this year's meeting, please contact dsmith@imaging.org to discuss your situation.

REDUCED COURSE REG FEES In celebration of 30 years of providing outstanding short courses to digital printing professionals, IS&T has reduced short course prices significantly for 2014. Always wanted to take a course? Now's the time to do it. In fact, take four!

Short Course Registration (see page 11 for course descriptions)	until 8/4	after 8/4	
Member registration	\$95	\$120	\$ ____
Non-member registration	\$130	\$155	\$ ____
Student registration	\$55	\$80	\$ ____
Check all that apply: <input type="checkbox"/> SC01 <input type="checkbox"/> SC02 <input type="checkbox"/> SC03 <input type="checkbox"/> SC04 <input type="checkbox"/> SC05 <input type="checkbox"/> SC06 <input type="checkbox"/> SC07 <input type="checkbox"/> SC08 <input type="checkbox"/> SC09 <input type="checkbox"/> SC10 <input type="checkbox"/> SC11 <input type="checkbox"/> SC12 <input type="checkbox"/> SC13 <input type="checkbox"/> SC14 <input type="checkbox"/> SC15			

Membership	US Address	Non-US Address	
new membership (begins now, expires 12/31/15)	\$145	\$160	\$ ____
annual membership renewal (expires 12/31/15)	\$95	\$105	\$ ____
student membership (begins now, expires 9/30/15)	\$25	\$25	\$ ____
for all memberships select one: <input type="checkbox"/> JIST online <input type="checkbox"/> JEI online			
join now and calculate fees based on member rates			

Tour

☐ Center of Excellence in Surface Imaging Tour

Note: There is no charge for this tour, however by signing up for it, you understand that should you not cancel in writing via e-mail by August 29th or not show up for the tour, you will be charged \$50. Tour limited to 20 people; first-come/first-served basis; a waiting list will be maintained. See page 10 for details.

Social Events		
___ Guest/spouse registration (Name: _____)	\$85	\$ ____
includes the Welcome and Conference receptions		
___ Extra Welcome Reception Ticket	\$40	\$ ____
___ Extra Conference Reception Ticket	\$55	\$ ____
Subtotal from previous page		\$ ____
Wire transfer fee (\$25 if applicable)		\$ ____
GRAND TOTAL		\$ ____

Payment Method: ☐ AmEx ☐ MasterCard ☐ VISA ☐ Discover ☐ Wire Transfer ☐ Check

Card#: _____ Exp. Date: _____

Name as it appears on card: _____

Authorization Signature: _____

Return this form with signed credit card authorization to
IS&T, 7003 Kilworth Lane, Springfield, VA 22151 or fax to 703/642-9094.
We do not encourage sending via e-mail.
Contact registration@imaging.org for wire transfer information.
Please note, \$25 must be added to the Grand Total for wire transfer payments to cover bank costs.

Please note: To cover bank charges and processing fees, there is a cancellation fee of \$75 until September 2, 2014. After that date, the cancellation fee is 50% of the total plus \$75. No refunds will be given after October 6, 2014. All requests for refund must be made in writing.

Contact Donna Smith (dsmith@imaging.org) for Exhibitor Registration and Information

NIP30/Digital Fabrication 2014



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Springfield, VA 22151 USA
703/642-9090; 703/642-9094 (fax)

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Join us
September 7-11, 2014
in Philadelphia, PA
and
SAVE THE DATE
next year
Sept. 29 - Oct. 1, 2015
in Portland, OR!