



**Digital  
Fabrication  
2012**



**NIP28**

28th International Conference on  
Digital Printing Technologies

**PRELIMINARY  
PROGRAM**

**[www.imaging.org/conferences/nip](http://www.imaging.org/conferences/nip)**

**September 9 - 13, 2012  
Quebec City, Quebec, Canada**

Digital Fabrication  
General Chair:  
Paul Benning  
Hewlett-Packard Company

Digital Fabrication  
Publications Chair:  
Werner Zapka  
XaarJet AB

NIP General Chair:  
Scott Silence  
Xerox Corporation

NIP Publications Chair:  
Steven Simske  
Hewlett-Packard Laboratories



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Contact Donna Smith at [dsmith@imaging.org](mailto:dsmith@imaging.org) for details.

*If you work in the field of digital printing, digital fabrication, or a related technology and are looking for the best training, exposure to cutting edge technology advances, and/or expanding your professional network, then . . .*

join us in **Quebec City, Quebec, Canada** for the **28th International Conference on Digital Printing Technologies (NIP28)** and the **2012 Digital Fabrication Conference!**

Digital printing technology continues to evolve and expand into new and exciting application areas and digital fabrication is taking revolutionary steps in technical innovation and launching into new commercial applications. The collocation of these conferences offer participants a unique chance to learn about the latest advances in both worlds. No other venue offers you the chance to attend vibrant sessions that present cutting edge research findings under a single registration fee.

Publications Chairs Steve Simske and Werner Zapka have developed an exceptional program to bring you presentations that both challenge and enlighten. Five content-packed days include:

- Three days on which to pick from an in-depth array of 28 informative short courses
- Four full days of multi-track technical sessions
- Exhibitors who represent the companies who provide you with the services and products you need to succeed
- Joint Interactive Paper and Demonstration Session and Print Gallery; the session will be held in the Exhibit Hall and will include a Happy Hour
- Five keynote talks from world-renowned experts in digital printing and digital fabrication.
- Special Monday topic networking session—connect with other professionals who share your interest in a particular technology area
- Wednesday afternoon roundtables on applications of digital printing and fabrication
- Welcome and Conference Receptions
- A Farewell Reception for one last round of networking opportunities

**Details of the entire conference begin on page 3.**

Please mark your calendars to join us in Quebec City, Quebec! We look forward to seeing you there.

—*Scott Silence, General Chair NIP28, and  
Paul Benning, General Chair Digital Fabrication 2012*

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**See details, page 32.**

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<b>General Chair</b> <b>Paul Benning*</b> Hewlett-Packard Company	<b>Program Chair (Special Topics)</b> <b>James W. Stasiak</b> Hewlett-Packard Company	<b>Interactive Session Chair</b> <b>Dietmar Zipperer</b> PolyIC GmbH & Co. KG
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## NIP28 Conference Committee

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		<b>Audio-Visual Chair</b> <b>Steven V. Korol</b> Xerox Corporation

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 Past NIP General Chair **Xavier Bruch**, Hewlett-Packard Company  
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# Technical and Social Program

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

All Technical Sessions will take place at the Quebec City Convention Centre.

## SPECIAL EVENT

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

**NIP/DF Welcome Reception**  
**Sunday, September 9th**  
**5:45 – 7:00 PM**  
**Location: TBA**

and Takao Abe<sup>1</sup>; <sup>1</sup>Shinshu University and <sup>2</sup>Mimaki Engineering Co., Ltd. (Japan)

**Preparation of Carbon Black Pigment Ink Using Branched Poly(Styrene-Alt-Maleic Anhydride) as a Dispersant (Interactive)**, Yunyan Xu, Shaohai Fu, Changhai Xu, and Anli Tian, Jiangnan University (China)

## SPECIAL NETWORKING SESSION

Session Chair: Branka Lozo, University of Zagreb

4:00 – 5:30 PM

Join us for a brainstorming experience: A number of technical challenges will be identified, followed by small group discussions on finding solutions to the identified problems. Details will be sent closer to the conference.

## Monday September 10, 2012

### ALL TRACKS WELCOME AND KEYNOTE

Session Chair: George Gibson, Xerox Corporation

8:30 – 9:30 AM

### 21st Century Libraries—from Print to Bits,

Franziska Frey, Harvard Library (USA)

### NIP TRACK 1 MEDIA FOR DIGITAL PRINTING

Session Chairs: Wolfgang Schmidt, Felix Schoeller jr Foto- und Spezialpapiere GmbH & Co KG, and

Toshiharu Enomae, University of Tsukuba

9:40 – 10:35 AM

### Color Reproduction Consistency and Capability of Tree-free Copy Paper (Focal), Yu-Ju Wu,

Appalachian State University (USA)

### Inkjet Wallpaper and Decor on Demand,

Patrick Le Galudec, Sihl (Switzerland)

### Research on the Printability of Coated Paper on High-fidelity Digital Printing (Interactive), Qifeng

Chen, Guangxue Chen, Baoling Tang, and Jinglei Tai, South China University of Technology (China)

### COMMERCIAL & INDUSTRIAL PRINTING

Session Chairs: Ron Askeland, Hewlett-Packard Company;

Daniel Mace, Tonejet Limited; and

Yasushi Hoshino, Nippon Institute of Technology

11:20 AM – 12:20 PM

### State of Art of Inkjet Textile Printing: Status Report 2012 (Focal), Hitoshi Ujiiie, Philadelphia University

(USA)

### Design Studies on Ink Jet Printhead to Improve Throughput, Shin Ishikura, Ayumu Matsumoto, and

Kentarō Mori, Kyocera Corporation (Japan)

### Development of Digital Quasi-embossing Technology with an Inkjet Printer (Interactive), Naoki

Matsumae, <sup>1</sup>Masaru Ohnishi, <sup>2</sup>Hironori Hashizume, <sup>2</sup>

### NIP TRACK 2

### ELECTRONIC PAPER AND PAPER-LIKE DISPLAYS

Session Chairs: Jeff Mabeck, Hewlett-Packard Company,

and Makoto Omodani, Tokai University

9:40 AM – 12:00 PM

### Development of Bistable Electronic Inks for Reflective Color Media (Focal), Zhang-Lin Zhou,

Qin Liu, Gregg Combs, Brad Benson, Dick Henze, and Tim Koch, Hewlett-Packard Company (USA)

### Advertising Efficacy Research on Electric Paper (E-Paper) Applications for Advertising Displays in

the MRT Station, Yung-Cheng Hsieh and Ssu-Yi Cheng, National Taiwan University of Arts (Taiwan)

### Organic Electrochromic Materials and Device toward Color Electronic Paper, Norihisa Kobayashi,

Yuichi Watanabe, and Kazuki Nakamura, Chiba University (Japan)

### Comparing Paper Books and Electronic Media in Reading to Answer Questions (Focal), Hirohito

Shibata and Kengo Omura, Fuji Xerox Co. Ltd. (Japan)

### Study on the Photo-alignment Performance of Liquid Crystalline Polymers with Photosensitive

Groups (Interactive), Weimin Zhang, Fanfan Yu, Yulei Zhao, Jilei Li, and Jialing Pu, Beijing Institute of Graphic Communication (China)

### Analysis of General Rashness of Reading on a Display (Interactive), Junko Inada and Makoto

Omodani, Tokai University (Japan)

## The Venue: Quebec City, Quebec, Canada

NIP28/Digital Fabrication 2012 will take place at the Centre des Congrès de Québec (Québec City Convention Centre), located just outside the gates of Vieux-Québec (Old Québec).

Vieux-Québec is a UNESCO World Heritage Site and the only remaining fortified city north of Mexico. Its winding cobblestone streets invite one to discover charming boutiques, restaurants of all cuisines, and historical attractions. Both French and English are spoken widely.

Québec City, the capitol of Québec province, sits on the banks of the St. Lawrence River and offers visitors stunning views of both the river and the stupendous mountains surrounding the city. It is possible to be hiking, golfing, or skiing within a 30-minute drive of downtown.

A number of museums highlight everything from Québec's place in the founding of the US and Canada to Canadian art. For more information on the city, visit [wikitravel.org/en/Quebec\\_City](http://wikitravel.org/en/Quebec_City) or [www.quebecregion.com/en?a=vis](http://www.quebecregion.com/en?a=vis).

Early September weather can range from a high of 63°F/17°C to a low of 46°F/8°C. We suggest you bring along a jacket and sweater to layer on during the evenings and an umbrella for possible light showers.

The Jean-Lesage International Airport (YQB) is 10 miles from downtown—a 20 minute drive. There are nonstop flights from a number of cities, including Chicago, Detroit, Montreal, Newark, Paris, Philadelphia, and Washington, DC (Dulles). For more information visit [www.aeroportdequebec.com/en/](http://www.aeroportdequebec.com/en/).

### INKJET PRINTING: MATERIALS

Session Chairs: Agnes Zimmer, Lexmark International, Inc.; Rüdiger Baur, Clariant Produkte Deutschland GmbH; and Hiroyuki Onishi, Seiko Epson

12:10 – 3:20 PM

#### **The Study of the Relation of Image Quality to the Physical Properties of Inkjet Ink**, Yuki

Wakabayashi, Yasufumi Ueda, and Hiromichi Takahashi, Kao Corporation (Japan)

#### **A New UV Curable Inkjet Ink**, Yasuo Yoshihiro and Takao Hiraoka, Ricoh Company, Ltd. (Japan)

**Effect of Alcohols on the Properties of Aqueous Pigment Dispersion for Preparation of Inkjet Inks (Interactive)**, Lianbing Zhang, Hebei University of Science and Technology, and Kuanjun Fang, Qingdao University (China)

#### **The Synthesis of Blocked Aqueous Polyurethane Obliger for the Pigmented Ink (Interactive)**,

Xiaoxia Long, Shaohai Fu, Changhai Xu, and Xia Zhang, Jiangnan University (China)

**Study on Droplets Formation Process of Polymer-encapsulated Super-fine Disperse Dye Ink (Interactive)**, Guifang Zhang, Shaohai Fu, Anli Tian, Xia Zhang, and Chaoxia Wang, Jiangnan University (China)

**Modification of SMA Using Epoxypropyl Trimethyl Ammonium Chloride and its Application for Carbon Black Dispersing (Interactive)**, Fushun Bai, Shaohai Fu, Anli Tian, Changhai Xu, and Chaoxia Wang, Jiangnan University (China)

**Improved Stray Light Resistance of UV Inkjet Inks (Focal)**, Hugh Allen and Steve Hall, SunChemical Ltd. (UK)

**Application of Color-changeable Ag Films Using Inkjet Technology (Interactive)**, Takayasu Suzuki, Suguru Kitasato, Tomoya Toyooka, and Shuichi Maeda, Tokai University (Japan)

**Preparation of a Cross-linkable Emulsion and its Effectiveness as the Binder Resin of Water-based Printing Inks Curable at Ambient Temperature (Interactive)**, Zhongxiao Li and Huasheng Lu, Beijing Institute of Graphic Communication (China)

### THERMAL PRINTING

Session Chairs: Susan Farnand, RIT; Andrew Clifton, Domino UK, Ltd.; and Hirotoshi Terao, Alps Electric Co., Ltd.  
4:00 – 5:00 PM

**Development of the High Durability Overcoat for Thermal Printhead (Focal)**, Yoshitiko Fujiwara, Hiroshi Masutani, Koji Ochi, and Kazuyoshi Sakamoto, Kyocera Corporation (Japan)

**Novel Approach to Plastic Card Overcoating Process**, Hideo Taniguchi and Shigemasa Sunada, HIT Devices Ltd. (Japan), and Jiro Oi, HIT Devices Ltd. (USA)

**Study of Thick Film Thermal Head Structure (Interactive)**, Takeshi Toyosawa, JC Wang, and Tatsuya Murakami, OYO Geospace (USA)

**On-demand Transcription Foil Print Technology for Smart-Phone Decoration (Interactive)**, Hirotoshi Terao, Masahito Watanabe, Hiroshi Kobayashi, Mitsuo Hirano, and Takara Ishiko, Alps Electric Co., Ltd. (Japan)

### **NIP TRACK 3**

#### **INKJET PRINTING: PROCESSES**

Sponsored by Xaar plc

Session Chairs: Kathleen Vaeth, Eastman Kodak Company;

Mandakini Kanungo, Xerox Corporation;

Andrew Clippingdale, Tonejet Limited;

Steve Hoath, University of Cambridge; and

Mineo Kaneko and Yutaka Kurabayashi, Canon, Inc.

9:40 – 10:55 AM

**Waterless Inkjet Process for High Speed Printing (Focal)**, Paul McConville, Xerox Research Center Webster (USA)

**Development of Novel Bend-mode Piezo Inkjet Print Head Utilizing MEMS Technology for Printed Electronics Applications (Focal)**, Yasuo Nishi,<sup>1</sup> Shigekazu Sakai,<sup>1</sup> Kusunoki Higashino,<sup>2</sup> Yuichi Machida,<sup>1</sup> and Koujiro Yoshida<sup>1</sup>; <sup>1</sup>Konica Minolta IJ Technologies, Inc. and <sup>2</sup>Konica Minolta Technology Center, Inc. (Japan)

**Influence of Aging Effect on the Inkjet Printing Performance of Plasma-treated PET Surfaces (Interactive)**, Chunming Zhang and Kuanjun Fang, Qingdao University (China)

**Research on Droplet Spreading on Substrate Influenced by Droplet Flying Velocity (Interactive)**, Chunjiang Jia, Guangxue Chen, Xiaozhou Li, and Qifeng Chen, South China University of Technology (China)

**A System Identification and Feedforward Control based Approach to Minimize the Cross-talk in a Piezo Inkjet Printhead (Interactive)**, Amol A. Khalate,<sup>1</sup> Xavier Bombois,<sup>1</sup> Robert Babuska,<sup>1</sup> and Sjirk Koekebakker<sup>2</sup>; <sup>1</sup>Delft University of Technology and <sup>2</sup>Océ Technologies B.V. (the Netherlands)

#### **DIGITAL PRINT FULFILLMENT AND FINISHING**

Session Chairs: Jean Piere van de Capelle, consultant, and

Takao Abe, Shinshu University

11:20 AM – 2:35 PM

**Cloud Computing for Graphic Arts Printing (Focal)**, Lee C. Moore and Barry G. Gombert, Xerox Corp. (USA)

**Seamless Publication Using 3D Proofing**, Zachy Karni, Mani Fischer, and Doron Shaked, Hewlett-Packard Laboratories Israel (Israel)

**Revolutionizing Photo Books through the Custom Album Page**, Mark B. Mizen, Creative Memories (USA)

**Intuitive and Scalable Operation Simulation of PSP (Focal)**, Eric Hoarau and Jun Zeng, Hewlett-Packard Laboratories (USA)

**Understanding Post-finishing Performance of Xerographic Prints (Interactive)**, Guiqin Song,<sup>1</sup> Gordon Sisler,<sup>1</sup> Suxia Yang,<sup>1</sup> Thomas P. Debies,<sup>2</sup> Kurt Halfyard,<sup>1</sup> Ed Zwartz,<sup>1</sup> and Brian McAneney<sup>1</sup>;

#### **2012 KEYNOTES**

##### **MONDAY**

**21st Century Libraries – from Print to Bits**  
Franziska Frey, Harvard Library

##### **TUESDAY**

**Paper Microfluidics as an Enabling Platform for Low-cost Diagnostics**  
Jason Rolland, Diagnostics for All

##### **WEDNESDAY**

**Single Pass Inkjet Digital Printing Technology for Commercial Printing Market**  
Hidetoshi Shinada, FUJIFILM Dimatix

**Nanographic Printing Technology**  
Gilad Tzori, Landa Digital Printing

##### **THURSDAY**

**Enabling Ambient Intelligence, Ubiquitous Computing, and the Internet of Things**  
James Stasiak, Hewlett-Packard Company

<sup>1</sup>Xerox Research Centre of Canada (Canada) and

<sup>2</sup>Xerox Research Centre of Webster (USA)

#### **COLOR SCIENCE/IMAGE PROCESSING**

Session Chairs: Behnam Bastani, Memjet; Rita Hofmann, ILFORD Imaging Switzerland GmbH; and Shigeru Kitakubo, Nippon Institute of Technology

4:00 – 4:55 PM

**Challenges for 3D High Fidelity Soft Proofing (Focal)**, Ingeborg Tastl, John Recker, Eric Hoarau, and Udi Chatow, Hewlett-Packard Laboratories (USA)

**A Printer Point Set Gamut Model based on BP Neural Network (Interactive)**, Lei Zhao,<sup>1,2</sup> Guangxue Chen,<sup>1</sup> Baoling Tang,<sup>1</sup> Ruixin Xu,<sup>1</sup> and Xiaozhou Li<sup>1</sup>; <sup>1</sup>South China University of Technology and <sup>2</sup>Hangzhou Dianzi University (China)

**Custom Fan Deck for Multi-primary Visualization (Interactive)**, Kok-Wei Koh, Nathan Moroney, Melanie Gottwals, and Gary Dispoto, Hewlett-Packard Company (USA)

**Experimental Results on Brain Activation by Color Stimulation (Interactive)**, Shigeru Kitakubo and Hidetoshi Nagasawa, Nippon Institute of Technology (Japan)

**Color Difference Evaluation and Calculation for Digital and Printed Images (Interactive)**, Haoxue Liu, Min Huang, Yu Liu, Bing Wu, and Yanfang Xu, Beijing Institute of Graphic Communication (China)

**Automatic Color Reproduction Using Color Chart Position Estimation Method (Interactive)**, Tosiaki Yamanouchi, Kanagawa Institute of Technology (Japan)



**DIGITAL FABRICATION****DEVICES**

Session Chairs: Jeff Nielson, Hewlett-Packard Company; Liisa Hakola, VTT; and Shinishi Nishi, Konica Minolta JJ

Technologies  
2:00 – 5:00 PM

**Direct Etch through SiNx, Selective Dope, and Seed Layer Dispense with Inert Piezoelectric Inkjet Print Head for Solar Cell Fabrication**, Ty Chen, Trident an ITW Company (USA)

**Inkjet Masking for Industrial Solar Cell Processes**, J.P. Hermans,<sup>1</sup> B. Ketelaars,<sup>2</sup> T. Wijnstekers,<sup>2</sup> E. Sonmezler,<sup>2</sup> K. Knechten,<sup>2</sup> R. van Knippenberg,<sup>1</sup> R. Eijmberts,<sup>1</sup> A. Verburg,<sup>1</sup> H. Veenstra,<sup>2</sup> and P. van de Haar<sup>1</sup>; <sup>1</sup>OTB Solar and <sup>2</sup>Océ Technologies B.V. (the Netherlands)

**Optimizing the Performance of Metal Grid Conductors by Modifying Printing Conditions**, Liisa Hakola, Elina Jansson, Mark Allen, Sanna Rousu, and Riikka Suhonen, VTT Technical Research Centre of Finland (Finland)

**Inkjet Printing for Small Molecule OLED**, Maosheng Ren, Holst Centre/TNO (the Netherlands)

**Low Cost Metallization Inks for Photovoltaics**, Heather A.S. Platt,<sup>1</sup> Yunjun Li,<sup>2</sup> James P. Novak,<sup>2</sup> S.E. Habas,<sup>1</sup> C. J. Curtis,<sup>1</sup> A. Miedaner,<sup>1</sup> David S. Ginley,<sup>1</sup> and Maikel F.A.M. van Hest<sup>1</sup>; <sup>1</sup>National Renewable Energy Lab and <sup>2</sup>Applied Nanotech, Inc. (USA)

**Front Side Metallization Issues of a Solar Cell with Ink-jet Printing**, Dong-Youn Shin,<sup>1</sup> Yong-Kee Cha,<sup>2</sup> and Han-Hee Ryu<sup>3</sup>; <sup>1</sup>Pukyong National University, <sup>2</sup>Samick THK Co., Ltd., and <sup>3</sup>Millinet Solar Co., Ltd. (Korea)

**Intelligent Packaging with Inkjet-printed Electrochromic Plastic Display—A Passive Display Infotag**, Jue Shen,<sup>1</sup> Li Xie,<sup>1</sup> Jia Mao,<sup>1</sup> Fredrik Jonsson,<sup>1</sup> Magnus Svensson,<sup>2</sup> and Lirong Zheng<sup>1</sup>; <sup>1</sup>KTH and <sup>2</sup>Acreo (Sweden)

**Central Challenges when Upscaling the Manufacturing of Thin-film Battery Applications**, Michael Espig,<sup>1</sup> Frank Siegel,<sup>1</sup> Jens Hammerschmidt,<sup>1</sup> Andreas Willert,<sup>2</sup> and Reinhard R. Baumann<sup>1,2</sup>; <sup>1</sup>Chemnitz University of Technology and <sup>2</sup>Fraunhofer Institute for Electronic Nano Systems ENAS (Germany)

**PARTICIPATE in the  
PRINT SAMPLE GALLERY and  
DEMONSTRATION SESSION**

**Interested?**

Free space is available for authors.  
See registration form or  
email nip\_df@imaging.org for details.

The Gallery will be available for viewing  
during exhibit hours.

**Tuesday September 11, 2012**

**ALL TRACKS  
REMARKS AND KEYNOTE**

Session Chair: Paul Benning, Hewlett-Packard Company  
8:30 – 9:30 AM

**Paper Microfluidics as an Enabling Platform for Low-cost Diagnostics**, Jason P. Rolland, Diagnostics for All (USA)

**NIP TRACK 1**

**TONER-BASED PRINTING: MATERIALS**  
Sponsored by Cabot Corporation

Session Chairs: Henryk Birecki, Hewlett-Packard Company; Volkhard Maess, Océ Printing Systems GmbH;

Detlef Schulze-Hagenest, Kodak Graphic Communications GmbH; Yoshihiro Hattori, Konica Minolta Business Technologies Inc.; and Nobuyuki Nakayama,

Fuji Xerox Co., Ltd.

9:40 AM – 3:15 PM

**Crystalline Polyester for Chemically Prepared Toner Having Low Energy Fusing**, Hiroki Kakiuchi, Eiji Shirai, Tomohide Yoshida, and Katsutoshi Aoki, Kao Corporation (Japan)

**Powder and Film Charging Characteristic Estimation by the Imaging Society Japan Standard Carrier**, Yasushi Hoshino, Disna Karunanayake, and Takashi Watanabe, Nippon Institute of Technology (Japan)

**New Submicron Silica Produced by the Fumed Process**, Naohiro Naito,<sup>1</sup> Yuki Amano,<sup>1</sup> Yusuke Tosaki,<sup>1</sup> Robert Johnson,<sup>2</sup> and Andreas Hille<sup>3</sup>; <sup>1</sup>Nippon Aerosil Co., Ltd. (Japan), <sup>2</sup>Evonik Degussa Corporation (USA), and <sup>3</sup>Evonik Industries AG (Germany)

**The Effects of Fumed Silica Structure on Toner Properties**, Leo M. Nelli, Evonik Degussa Corp. (USA), and Yuki Amano, Nippon AEROSIL Co., Ltd. (Japan)

**Latex Optimization for Emulsion Aggregation Toners with Design for Lean Six Sigma (DfLSS)**

**Methodology**, Zhen (Jerry) Lai and Chieh-Min Cheng, Xerox Corporation (USA)

**Materials Compatibility Assessment via Temperature Controlled Contact Angle Measurements**, Doris Chun, Albert Teishev, Hou T. Ng, and Eric Hanson, Hewlett-Packard Laboratories (USA)

**Palm Oil-based Bio-resin for Toner**, Jaan Soon Tan, Jun Shen Chia, Choon Liew, and Seng Neon Gan, Jadi Imaging Technologies Sdn Bhd (Malaysia)

**External Additives for Toners: Characteristics of Fumed Silica, Colloidal Silica, and Next Generation Materials**, Hajime Kambara, Jim Boswell, Anna Groenewal, Hairuo Tu, Alyson Christopher, and Dmitry Fomitchev, Cabot Corporation (USA)

**Advanced Process for Polyester Chemically Prepared Toner in Aqueous Phase**, Hiroshi Mizuhata,



## TUESDAY AND WEDNESDAY SPECIAL EVENT

### Conference Exhibit

Tuesday: 10:00 AM – 6:30 PM  
and  
Wednesday: 9:00 AM – 3:30 PM  
Please visit our exhibitors!

*Manabu Suzuki, Nobumichi Kamiyoshi, and  
Shinichi Sata, Kao Corporation (Japan)*

**Temperature Effects on Liquid Electrophoretic Inks,**  
*Henryk Birecki, Hewlett-Packard Company (USA)*

**The Research on Recovery for the Shrinkage of  
the Film (Interactive),** *Meifang Zhang, Renmin  
University of China (China)*

**Effects of Toners on Photothermographic Materials  
based on Silver Benzotriazole (Interactive),**

*Yao Shi, Xinmin Yang, Zhi Li, and Wangjing Ma,  
Chinese Academy of Science (China)*

**A Method for Measuring Electrical Properties of  
OPC Drum Using "Liquid Electrode Contact  
Method" (Interactive),** *Toshinori Nozaki and Miki  
Harigai, GENTEC CO., Ltd. (Japan)*

## NIP TRACK 2 PRINTING SYSTEMS ENGINEERING/OPTIMIZATION

Session Chairs: Jim Boeder, ImTech; Mark Crankshaw,  
Xaar; Kai Hsiao, University of Cambridge; and  
Teruaki Mitsuya, Ricoh Co., Ltd.  
9:50 – 11:00 AM

**Simulation of Toner Mixing and Delivery System  
(Focal),** *Akin Ecer, Vladimir Rubek, and Kemal  
Arican, Technalysis, Inc. (USA)*

**Synchronized Impact through a Generic Substrate  
Carrier,** *Arend-Jan Beltman, John Hazenberg,  
Ronald Plak, and Rob Pulles, Center for Concepts in  
Mechatronics (the Netherlands)*

**An Adaptive Model-based Approach to Reduce  
Calibration Frequency while Maintaining Tone  
Consistency for Color Electrophotography,** *Yan-Fu  
Kuo,<sup>1</sup> George T.-C. Chiu,<sup>2</sup> George Kerby,<sup>3</sup> Jeff  
Trask,<sup>3</sup> Yuehwern Yih,<sup>2</sup> and Jan P. Allebach<sup>2</sup>; <sup>1</sup>National  
Taiwan University (Taiwan), <sup>2</sup>Purdue University  
(USA), and <sup>3</sup>Hewlett-Packard Company (USA)*

## PRINT & IMAGE QUALITY

Session Chairs: Franziska Frey, Harvard University;  
Robert Harvey, AtomJet Ltd.; and  
Yoshihiko Shibahara, FUJIFILM Corporation  
11:30 AM – 3:25 PM

**Analysis of Large Area Field Printing Quality  
based on HP Indigo 5500,** *Yingmei Zhou,  
Shanghai Printing and Publishing College (China);*

## TUESDAY SPECIAL EVENT ALL TRACKS

### INTERACTIVE PAPER, DEMONSTRATION SESSION, PRINT GALLERY, AND EXHIBIT HALL HAPPY HOUR

Session Chairs:

Devon Strain, Lexmark International, Inc.;  
Dietmar Zipperer, PolyIC GmbH & Co. KG;  
Susan Farnand, Rochester Institute of Technology; and  
Jolke Perelaeer, Friedrich-Schiller-Universität Jena  
3:50 – 6:30 PM

Sponsored by Baker Hughes Specialty Polymers

*Xiaoying Rong, Cal Polytechnic State University  
(USA); and Zhongmin Jiang, University of Shanghai  
for Science and Technology (China)*

**Use of Face Detection to Qualify Image Processing  
Algorithms,** *Steven Simske, Dalong Li, and  
Darryl Greig, Hewlett-Packard Laboratories (USA)*

**Laser Spot Size Measurements and Resulting  
Developed Toner Features,** *Jon B. Whitney,  
Lexmark International (USA)*

**Experimental Comparison of Wettability of  
Pico- and Microliter Droplets with Range of Liquid  
Surface Tensions on Porous and Non-Porous  
Substrates,** *Maiju Pykönen and Susanna Aura,  
Biolin Scientific (Finland)*

**Performance of Print Masks Using Image Quality  
Measurements,** *J. William Boley, ChenChao Shou,  
and George T.-C. Chiu, Purdue University (USA)*

**Implementation of Halftone Blending in Dual-Mode  
Halftoning to Improve Print Quality for Electropho-  
tographic Printers,** *Seong Jun Park,<sup>1</sup> Mark Shaw,<sup>2</sup>  
George Kerby,<sup>2</sup> Terry Nelson,<sup>2</sup> Di-Yuan Tzeng,<sup>2</sup>  
Victor Loewen,<sup>2</sup> Kurt Bengtson,<sup>2</sup> and Jan P.  
Allebach<sup>3</sup>; <sup>1</sup>Texas Instruments Inc., <sup>2</sup>Hewlett-Packard  
Company, and <sup>3</sup>Purdue University (USA)*

**The Study on Tone Reproduction Characteristic of  
Digital Printing (Interactive),** *Shi Ruizhi, Zhou Xiao,  
and Sun Bing, Zhengzhou Institute of Surveying and  
Mapping (China)*

**Study on Quality Analysis and Evaluation System  
of Inkjet Printed Image (Interactive),** *Guangxue  
Chen, Yan Zhong, Qifeng Chen, Xiaomeng Cui,  
and Chunjiang Jia, South China University of  
Technology (China)*

**Hybrid Target for Camera-based Document/  
Object Capture System (Interactive),** *Yang Lei,<sup>1</sup>  
Peter Majewicz,<sup>2</sup> Kurt Bengtson,<sup>2</sup> Lisa Li,<sup>2</sup> and  
Jan P. Allebach<sup>1</sup>; <sup>1</sup>Purdue University and <sup>2</sup>Hewlett-  
Packard Company (USA)*

**Measurement of Electrostatic Latent Images Using**

**Scanning Electron Microscope (Interactive),**  
Naotaro Kumagai and Makoto Omodani, Tokai  
University (Japan)

**Relationship between the Readability and  
Resolution of 3D Lenticular Comics (Interactive),**  
Hideo Kasuga, Hayato Takahashi, Kengo Kaji,  
Karin Biwaki, and Kazuhisa Yanaka, Kanagawa  
Institute of Technology (Japan)

### NIP TRACK 3

#### ADVANCED & NOVEL PRINTING AND APPLICATIONS

Session Chairs: Mandakini Kanungo, Xerox Corporation;  
Jordi Sender, Hewlett-Packard Company; and  
Shuichi Maeda, Tokai University

9:40 AM – 12:00 PM

**Custom Cloud Printing (Focal),** Udi Chatow,  
Hewlett-Packard Company (USA)

**Biofabrication of Cancer Microenvironment  
Mimics by Inkjet Printing (Focal),** Anu Ilmonen and  
Tuija Teerinen, VTT Technical Research Centre of  
Finland (Finland)

**Integral Photography Using 2D Printer Output  
and Fly's Eye Lens Made with 3D Printer,**  
Kazuhisa Yanaka, Naoki Kira, and Hideo Kasuga,  
Kanagawa Institute of Technology (Japan)

**An LED Print-Head for Novel Imaging  
Applications,** William Henry, InfiniLED Ltd. (Ireland),  
and Najeeb Khalid, Escher Grad Inc. (Canada)

**New High-resolution Technique of Image Reading  
Using LMS-type Spectrum Filter (Interactive),**  
Hidekazu Sekizawa, Masahiro Suzuki, Kazuhisa  
Yanaka, and Kazutake Uehira, Kanagawa Institute  
of Technology (Japan)

**An In-situ formed Cross-linked Coating and its  
Effectiveness as Under-layer in Laser Imaging  
(Interactive),** Jialing Pu and Yuguang Feng, Beijing  
Institute of Graphic Communication (China)

#### PRINTING SYSTEMS ENGINEERING/ OPTIMIZATION APPLICATIONS

Session Chairs: Jim Boeder, ImTech;  
Mark Crankshaw, Xaar; Kai Hsiao, University of  
Cambridge; and Teruaki Mitsuya, Ricoh Co., Ltd.

2:00 – 3:50 PM

**Dielectric Properties Study of Thin Film Polymers  
Layers Used in LEP,** Rafael Kahatabi, Peter Forgacs,  
Naseem Yacoub, Wael Salalha, and Doron  
Avramov, Hewlett-Packard Indigo (Israel)

**An Analysis and Prediction of Paper Curl in the  
Fusing Process of Electrophotography,** Shunichi  
Oohara,<sup>1</sup> Yuko Hayama,<sup>1</sup> Hirofumi Tanigawa,<sup>2</sup>  
and Takaharu Tsuruta<sup>2</sup>; <sup>1</sup>Ricoh Company, Ltd. and  
<sup>2</sup>Kyushu Institute of Technology (Japan)

**Sensing Volatile Hydrocarbons in Printing Process,**

K. Nauka and Seongsik Chang, Hewlett-Packard  
Company (USA)

**Potential-profile Measurement and Mechanism  
Analysis of Electrostatic Latent Image by Detecting  
Primary Electrons (Focal),** Hiroyuki Suhara, Ricoh  
Company, Ltd. (Japan)

**Technology of Media Capability for Color POD  
Printers,** Hiroshi Inenaga, Ricoh Company, Ltd.  
(Japan)

### DIGITAL FABRICATION

#### METROLOGY, INSTRUMENTATION, AND DESIGN OF PRINT PATTERN

Session Chairs: Thomas Boland, University of Texas El  
Paso; Shlomo Magdassi, The Hebrew University of  
Jerusalem; and Shinri Sakai, Seiko Epson Corporation

9:50 AM – 12:30 PM

**Patterned by Printing—A New Approach to  
Printed Electronics,** Carolyn Ellinger, David Levy,  
and Shelby Nelson, Eastman Kodak Company  
(USA)

**Measurement of Mass of Single Inkjet Drops with  
a Quartz Crystal Microbalance QCM,** Ingo  
Reinhold,<sup>1</sup> Vasile Mecea,<sup>2</sup> Lucas Armbrecht,<sup>1</sup>  
Wolfgang Voit,<sup>1</sup> Maik Müller,<sup>1</sup> and Werner  
Zapka<sup>1</sup>; <sup>1</sup>Xaarjet AB and <sup>2</sup>QCM Lab (Sweden)

**Scope of Nanomechanical Characterization in  
Combination with In-Situ SPM Imaging and  
Nanoscale Electrical Contact Resistance Mapping  
in Printed Organi,** Srikanth G. Vengasandra and  
Jeremiah Vieregge, Hysitron, Inc. (USA)

**Inkjet Geometric Design & Compensation Rules  
Generation and Characterization,** Eloi Ramon,  
Carme Martínez-Domingo, Ana Alcalde-Aragones,  
and Jordi Carrabina, Universitat Autònoma de  
Barcelona (Spain)

**Evaluation of Inkjet Print Heads for Digital  
Fabrication and Printed Electronic Applications,**  
Vincent Cahill, VCE Solutions, and Dene Taylor,  
SPF Inc. (USA)

#### FORMULATION OF FUNCTIONAL INKS

Session Chairs: Omer Gila, Hewlett-Packard Company;  
Rob Harvey, AtomJet Ltd; and Masahiko Fujii, Fuji Xerox

2:00 – 2:20 PM

**Mechanochemical Approaches to Ceramic Ink  
Formulation for Digital Fabrication of Solid Oxide  
Fuel Cells,** L. Jay Deiner,<sup>1</sup> Alexis Marruffo,<sup>2</sup> and  
Thomas L. Reitz<sup>2</sup>; <sup>1</sup>New York City College of Tech-  
nology and <sup>2</sup>The Air Force Research Laboratory (USA)

**Method to Synthesize Silver Nano-particles for  
Inkjet Inks to Reduce Environmental Load,**  
Sosuke Kanzaki, Jun Natsuki, and Takao Abe,  
Shinshu University (Japan)

**Research on Preparation of Nano-silver Flake in  
Conductive Ink,** Baoling Tang, Guangxue Chen,

Qifeng Chen, and Jinglei Tai, South China University of Technology (China)

**Paper-based Nanosilver Conductive Ink**, Chunyan Liu, Wendong Yang, Zhiying Zhang, and ShiDong Nie, Technical Institute of Physical & Chemistry, CAS (China)

### 3D PRINTING

Session Chairs: Thomas Boland, University of Texas El Paso; Rob Harvey, AtomJet Ltd; and Masahiko Fujii, Fuji Xerox  
2:20 – 4:10 PM

**The Influence of Residual Toner Charge on 3D Laser Printed Objects**, Jason Jones,<sup>1,2</sup> Greg Gibbons,<sup>1</sup> and David Wimpenny<sup>2</sup>; <sup>1</sup>University of Warwick and <sup>2</sup>De Montfort University (UK)

**Solid Free-form Fabrication of Ceramics as a Design Aid for Concept Modelling**, David Huson, University of the West of England (UK)

**3D Printing of Transparent Glass**, Susanne Klein,<sup>1</sup> Steven Simske,<sup>1</sup> Guy Adams,<sup>1</sup> Carinna Parraman,<sup>2</sup> and David Huson<sup>2</sup>; <sup>1</sup>Hewlett-Packard Laboratories and <sup>2</sup>University of the West of England (UK)

**Digital Fabrication of 3D Bio Devices Utilizing PELID (Patterning with Electrostatically-Injected Droplet) Method**, Shinjiro Umezumi, Tokai University and RIKEN (Japan)

**3D Printing of Self-glazing Ceramics: An Investigation into Egyptian Faience**, Stephen Hoskins and David Huson, University of the West of England (UK)

## Wednesday September 12, 2012

### ALL TRACKS MORNING KEYNOTE

Session Chair: Hitoshi Nakai, Brother Industries, Ltd.  
8:30 – 9:45 AM

**Single Pass Inkjet Digital Printing Technology for Commercial Printing Market**, Hidetoshi Shinada, FUJIFILM Dimatix (Japan)

### AFTERNOON KEYNOTE

Session Chair: Paul Drury, Xaar Technology Limited  
2:00 – 3:00 PM

**Nanographic Printing Technology**, Gilad Tzori, Landa Digital Printing (Israel)

### NIP TRACK 1 TONER-BASED PRINTING: MATERIALS CONTINUED Sponsored by Cabot Corporation

Session Chairs: Henryk Birecki, Hewlett-Packard Company; Volkhard Maess, Océ Printing Systems GmbH; Detlef Schulze-Hagenest, Kodak Graphic Communications GmbH; Yoshihiro Hattori, Konica Minolta Business Technologies Inc.; and Nobuyuki Nakayama, Fuji Xerox Co., Ltd.  
9:50 AM – 4:30 PM

**Preparation of Silica Aerogels with Improved Mechanical Properties and Extremely Low Thermal Conductivities through Modified Sol-Gel Process**, Yanjia Zuo and Santokh Badesha, Xerox Corporation (USA)

**Electro-Rheological Model of HP-Indigo ElectroInk**, Peter Forgacs and Albert Teishev, Hewlett-Packard Co. Indigo Division (Israel)

### SPECIAL EVENT

NIP28/Digital Fabrication 2012  
Conference Reception

Wednesday, September 12  
7:00 – 10:00 PM

Location TBA

**Study of Relationship between External Additive Adhesion and Toner Stress in a Cartridge**, Chanhyuk Park, Nahyoung Kim, Il-sun Hwang, Hyun Jin, and Kyung-Yol Yon, Samsung Fine Chemicals (Korea)

**Semiconducting Polymer Matrix as Charge Transport Materials and its Application in Polymer Electronic Devices (Focal)**, Zhang-Lin Zhou, K. Nauka, Lihua Zhao, Hou T. Ng, and Omer Gila, Hewlett-Packard Company (USA)

**Aggregation Behaviors of Colloidal Particles for Production of Polyester-based Chemically Prepared Toner**, Sung Yul Kim, Bo Young Kim, and Kyung-Yol Yon, Samsung Fine Chemicals Co., Ltd. (Korea)

**The Effect of Carrier Surface Morphology on the Triboelectric and Imaging Performance of Insulative Two-Component Xerographic Developers (Focal)**, Robert J. Nash, Hafren Associates (USA)

**Linking the Chemistry and Physics of Electronic Charge Transfer in Insulators: Theory and Experiment (Focal)**, Richard P. N. Veregin,<sup>1</sup>

Michael S. Hawkins,<sup>1</sup> Qingbin Li,<sup>2</sup> Sergey Gusarov,<sup>2</sup> and Andriy Kovalenko<sup>2,3</sup>; <sup>1</sup>Xerox Research Centre of Canada, <sup>2</sup>National Institute for Nanotechnology, and <sup>3</sup>University of Alberta (Canada)

### ROUNDTABLE DISCUSSION

4:30 – 5:45 PM

see details page 11

## NIP TRACK 2 ACTIONABLE, SECURITY, AND FORENSIC PRINTING

Session Chairs: Jason Aronoff, Hewlett-Packard Company;  
Alan Hodgson, 3M UK; and  
Toshio Uehara, TREK Japan K.K.  
9:50 – 11:50 AM

**Combined Covert Data Embedding and Forensic Markings for Graphic Objects**, Robert Ulichney, Stephen Pollard, Matthew Gaubatz, and Steven Simske, Hewlett-Packard Company (USA)

**Progressive Barcodes**, Marie Vans, Steven Simske, and Brad Loucks, Hewlett-Packard Company (USA)

**Mobile Capture of High-resolution Data-bearing Markings**, Matthew Gaubatz, Stephen Pollard, Robert Ulichney, and Steven Simske; Hewlett-Packard Company (USA)

**Incremental Information Objects and Progressive Barcodes (Focal)**, Steven Simske, Marie Vans, and Brad Loucks, Hewlett-Packard Company (USA)

### IMAGE PERMANENCE

Session Chairs: Jack Gormley, Sun Chemical, and  
Yoshihiko Shibahara, FUJIFILM Corporation  
11:50 AM – 4:30 PM

**The Light Induced Deterioration of Inkjet Media in Frames**, Eugene Salesin and Daniel Burge, Rochester Institute of Technology (USA)

**Factors to Consider in the Design and Evaluation of Commercial Printing Inks and Substrates for Permanence and Durability**, Douglas Bugner and Stuart Gordon, Eastman Kodak Company (USA)

**Colorant Fade and Page Yellowing of Bound and Unbound Materials Printed Using Digital Presses and Offset Lithography when Exposed to Nitrogen Dioxide (Focal)**, Nino Gordeladze and Daniel Burge, Rochester Institute of Technology (USA)

**Test Methods for the Water Sensitivity of Photo-books (Focal)**, Alan Hodgson, 3M UK, and Anna L. Fricker, University of the Arts London (UK)

### ROUNDTABLE DISCUSSION

4:30 – 5:45 PM  
see details page 11

## NIP TRACK 3 INKJET PRINTING: PROCESSES CONT'D

Session Chairs: Andrew Clippingdale, Tonejet Limited;  
Steve Hoath, University of Cambridge; and  
Mineo Kaneko and Yutaka Kurabayashi, Canon, Inc.  
9:50 AM – 4:00 PM

**Stability Analysis of a Drop Generation from a Nozzle in an Electric Field with Corona Discharge**, Kazuyuki Tada and Hiroyuki Kawamoto, Waseda University (Japan)

### 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. On most days, 30-minute coffee breaks occur sometime between 10:00–11:00 AM and 3:30–4:30 PM; lunch breaks are generally from 12:30–2:00 PM. Presentation lengths include time for Q&A.

Keynote: 50 minutes

Focal: 30 minutes

Oral: 20 minutes

Interactive previews: 5 minutes

To facilitate planning, we've color coded the technical session as follows:



NIP Session/Focus



Digital Fabrication Session/Focus

### Jet Fluctuations and Drop Velocity Jitter:

**Confirmation of a Causal Model**, Jeremy Grace, Carolyn Ellinger, Giuseppe Farruggia, and Yonglin Xie, Eastman Kodak Company (USA)

**Digital Printing of Packaging—the Tonejet Solution**, Daniel Mace, Tonejet Limited (UK)

**Regimes of Polymer Behaviour in Drop-on-Demand Ink-jetting (Focal)**, Stephen D. Hoath,<sup>1</sup> Oliver G. Harlen,<sup>2</sup> Neil F. Morrison,<sup>2</sup> and Ian M. Hutchings<sup>1</sup>; <sup>1</sup>University of Cambridge and <sup>2</sup>University of Leeds (UK)

**The Interaction between Substrate-induced Airflow and Inkjet Drops and Satellites**, W.K. Hsiao, S.D. Hoath, G.D. Martin, and I.M. Hutchings, University of Cambridge (UK)

**Line Formation Analysis for Offset Solid Ink Printing**, Trevor Snyder, Xerox; Noel Tavan, Yongkang Chen, and Mark Weislogel, Portland State University (USA)

**Drying and Deposition of Picolitre Droplets of Colloidal Suspensions in Binary Solvent Mixtures (Focal)**, Emma L. Talbot, Arganthaël Berson, Philip S. Brown, and Colin D. Bain, Durham University (UK)

### ROUNDTABLE DISCUSSION

4:30 – 5:45 PM  
see details page 11

## SPECIAL EVENT

### TECHNOLOGY AND APPLICATION ROUNDTABLES

Wednesday, September 12, 2012

4:15–5:25 PM

#### Session Chairs:

Omer Gila, Hewlett-Packard Company, and George Gibson, Xerox Corporation

NIP28 includes four moderated, small group discussions. The goal of the roundtables is to integrate newly discovered and published data with the expertise of participants. While the discussion will begin with an exploration of several questions at the leading edge of the discipline, it will move to accommodate the particular interests of the group members. The goal is to let everyone participate and share information, brainstorm the technology and market trends, and increase networking for future collaboration.

#### NIP28/Digital Fabrication 2012 Roundtable Options:

Highlights from Drupa, moderated by Omer Gila, Hewlett-Packard Co.

University/Industry Collaborations, moderated by Steve Simske, Hewlett-Packard Co.

The Document Ecosystem, moderated by George Gibson, Xerox Corp.

3D Printing, moderated by David Huson, University of the West of England

*To sign up for one of these groups please send an email to [omer.gila@hp.com](mailto:omer.gila@hp.com) and [nip\\_df@imaging.org](mailto:nip_df@imaging.org) and specify your first and second roundtable priority.*

### DIGITAL FABRICATION PRE & POST PROCESSING

Session Chairs: Arun Agarwal, Hewlett-Packard Company;

Ingo Reinhold, Xaarjet AB; and Masaaki Oda, ULVAC

9:50 AM – 12:40 PM

#### Development Towards Fast ‘Wet Photonic Sintering’ of Inkjet Printed Silver Inks,

*Ingo Reinhold, Wolfgang Voit, Maik Müller, Matthias Müller, and Werner Zapka, Xaarjet AB (Sweden)*

#### Inkjet Printing and Curing of Nano Copper Ink,

*Sooman Lim, Margaret Joyce, and Paul D. Fleming, Western Michigan University (USA)*

#### Digital Printing of $\mu$ Plasmas to Selectively Improve

**Wetting Behaviour of Functional Inks for Printed Electronics,** *M. van Dongen, E. Nieuwenhuis, L. Verbraeken, P. Ketelaars, and J. Bernards, Fontys University of Applied Sciences (the Netherlands)*

#### Advanced Photonic Curing for Drying Films Rapidly and Efficiently,

*Stan Farnsworth, Kurt Schroder,*

*Ian Rawson, and Dave Pope, NovaCentrix (USA)*

#### The Influence of Post-treatment Strategies in Inkjet

**Printing on the Morphology of Layers and the**

**Functional Performances of Electronic Devices,**

*Jens Hammerschmidt,<sup>1</sup> Enrico Sowade,<sup>1</sup> Kalyan Yoti*

*Mitra,<sup>1</sup> Lilli Marlen Wohlleben,<sup>1</sup> and Reinhard R.*

*Baumann<sup>1,2</sup>; <sup>1</sup>Chemnitz University of Technology*

*and <sup>2</sup>Fraunhofer ENAS (Germany)*

#### Up-scaling Alternative Sintering Methods for Fast Sintering of Inkjet Printed Nanoparticles,

*Jolke Perelaer,<sup>1</sup> Sebastian Wünsch,<sup>1</sup> Robert Abbel,<sup>2</sup> and Ulrich S. Schubert<sup>1</sup>; <sup>1</sup>Friedrich-Schiller University Jena (Germany) and <sup>2</sup>Holst Centre, High Tech Campus (the Netherlands)*

### PRINTING OF ELECTRONICAL CONNECTIONS

Session Chairs: Mark Crankshaw, Xaar, and

Shinjiro Umezu, Tokai University

3:30 – 4:40 PM

#### Low-cost Ink-jet Printing for Electrical Functionalization of Rigid Substrate Materials,

*Marcus Reichenberger, Oleksandr Kravchuk, and Andreas Mühlbauer, Georg Simon Ohm University of Applied Sciences Nuremberg (Germany)*

#### Feasibility Study: Inkjet Filling of Through Silicon

**Vias (TSV),** *Andreas Rathjen,<sup>1</sup> Yvonne Bergmann,<sup>2</sup>*

*and Klaus Krüger<sup>1</sup>; <sup>1</sup>Helmut-Schmidt-University/*

*University of The Federal Armed Forces Hamburg*

*(Germany) and <sup>2</sup>Robert Bosch GmbH (Germany)*

#### Copper Ink-jet Inks for Flexible and Plastic Elec-

**tronics,** *Michael Grouchko and Shlomo Magdassi,*

*The Hebrew University of Jerusalem (Israel)*

### ROUNDTABLE DISCUSSION

4:30 – 5:45 PM

see details above

**Thursday September 13, 2012**

**ALL TRACKS  
AFTERNOON KEYNOTE**

Session Chair: Werner Zapka, XaarJet AB  
2:25 – 3:15 PM

**Digital Fabrication—Enabling Ambient Intelligence, Ubiquitous Computing and the Internet of Things**, James Stasiak, Hewlett-Packard Company

**NIP TRACK 1  
FUSING, CURING, AND DRYING**

Session Chairs: Dinesh Tyagi, Eastman Kodak Company; Gerhard Bartscher, Felix Boettcher GmbH & Co. KG; and Kuk Keon, Samsung Electronics  
8:30 – 10:10 AM

**HP DesignJet L65500 Drying and Curing Systems (Focal)**, Jesus Garcia, Hewlett-Packard Company (Spain)

**A Numerical Study for Fusing Process Including Moisture Phase Change in the Porous Media**, Soohwan Bae, Dongwoo Lee, Juntae Kim, Seongyul Kim, and Jeongchul Song, Samsung Electronics Co., Ltd. (Korea)

**Analysis of Electrostatic Offset**, Hiroki Eguchi, Yasunari Kobaru, Yasuo Yoda, Ryosuke Hamamoto, Takuma Onishi, and Toyoshige Sasaki, Canon Inc. (Japan)

**Toner Fix Analysis Using Numerical Simulation Techniques (Focal)**, Takuma Onishi, Kyohei Kato, Masaki Kouno, Hiroki Eguchi, Yasunari Kobaru, and Yasuo Yoda, Canon Inc. (Japan)

**MATHEMATICAL MODELING**

Session Chairs: Margaret Sturgill, Hewlett-Packard Company; Steve Hoath, University of Cambridge; and Tomoyuki Ito, Fuji Xerox Co., Ltd.  
11:30 AM – 2:20 PM

**Plasma Dynamics and Charging Characteristics of a Single Nozzle Ion Head**, Jun-Chieh Wang,<sup>1</sup> Napoleon Leoni,<sup>2</sup> Henryk Birecki,<sup>2</sup> Omer Gila,<sup>2</sup> and Mark J. Kushner<sup>1</sup>; <sup>1</sup>University of Michigan (USA) and <sup>2</sup>Hewlett-Packard Laboratories (USA)

**Heat Transfer Simulation for Thermal Design of Fusing System**, Kazuki Kitazawa and Tomoyuki Ito, Fuji Xerox Co., Ltd. (Japan)

**Semi-analytical Model of Charge Image Formation in Electrophotography**, Brandon A. Kemp, Arkansas State University (USA)

**Charging of Surfaces with a Wire Corona Discharge: Simulations of Plasma Hydrodynamics with Moving Surfaces**, Jun-Chieh Wang,<sup>1</sup> Napoleon Leoni,<sup>2</sup> Henryk Birecki,<sup>2</sup> Omer Gila,<sup>2</sup> and

Mark J. Kushner<sup>1</sup>; <sup>1</sup>University of Michigan (USA) and <sup>2</sup>Hewlett-Packard Laboratories (USA)

**Simulation Technology to Predict Paper Curl Reformation by Visco-elasto-plastic Model**, Ryosuke Takahashi, Tomoyuki Ito, Kiyoshi Hosoi, and Takashi Ogino, Fuji Xerox Co., Ltd. (Japan)

**NIP TRACK 2  
TONER-BASED PRINTING: PROCESSES  
Sponsored by Ricoh Company Ltd.**

Session Chairs: Ligia Bejat, Lexmark International, Ltd., and Hiroyuki Kawamoto, Waseda University  
8:30 – 10:10 AM

**Parametric Investigation on Dynamics of Toner and Carrier Particles in Electrophotographic Two-Component Magnetic Brush Development System (Focal)**, Hiroyuki Kawamoto, Waseda University (Japan)

**ElectroInk Charge Retention in the HP Indigo LEP Press**, Thomas C. Anthony, Seongsik Chang, Quang Lam, and Omer Gila, Hewlett-Packard Laboratories (USA)

**Small Dot Printing with Ion Head**, Napoleon Leoni, Henryk Birecki, Omer Gila, Michael H. Lee, and Eric G. Hanson, Hewlett-Packard Laboratories; and Richard Fotland, Illumina Inc. (USA)

**Toner/Transfer Member Adhesion Response to Environment Induced Material Property Changes and Their Impact on Transfer Fields (Focal)**, Julie Whitney, Lexmark International (USA)

**PANEL DISCUSSION: COEXISTENCE OF  
PRINT AND DIGITAL MEDIA**

Session Chair: Branka Lozo, University of Zagreb  
10:40 AM – 12:10 PM

**TONER-BASED PRINTING:  
PROCESSES CONTINUED  
Sponsored by Ricoh Company Ltd.**

Session Chairs: Ligia Bejat, Lexmark International, Ltd., and Hiroyuki Kawamoto, Waseda University  
1:20 – 2:20 PM

**Three Dimensional Simulation of Transfer Process, Masami Kadonaga, Ricoh Company, Ltd. (Japan)**  
**Cartridge Clustering and Classification for Improving Tone Prediction Accuracy in Calibration for Color Electrophotography**, Chao-Lung Yang,<sup>1</sup> Yan-Fu Kuo,<sup>2</sup> Yuehwen Yih,<sup>3</sup> George T.-C. Chiu,<sup>3</sup> and Jan P. Allebach<sup>3</sup>; <sup>1</sup>National Taiwan University of Science and Technology (Taiwan), <sup>2</sup>National Taiwan University (Taiwan), and <sup>3</sup>Purdue University (USA)  
**A Model for the Dynamics of Charging Photoreceptor and Ionic Wind in Positive DC Corona Discharge in Electrophotography**, Masato Kobayashi, Norio Uchida, and Hidekazu Nogami, Brother Industries Ltd. (Japan)



### NIP TRACK 3

#### ENVIRONMENTAL SUSTAINABILITY

Session Chairs: Daniel Burge, RIT, and  
Norio Nagayama, Ricoh Company, Ltd.

8:30 AM – 12:10 PM

#### Deinking of Recovered Paper Mixtures Containing Digital Prints—Challenges and Prospects (Focal),

*Dennis Voss, Hans-Joachim Putz, and Samuel Schabel, Technische Universität Darmstadt (Germany)*

#### Effects of Paper on LEP Digital Print Deinking with Alkaline and Neutral Chemistries, Manoj K.

*Bhattacharyya, Hou T. Ng, Laurie S. Mittelstadt, and Marc Aronhime, Hewlett-Packard Company (USA)*

#### Deinking of Thermal Inkjet Newsprint,

*Laurie S. Mittelstadt, Hou T. Ng, Manoj K. Bhattacharyya, and Wenjia Zhang, Hewlett-Packard Laboratories (USA)*

#### Sustainability through Variable Data Printing (Focal),

*Steven Simske, Jason Aronoff, Margaret Sturgill, and Marie Vans, Hewlett-Packard Laboratories (USA)*

#### Imaging Devices, Sustainable Design and Indoor Air Quality (Focal),

*Marilyn Black, GREENGUARD Environmental Institute; Scott Steady, Air Quality Sciences, Inc.; and Paul Emerson, Hewlett-Packard Company (USA)*

#### New Deinkable Water based Inkjet Inks,

*Axel Fischer, International Association of the Deinking Industry (INGEDE), and Elisabeth Hanecker, PTS – Paper Technology Specialists (Germany)*

#### Application of Wet Image Analysis on Recycled Paper Ink Elimination Evaluation,

*Roland Gong, Western Michigan University; Paul D. Fleming and Roy Rosenberger, Verity IA LLC (USA)*

#### Explaining the Present Parameters for Safety and Climate Considerations as Necessary Prerequisites for Digital Printing,

*Werner Sobotka, VFG (Austria)*

### SPECIAL EVENT

#### PANEL DISCUSSION: COEXISTENCE OF PRINT & DIGITAL MEDIA

Thursday, September 13, 2012

10:40 AM – 12:10 PM

Moderator: Branka Lozo, University of Zagreb

#### Confirmed Panelists:

James Larson, Xerox Corporation  
Wolfgang Schmidt, Felix Schoeller  
Shibata Hirohito, Fuji Xerox

### SPECIAL EVENT

#### GROUP DISCUSSION: LAB-TO-FAB

Thursday, September 13, 2012

1:20 – 2:20 PM

Moderator: Werner Zapka, XaarJet AB

### DIGITAL FABRICATION DEVICES CONTINUED

Session Chairs: Paul Benning and James Stasiak, Hewlett-Packard Company; Dietmar Zipperer, PolyIC; Werner Zapka, XaarJet AB; Koei Suzuki, Ricoh Company, Ltd.; and Kye-Si Kwon, South Korea Soonchunhyang University  
8:30 AM – 12:20 PM

#### Touch Sensors based on PolyTC Transparent Conductive Films, Dietmar Zipperer, PolyIC GmbH & Co. KG (Germany)

**Inkjet System for Printing Mechanical Reinforcing Patterns Directly on Fragile Membranes Floating on Liquid Surfaces,** Peter Ueberfuhr,<sup>1</sup> Jens Hammerschmidt,<sup>1</sup> Kerstin Gläser,<sup>1</sup> Werner A. Goedel,<sup>1</sup> and Reinhard R. Baumann<sup>1,2</sup>; <sup>1</sup>Chemnitz University of Technology and <sup>2</sup>Fraunhofer Institute ENAS (Germany)

**All Inkjet Printed “Lab-on-Paper” with Electrodes and Microchannels,** Kento Maejima,<sup>1</sup> Toshiharu Enomae,<sup>1</sup> Akira Isogai,<sup>1</sup> Koji Suzuki,<sup>2</sup> and Daniel Citterio<sup>2</sup>; <sup>1</sup>The University of Tokyo and <sup>2</sup>Keio University (Japan)

**Inkjet Printing for Applications in Microfluidic Lab-on-Chip Systems,** Erik Beckert,<sup>1</sup> Oliver Pabst,<sup>1,2</sup> Jolke Perelaer,<sup>2</sup> Ulrich S. Schubert,<sup>2</sup> Ramona Eberhardt,<sup>1</sup> and Andreas Tünnermann<sup>1,2</sup>; <sup>1</sup>Fraunhofer Institute for Applied Optics and Precision Engineering and <sup>2</sup>Friedrich-Schiller-University Jena (Germany)

**Nanomaterials for Printed Electronics,** Shlomo Magdassi, the Hebrew University of Jerusalem (Israel)

**Inkjet Printing of Chemiresistive Sensors for the Detection of Volatile Organic Compounds,** Panida Lorwongtragool,<sup>1,2</sup> Enrico Sowade,<sup>1</sup> Jens Hammerschmidt,<sup>1</sup> Teerakiat Kerdcharoen,<sup>3</sup> and Reinhard R. Baumann<sup>1,3</sup>; <sup>1</sup>Chemnitz University of Technology (Germany), <sup>2</sup>Mahidol University (Thailand), and <sup>3</sup>Fraunhofer Institute ENAS (Germany)

**Enabling Low Cost UHF RFID Transfer Tattoo Tags by Inkjet Printing Means,** Veronica Sanchez-Romaguera,<sup>1</sup> Stephen G. Yeates,<sup>1</sup> Mohamed A. Ziai,<sup>2</sup> John C. Batchelor,<sup>2</sup> and E. A. Parker<sup>2</sup>; <sup>1</sup>University of Manchester and <sup>2</sup>University of Kent (UK)

#### GROUP DISCUSSION: LAB-TO-FAB

Session Chair: Werner Zapka, XaarJet AB  
1:20 – 2:20 PM



# Short Course Program

This year's NIP/DF Short Course Program offers a wide range of introductory and advanced classes in the fields of digital printing and digital fabrication given by internationally recognized experts dedicated to promoting the understanding and advancement of imaging science and technology. Attendees receive 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.

**Special Offer**  
**Sign up for 2 or more short courses and**  
**receive 10% off your total short course fee.**

Students may take any short course for \$50. Above noted discount does not apply.

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

**Sunday September 9, 2012**

## **SC01-S1: Printing and Imaging Standards Now and Into the Future**

Sunday 8:00 – 10:00 AM (2 hours)  
 Instructor: Paul Jeran, Hewlett-Packard Company

The first part of this course introduces the participant to the framework for standards development in the printer and imaging areas. The focus is on international standards development organizations and consortia, but touches on some areas of national development. The structure of several organizations is highlighted as well as the standards development processes associated with each organization.

The second part focuses on some of the existing standards in the area of office equipment and future directions for standards development in this area. Key areas of focus are performance measurement and environmental assessment for office equipment.

### **Benefits**

This course enables an attendee to:

- Understand the structure of various international standards bodies.
- How to participate in development of international standards.
- Gain insight into trends in standards development

**Intended Audience:** office equipment imaging professionals who need to understand how standards are developed and how to participate in their creation and gain insight into standards trends.

*Paul Jeran is a R&D engineer and currently works in laser jet supplies at Hewlett-Packard. He has been involved in the development of new printing technologies, print quality measurement, printer reliability, and printer standards. He is a*

*member of ISO/IEC JTC1 SC28, an international office equipment standards committee, chair of the US Technical Advisory Group to SC28 and convener of WG 2 – Consumable Yield within SC28. He is editor of several standards for ink and laser cartridges.*

## **SC02-S1: Organic Photoreceptors in Electrophotography**

Sunday 8:00 AM – 12:00 PM (4 hours)  
 Instructor: David Weiss, University of Rochester

Organic photoreceptors (OPCs) are at the heart of today's electrophotographic printers and this technology is also the foundation upon which the current research and development of organic electronic devices (light emitting diodes, photovoltaic solar cells, and field-effect transistors) is based. This course provides the attendee with a comprehensive understanding of OPCs.

What are OPCs, what is their development history, what are they made of and how are they made? How do OPCs function in electrophotographic printers? How are OPCs studied and characterized? What are OPC failure modes and what are the approaches to longer lived OPCs?

### **Benefits**

This course enables an attendee to:

- Understand the design and function of organic photoreceptors in an electrophotographic printer.
- Appreciate the interplay between photoreceptor physics and electrophotographic function.
- Understand the relationship between chemical composition and the functions of the various layers in an organic photoreceptor.
- Describe the technologies involved in the

manufacturing and certification of organic photoreceptors.

- Describe how organic photoreceptors are studied and characterized.
- Be aware of the currently accepted mechanisms of charge generation and transport in organic photoreceptors.
- Identify photoreceptor failure modes and diagnose problems.
- Appreciate how organic photoreceptor technology has been adapted to other electronic devices.

**Intended Audience:** those interested in understanding the essential role of organic photoreceptors in modern digital electrophotographic printers will benefit from this course. It is anticipated that attendees will have a variety of backgrounds and experience: students, managers, sales and marketing personnel, technicians, engineers, and scientists. A general background in chemistry, physics, and the electrophotographic process will be helpful but not essential.

*David S. Weiss, senior scientist (University of Rochester, Dept. of Chemical Engineering), is a consultant on organic photoreceptors and organic electronic materials and devices. He received his PhD in chemistry from Columbia University (1969) and retired from Eastman Kodak Company as a Scientist Fellow (2009). Weiss is the inventor on 24 US patents and author on 99 publications. He is co-author of Organic Photoreceptors for Imaging Systems (1993) and Organic Photoreceptors for Xerography (1998) and co-editor for Handbook of Imaging Materials, Second Edition (2002). He received the Chester F. Carlson Award (1999) and is an IS&T Senior Member, Fellow, and past IS&T vice-president and past treasurer.*

### SC03-S1: Papermaking, Coating Fundamentals, and Media for Digital Printing

Sunday 8:00 AM – 12:00 PM (4 hours)

Instructor: Sen Yang, Avon Products

This short course includes an introduction to papermaking and coating technologies, and a discussion on media requirements for digital printing with an emphasis on electrophotographic and ink jet printing applications. Paper attributes that are important for color electrophotographic and ink jet printing are discussed. A review of recent developments of ColorLok™ Technology and “better paper for better printing” is included.

#### Benefits

This course enables an attendee to:

- Describe the basics of papermaking and paper coating processes.

**Short Course Monitors are needed to help with classes. Monitors take courses for free.**

**Interested? Contact Diana Gonzalez at  
nip\_df@imaging.org  
Priority is given to students.**

- Understand paper property and testing methods.
- Comprehend key media properties for achieving good color printing performance for electrophotographic and ink jet printing.

**Intended Audience:** anyone seeking an introduction to papermaking and paper coating fundamentals, and who wants a better understanding of the relationship of media properties, performance for electrophotographic, and ink jet printing. No working knowledge of papermaking or coating techniques is presumed or required.

*Sen Yang is currently a senior manager for Product Innovation with Avon Products. He spent 17 years with International Paper, Champion International, and Océ-Arkwright managing digital printing media R&D and new product development projects. He received his PhD in polymer science from Brown University (1990). Yang has led and contributed to a number of new-to-the-industry and commercially successful digital printing media launches for both private label and OEM brands. He has more than 10 patents in the area of coated inkjet, EP papers, and specialty media.*

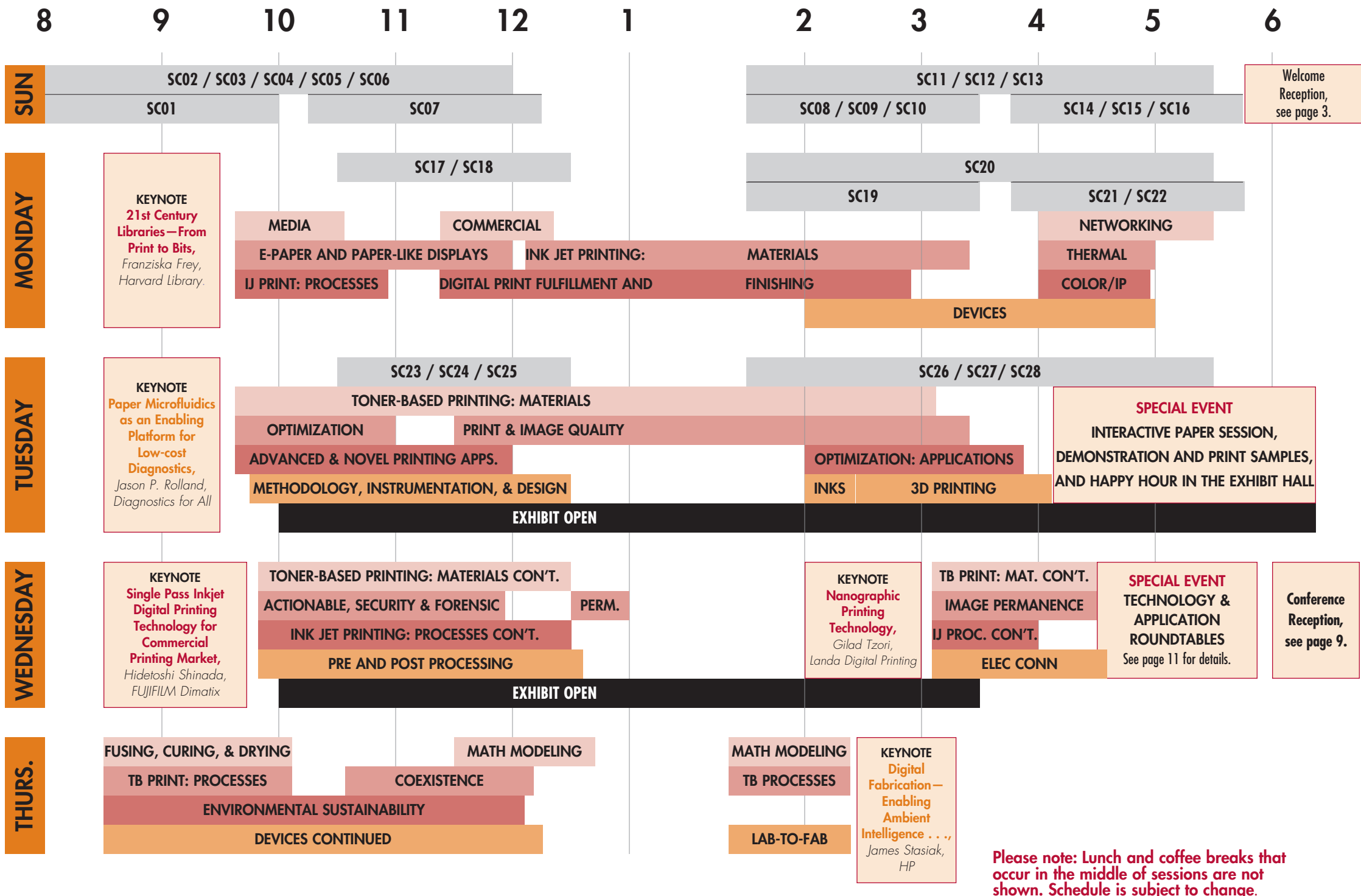
### SC04-S1: Polymer Structure and Toner Rheology for Fusing

Sunday 8:00 AM – 12:00 PM (4 hours)

Instructor: Suresh (Sam) Ahuja, Xerox Corporation

This course focuses on the functional dependence of polymer structure on rheology and the significance of rheology, specifically of toner rheology on digital imaging. Polymer structure models are reviewed as single and multiple bead-spring chains that get entangled with degrees of polymerization leading to dramatic changes in strength, viscosity and elasticity. The course covers stress and strain analysis in continuous media. Topics include: stress and strain concepts, the relation of elasticity to structural mechanics theories, physical basis of plastic/inelastic deformation of solids, and constitutive descriptions of plasticity including yielding. The power-law model for viscosity, Carreau-Yassuda model for viscosity, and Bingham model for viscosity (yield stress) are used to fit viscosity models to rheological data. In the visco-elasticity Maxwell model/generalized Maxwell model, generalized linear-viscoelastic constitutive **continued on page 18**

# NIP28/Digital Fabrication 2012 Week At-a-Glance



Please note: Lunch and coffee breaks that occur in the middle of sessions are not shown. Schedule is subject to change.

**LEGEND**

NIP Track 1	NIP Track 3	Special Joint Events	Short Course
NIP Track 2	Digital Fabrication	Exhibit	

**continued from page 15** equations and small-amplitude oscillatory shear are given. Regimes where linear and non-linear viscoelastic models are applicable are described. Effects of polymer properties such as morphology, crystallinity, polymer structure, molecular weight, crosslinking (gelation), fillers, and external additives on viscoelasticity of toners are shown. Fusing and fixing of toner particles to substrates are analyzed in terms of coalescence of toner, spreading, and adhesion of images to substrates. The course also covers evaluation of images by image analyzers

### Benefits

This course enables an attendee to:

- Have an enhanced understanding of toner materials.
- Improve characterization of polymer and toners.
- Appreciate improvement in designing materials.
- Reduce the risk of image failure due to inadequate toner mechanical properties.

**Intended Audience:** scientists and engineers working in imaging systems as well as managers and executives interested in improving the imaging products.

*Suresh (Sam) Ahuja is a consultant after retiring from Xerox Corporation. He has worked in the field of polymer science and rheology for more than 30 years. His research interest has always been in the structure-processing-property relationships of a wide variety of materials used in a variety of non-silver halide imaging systems. He was a regular teacher at the continuing education department of Xerox Corporation and gave seminars to graduate students and its faculty at Rutgers University, the University of Massachusetts, University of Minnesota, the University of Rochester, Cornell University, State University of Pennsylvania, and the University of Karlsruhe. He has undergraduate degrees in both physics and chemistry, an MSc in soil physics from Indian Agriculture Research Institute, and a PhD in polymer science from the Polytechnic Institute of New York.*

### SC05-S1: Liquid Toner Printing: Technology and Applications

Sunday 8:00 AM – 12:00 PM (4 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 DRUPA this year 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.

*George A. Gibson is the program manager for New PII 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.*

*"I enjoyed the interactive nature and openness of the class."*

### SC06-S1: Intro to Electrophotography

Sunday 8:00 AM – 12:00 PM (4 hours)

Instructor: Marc Cousoulis, Lexmark International, Inc.

Electrophotography is the underlying print engine technology that drives the multimillion dollar laser printer and toner industries. This short course provides a review of the foundational science required to understand the functional and architectural decisions that define the design of modern toner based imaging systems. Electrophotography is examined from both a historical perspective and with an emphasis on current technological trends. The business of electrophotography transcends multiple industries and disciplines, from chemical manufacturers to managed print service providers, from physicists to IT specialists. Any individual who works directly or indirectly with the toner based imaging industry should benefit from this course.

#### Benefits

This course enables an attendee to:

- Appreciate the history and evolution of electrophotography.
- Identify and explain the six fundamental steps of electrophotography.
- Comprehend the basic physics of toner charging, development, transfer and fixation.
- Understand how industry standards are used/misused when categorizing marking systems.
- Compare the current technology choices utilized commercially.

**Intended Audience:** imaging professionals in all disciplines who are seeking an overview of the science and application of electrophotography.

*Marc Cousoulis has more than 15 years of electrophotographic experience across three market segments, holding the positions of senior scientist at Moore Business Forms developing ultra high speed toner based imaging systems, senior electrophotographic engineer at Aetas Technology developing low end color laser printer technologies, and is currently electrophotographic technology team lead for high end color laser printers for Lexmark International. He holds separate degrees in physics and imaging science from the Rochester Institute of Technology.*

### SC07-S2: Life Cycle Analysis in the Printing Industries

Sunday 10:15 AM – 12:15 PM (2 hours)

Instructor: Marcos Esterman, RIT

Conducting Life Cycle Assessments (LCAs) and similar assessments such as carbon footprint, has become more prevalent as a means to convey environmental impacts to a range of stakeholders. Given the pervasiveness of print, many or-

ganizations are interested in the environmental impacts associated with the life cycle of print. The printing industry faces many challenges in its attempt to measure and compare environmental impacts. Considered in their entirety, these impacts are significant. This workshop presents an overview of Life Cycle Assessment approaches, the current state and challenges of performing environmental impact assessment within the printing industry, as well as discusses some recommendations for the future of environmental impact assessment within the printing industry.

#### Benefits

This course enables an attendee to:

- Appreciate the environmental impact assessment methods.
- Understand efforts to address the challenges the print industry is facing in particular, such as the definition of functional unit, the effects of multi-functionality of devices, variability in use patterns, and standardization of assumptions and boundary conditions.
- Be exposed to possible strategies to overcome these challenges in the future.

**Intended Audience:** this workshop will be of greatest benefit to print industry practitioners who want an introductory overview of environmental impact assessment and/or who are interested on a perspective on the current state of practice and challenges within the print industry.

*Marcos Esterman is an associate professor in the Industrial and Systems Engineering Department at the Rochester Institute of Technology (RIT). He directs the Print Research and Image Systems Modeling and co-directs the Sustainable Print Systems Laboratories. Prior to joining the RIT faculty, he worked for Hewlett-Packard's Imaging and Printing Division in Boise, ID, and General Electric Medical Systems in Milwaukee, WI. Esterman earned his PhD in mechanical engineering from Stanford University, and MSME and BSME from MIT.*

### SC08-S3: Cloud Printing

Sunday 1:30 – 3:30 PM (2 hours)

Instructor: Phil McCoog, Hewlett-Packard Company

Cloud Printing has moved from an interesting technology to a major part of the printing landscape. Its symbiotic relationship with cloud computing and mobility as well as enabling “driverless” printing has driven explosive growth. Cloud computing is a broad topic area that spans many market segments and has multiple embodiments. The needs for scalability, reliability, security demands some technologies not typical to the printing industries. This course benefits the

printer developer and cloud developer alike. The course will be presented in a way to enable developers to have a working understanding of the needed architecture components as well as marketing and business participants to have a working understanding of the terminology and technology. We will compare and contrast several market deployments.

### Benefits

This course enables an attendee to:

- Understand the various types of cloud print solutions: consumer/public; public print locations; enterprise/private cloud solutions.
- Develop an understanding of the business challenges shared by the three solutions and the challenges unique to each.
- Have a basic understanding of the basic technology elements that are used to create cloud print solutions.

**Intended Audience:** printing professionals interested in understanding the business and technology challenges and various solutions across the spectrum of cloud print solutions.

*Phil McCoog has more than 24 years of experience in HP printing business across multiple technologies and market segments. He is the technology strategist and senior architect for HP Mobile and Web-Enabled Printing Solutions. McCoog has driven the technology and partnerships that have yielded HP ePrint, HP ePrint Enterprise, HP ePrint On-the-Go (Public Print location), HP integration with Google Cloud Print, and HP deployment of Apple AirPrint. He holds an undergraduate degree in computer engineering from University of California San Diego and a MS in computer engineering from Columbia University.*

### SC09-S3: Paper Recycling and Deinking

Sunday 1:30 – 3:30 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. In the meantime, the recycling cycle has proven to be an essential part of sustainable handling of resources. Therefore, all members of the paper chain contribute to its conservation.

Digital printing has a lot of environmental benefits. However, some print processes can lead to severe problems in paper recycling. This short course—supported by videos and other descriptive materials—explains deinking in the industrial paper recycling process, how this is simulated and evaluated in the lab, and how it is challenged by different printed products.

### 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, the importance and mechanism of deinking as the key of this process.
- Appreciate what European and US paper recycling have in common and how they differ.
- Learn about the different challenges of different 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 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, environmental regulatory managers, sales engineers, field application engineers, ink developers and others.

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

### SC10-S3: Electrostatics and Charged Particle Deposition

Sunday 1:30 -3:30 pm (2 hours)

Instructor: Dan Hays, consultant

Charged particle deposition is widely used in digital copiers and printers to produce high-quality documents. Such deposition is also being utilized to digitally fabricate various devices. This short course provides a foundation for understanding electrostatics phenomena that enable charged particle deposition.

### Benefits

This course enables an attendee to:

- Understand basic concepts regarding electrostatic forces, electric fields, electrostatic potential and energy.
- Describe different methods for charging or neutralizing an insulative layer and powder.
- Describe techniques for measuring the charge on an insulative layer and powder.



- Discuss how the maximum electric field for air breakdown depends on the air gap and particle size.
- Understand electric field detachment of triboelectric, ion, and induction charged particles.

**Intended Audience:** for technicians, engineers, scientists, and managers involved in electrophotography and digital fabrication research and engineering. Familiarity with college-level physics is a recommended prerequisite.

*Dan A. Hays retired from Xerox Corporation in 2006 as a Senior Research Fellow. His research contributions in the field of electrophotography have spanned the areas of triboelectricity, charged particle adhesion, and xerographic development systems. During a 38 year career, he published 57 scientific papers and obtained 79 US patents. Prior to joining Xerox in 1968, he received a BS from Iowa State University and a PD in physics from Rutgers University.*

### SC11-S3: Digital Packaging

Sunday 1:30 – 5:30 PM (4 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 the various package printing segments and the opportunities for market growth.
- Understand the applications and requirements for package printing in label, folding carton, corrugated packaging and flexible packaging.

## 10% SAVINGS

Take 2 or more short courses and get 10% off your total short course registration fee!

See registration form for details.

You may also take advantage of this when you register online.

- 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.

*Bio see: SC05-S1: Liquid Toner Printing: Technology and Applications*

### SC12-S3: Introduction to Toner Technology

Sunday 1:30 – 5:30 PM (4 hours)

Instructor: George Marshall, Lexmark International, Inc.

This course includes an introduction to electronic printing technologies and defines the place of electrophotography in its various embodiments. One common element—toner—is discussed in terms of architecture, formulation, and implementation in each of these embodiments. Also discussed are various toner design criteria and performance requirements. Analytical and measurement techniques are surveyed including size, shape, charge, and rheological attributes. Recent product introductions and future trends in toner technology are reviewed and presented. 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.

*George P. Marshall is a member of senior technical staff at Lexmark International's Boulder, Colorado facility. He has been involved in many aspects of printer and copier development, including development of toner formulations for IBM and Lexmark printers, and is a recognized figure in the area of electrophotography and supplies-related disciplines. Marshall received a PhD in organic chemistry from the University of Arizona (1978), and worked for IBM's Office Products Division from 1978 until 1991, at which time a divisional sale created Lexmark. He has worked in the toner development group since 1978. Marshall has served on the IS&T Board of Directors, edited several IS&T books, and is a member of the Particulate Science and Technology: An International Journal Editorial Review Board. In 1996, he received Lexmark's highest employee honor: Customer for Life Award.*

### SC13-S3: Product Development and Manufacturing in Emerging Labor Markets

Sunday 1:30 – 5:30 PM (4 hours)

Instructor: David Larson, Hewlett-Packard Company

In today's competitive global business environment, many companies are looking to lower costs by developing and manufacturing products in emerging labor markets like China and Southeast Asia. While improvements to the bottom line look compelling on the surface, there are numerous challenges and "hidden" costs associated with fully engaging with this expanding area of the world. The first half of the course discusses experiences and lessons learned from expanding R&D digital printing operations from a US-based firm to a Chinese setting. Issues such as hiring, retention, training, and communication are covered. The second half of the course discusses volume manufacturing of digital printing products in emerging markets. Areas discussed include the use of contract manufacturers, part sourcing and quality issues, top level manufacturing, and import/export issues. A variety of real life successes and failures pertaining to these topics are presented.

*"The short course program prepares you for future career development."*

### Benefits

This course enables an attendee to:

- Become familiar with some of the unique opportunities and challenges of creating and maintaining a product-focused R&D operation in emerging labor markets, such as training, employee retention, work style, etc.
- Understand the challenges of developing and maintaining manufacturing operations and associated supply chain in emerging labor markets.
- Learn "best practices" when engaging and working with manufacturing partners and parts vendors in emerging labor markets.
- Make informed decisions or recommendations when deciding when and how to begin product development and/or manufacturing operations in emerging markets.

**Intended Audience:** anyone with technical, management, or business-related responsibilities who is investigating or beginning to develop product manufacturing/development operations in emerging labor markets, especially China and Southeast Asia.

*David Larson has worked in manufacturing and design engineering with Hewlett-Packard Company for 17 years, including a two year assignment to Shanghai, China in 2008-2009. He has worked in both the ink and laser printing industries and has traveled extensively to Asia for the past 10 years doing product design and manufacturing launch activities. He holds BS and MS degrees in mechanical engineering from Brigham Young University and the University of Utah.*

### SC14-S4: Electrostatic Toner Transfer

Sunday 3:45 – 5:45 PM (2 hours)

Instructor: Mark Zaretsky, Eastman Kodak Company

The transfer of toner from photoconductor to receiver is a potentially quality-limiting step in all electrophotographic machines. Achieving high quality electrostatic toner transfer requires an understanding of toner design (optimally charged toner with minimal surface adhesion) and electrostatic field generation (maximize electrostatic forces and minimize unwanted ionization). A significant degree of complexity is inherent in toner transfer resulting from the many interactions that exist with essentially every other subsystem in the electrophotographic process. In this course, explanations

and models of the key mechanisms affecting dry-toner transfer provide a foundation for understanding transfer subsystem design and performance, its interactions with other subsystems, and the importance of various noise factors. Throughout the course, examples are drawn from many practical transfer subsystems.

### Benefits

This course enables an attendee to:

- Understand basic electrostatic concepts related to transfer.
- Comprehend the operation of various electrostatic transfer technologies.
- Explain the important mechanisms governing electrostatic toner transfer.
- Identify noise factors and material properties that affect electrostatic toner transfer.
- Describe and explain causes of transfer related image quality degradation.
- List and explain the interactions between the transfer subsystem and other subsystems.

**Intended Audience:** engineers, scientists, and managers involved or interested in electrophotographic research, development, or commercialization. Familiarity with the electrophotographic process and college-level physics are recommended.

*Mark C. Zaretsky, senior electrophotographic engineer at Eastman Kodak Company, received his SB ('80), SM ('82), and PhD ('88) in electrical engineering from the Massachusetts Institute of Technology. He has worked in the area of electrostatic technology for Eastman Kodak since 1982. At present, his work focuses on electrophotography, including toner transfer and corona charger technology. He has considerable experience in the design and manufacture of photographic and non-photographic products from an electrostatic perspective, involving material composition, coating and conveyance technology, and customer usage. He holds 25 US patents and authored 10 peer reviewed papers. He received the IS&T Charles Ives Award in 1995 as a co-author. He has been the newsletter editor for the Electrostatics Society of America since 2003*

### SC15-S-4: Fluid Dynamics and Acoustics of Ink Jet Printing

Sunday 3:45 – 5:45 PM (2 hours)

Instructor: Frits Dijkstra, University of Twente

Ink jet printing is a process of depositing on demand droplets with a well-defined volume on a precisely given location on a 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 can be presented in the time and frequency domain.

Droplet landing is a highly dynamic phe-

nomenon. A too high landing speed leads to splashing and consequently to poor printing quality. Therefore the landing speed should be limited. The aim of this course is to couple the characteristics of droplet formation and landing to the acoustics of the fluidics of the print head behind the nozzle all the way up into the ink supply.

### Benefits

This course enables an attendee to:

- Understand the basic acoustical principles related to piezo driven ink jet print heads.
- Comprehend the concepts of responses in the frequency and time domain.
- Explain the importance of pulse shaping on droplet generation.
- Identify key parameters that control droplet formation and impact.
- Describe and explain the relation between print head acoustics, droplet formation and droplet impact.
- List and explain acoustically related causes for missing droplets.

**Intended Audience:** engineers and scientists involved and interested in piezo print head design, ink formulation, and testing. Familiarity with piezo ink jet technology and college-level physics are recommended.

*Frits Dijkstra is a professor in the field of biomedical applications of ink jet technology at the University of Twente, the Netherlands. He has worked with Philips Research for more than 30 years. His main area of interest has been ink jet technology for non-consumer applications such as PolyLED display manufacturing and the printing of biomolecules. (Note: Anke Pierik, senior scientist, Philips Research Europe, contributed to this course.)*

### SC16-S4: Innovation Processes: an Oxymoron?

Sunday 3:45 – 5:45 PM (2 hours)

Instructor: Marcos Esterman, RIT

As engineers and scientists, we are trained in convergent methodological approaches; we typically arrive at “an” answer. However, innovation, and the creative problem solving processes at the heart of innovation, is dominated by divergent thinking and processes. This short course explores creativity and innovation through the lens of a systems engineer. Several concept generation approaches and methodologies are discussed and explored that can help you think about the innovation process in a different light. Furthermore, a concept selection approach is presented that not only promotes convergence, but divergence, and as a result, leads to more robust solutions.

**Benefits**

This course enables an attendee to:

- Gain an appreciation for the benefits of structured processes to aid in the systematic generation of innovative solution alternatives.
- Understand a variety of approaches to generate innovative solution alternatives.
- Learn a structured approach for selecting and refining superior solution alternatives.

**Intended Audience:** product and technology developers or people who directly interact with these functions. However, the techniques are general enough to be applied to all problem solving situations.

*Bio: See SC07-S2: Life Cycle Analysis in the Printing Industries*

**Monday September 10, 2012**

**SC17-M2: Imaging Processing Pipeline for Color Printers & Printing Systems**

Monday 10:30 AM – 12:30 PM (2 hours)

Instructors: Jan Allebach, Purdue University, and Mark Shaw, Hewlett-Packard Company

Color printing systems that are available in the marketplace span a remarkable range of capabilities (quality, format, and speed) and accordingly price points that range from approximately \$50/unit upwards to \$2.5M/unit. Despite a range in price that spans approximately four orders of magnitude, all these products need to perform a surprisingly similar set of functions in order to transform from the high-level page description language (PDL) in which the document is represented to the placement of colorant on the output medium by the marking engine. The goal of this short course is to provide an inside view of the stages of the imaging pipeline for single-function printers and multifunction products that can both scan documents, and then print them.

**Benefits**

This course enables an attendee to:

- Understand the overall imaging pipeline for color printers and printing systems.
- Understand the interaction and differences between different PDLs, and their implications for color and imaging workflows.
- Understand the role of each of the stages in the imaging pipeline of a single-function printer conversion of a document described in a high-level page description language to an sRGB bit-map, conversion from sRGB to the native printer CMYK space, including

*“I was amazed at the depth and breadth of the instructor’s knowledge of the topic.”*

gamut mapping, conversion from 8-bit “continuous-tone” CMYK values to 1-8 bit CMYK halftone values, including the possibility of pulse-width modulation or multi-level halftoning with 2 or more bits/pixel.

- Understand the role of each of the stages in the imaging pipeline for multifunction products that have the capability to scan and print descreening to remove the halftone pattern in the scanned image that may beat against the frequencies in the halftone pattern used to reprint the page, halftoning using the dot structure that is most appropriate for the target marking engine technology.

**Intended Audience:** scientists, engineers, analysts, and managers involved in the design, engineering, manufacturing, marketing, or evaluation of printing products, algorithms, or systems. Students should be familiar with the function and basic properties of imaging systems. A basic knowledge of color science, linear systems, and image processing will be helpful, but is not essential.

*Jan P. Allebach is Hewlett-Packard Distinguished Professor of Electrical and Computer Engineering at Purdue University. His work on digital halftoning and image rendering algorithms has been licensed by major vendors in the printing industry and is used in products, some of which have sold 100s of millions of units world-wide. His current research interests include image rendering, image quality, color imaging and measurement, printer and sensor forensics, and digital publishing. Allebach is a Fellow of IEEE, IS&T, and SPIE. He has served as Distinguished or Visiting Lecturer for both the IEEE Signal Processing Society and IS&T, and as Editor of the IS&T/SPIE Journal of Electronic Imaging (2000-2010). He received the Senior (best paper) Award from the IEEE Signal Processing Society, the IS&T Bowman and Iték Awards, was named IS&T/SPIE Electronic Imaging Scientist of the Year, and is an Honorary Member of IS&T, the highest award IS&T bestows. From Purdue University, he is co-recipient of the College of Engineering Team Award in recognition of his long-term work with HP, and recipient of the College of Engineering Mentoring Excellence Award, the Sigma Xi Faculty Research Award, the Eaton Faculty Award, and five teaching awards.*

*Mark Q. Shaw is a color and imaging architect at the Hewlett-Packard Company, in the LaserJet Hardware Division in Boise, Idaho. Shaw has more than 10 years experience in the color and imaging industry, having previously worked for 3M, Xerox, and others. Shaw received his BS in graphic media studies from the University of Hertfordshire, his MS in color science from the RIT Munsell Color Science Laboratory, and is currently working towards a PhD in electrical and computer engineering at*

Purdue University. His research interests include video coding, multispectral color reproduction, color modeling, gamut mapping, color management, and image understanding. In 2010, he was awarded an HP Research Fellowship, an honor given to only seven employees per year in the Imaging and Printing Division. He was previously awarded the Grum Scholarship from the Munsell Color Science Laboratory, the Varns Excellence in Printing Award, the AGFA Printing Award, and the Institute of Printing Bronze Medal.

### SC18-M2: Laser Printer Fundamentals and Trends

Monday 10:30 AM – 12:30 PM (2 hours)  
Instructor: Marc Cousoulis, Lexmark International, Inc.

While the physics of electrophotography have been studied for more than 60 years, market challenges are still providing opportunities for technical innovation. This course provides an insight into how industry demands are driving scientific advancements within the established technological boundaries of the modern laser printer. After the physics of electrophotography are reviewed, with an emphasis on current challenges being placed on component technologies, a comprehensive review of some of the most important technical innovations recently introduced to the market is given.

#### Benefits

This course enables an attendee to:

- Identify and explain the six fundamental steps of electrophotography.
- Understand the primary failure modes of modern laser printers.
- Understand how the industry is adapting designs to new energy and cost constraints.
- Distinguish between the different technology choices currently being used.

**Intended Audience:** any individual who works directly or indirectly with the toner based imaging industry should benefit from this course.

See bio under SC06-S1: Intro to Electrophotography

### SC19-M3: An Introduction to Photo-Voltaic Systems and Manufacturing Technology

Monday 1:30 – 3:30 PM (2 hours)  
Instructor: Bob Detig, Electrox Corporation

The first part of the course is a survey of the existing technology, the printing of thick film silver inks and pastes for keyboards, and photo-voltaics. Next we look at the various particle technologies and the four printing processes used to apply them, mostly for photo-voltaics.

There are at least a half dozen systems offered by as many as a dozen companies. A review of the various technologies and a comparison survey of their capabilities is included. We expand the discussion to include the uniform plating or coating of nano/micro particles for high surface area electrodes for various energy applications (batteries, fuel cell electrodes, PV systems, super-capacitors, etc.), which is an important new application market for printed electronics.

#### Benefits

This course enables an attendee to:

- Appreciate the scope of the technology for printing conductive traces including inorganic and organic systems, silver and non-silver systems, and solution based systems.
- Understand printing platforms.
- Gain an historic perspective on how mostly screen printing has created several industries.
- Learn about opportunities in the emerging energy industries, batteries, fuel cell electrodes, super capacitor electrodes, and any high surface area electrode.
- Learn about near term needs: (next 5-10 years) for new technology solutions.

**Intended Audience:** any imaging scientist, ink formulator, materials or energy engineer/scientist studying low cost manufacturing innovations.

*Robert H. Detig has extensive experience, and know-how in electrographic imaging, liquid toner technology and electrostatic printing. Detig is an electrical engineer and has an extensive patent estate in the field. He has published numerous scientific papers and regularly presents at industry conferences and trade shows. His industry experience includes Xerox, Olivetti, Honeywell, and Olin Hunt Corp. His other graphic arts experience includes extensive work with screen printing systems and some work with Flexo. He received his PhD from the Carnegie Mellon University. He served on active duty with the US Army Signal Corp where he did systems design work on a synchronous communication satellite system in the early 1960s.*

### SC20-M3: Fusing Technologies and Toner Materials Relationships

Monday 1:30 – 5:30 PM (4 hours)  
Instructor: Dinesh Tyagi, Eastman Kodak Company

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. The first part of this course reviews the fundamental functions of fusing and details past and current fusing technology trends in the

*“I learned more in four hours than I had in three months of internet and library work.”*

electrophotographic industry. The physics of each technology is discussed, with a specific focus on each technology’s strengths and weaknesses. In the second part, the influence of toner components on fusing performance is described, including the underlying polymer architecture and viscoelasticity concepts that govern resin binder. Effect of pigments and other toner additives is explained. In the last part of the course, the two to three 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.

### 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.
- Understand the polymeric concepts that influence fusing and various considerations necessary in toner formulations.
- 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.

**Intended Audience:** scientists and engineers in toner design as well as 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 from Virginia Tech (1985) from the Department of Chemical Engineering with a thesis titled “Structure-Property Relationships in Segmented Polymers.” After a one-year post-doctoral position there, he joined Eastman Kodak Company as a research scientist where he has continued to work in the area of toner formulations and electrophotography. He was inducted into Kodak’s Distinguished Inventors Gallery in 1994. In 1999, he joined NexPress Solutions, which was later absorbed back into Kodak. Tyagi has more than 80 patents worldwide. In the past, he has taught this course with David Thompson, Xerox Research Center Webster.*

### SC21-M4: An Introduction to Digital Fabrication: Methods, Materials, and Applications

Monday 3:45 – 5:45 PM (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.
- 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.

### SC22-M4: Overview and Segmentation of Digital Production Printing as Shown at Drupa 2012

Monday 3:45 – 5:45 PM (2 hours)

Instructor: Detlef Schulze-Hagenest, Kodak Graphics Communications GmbH

Toner technologies, specifically dry and liquid electrophotography, have been leading digital printing technologies in most segments of the marketplace. Ink jet technologies have been available for this application for a long time, but specifically since DRUPA 2008. Ink jet based production printing is now the focus of the digital print community. At DRUPA 2012 this trend has increased and the “digital factory,” from order taking through finishing, is starting to take form.

This short course provides a segmentation and overview on the toner and ink-based products for digital production printing as shown at DRUPA 2012 from the technical viewpoint.

#### Benefits

This course enables an attendee to:

- Identify the basic concepts of production digital printing.
- Understand the toner and ink based print technologies used in this market segment and their related strength.
- Gain an overview of the current application spectrum of digital production printing.
- Identify the current products on the market and their main applications.
- Learn how the different technical approaches lead to the product properties as requested in the market.
- Be aware of components and materials relevant for the success of the products.

**Intended Audience:** anyone working in the field of digital production printing and is seeking a mainly technical driven introduction. Engineers, scientist, technical product managers, suppliers working in the field of digital production printing or seeking to develop an in-depth understanding for it.

*Detlef Schulze-Hagenest studied physics and intellectual property law in Hamburg and Berlin and received his PhD in physics from Kaiserslautern-University. Since 1980, he has*

*“My manager made me sign up and now I realize he’s a little smarter than I thought.”*

*been working in the field of platforms, processes, and materials for digital printing, with a special focus on electrophotography and ink jet. He is currently the senior engineer of technology development at Kodak Graphic Communications GmbH in Kiel, Germany. He is the author of approximately 50 patent families; practices classical music, sailing, gardening; and is active as a driver at a street car museum. He is a member of IS&T and was General Chair of NIP2A.*

### Tuesday September 11, 2013

#### SC23-T2: Free-Volume Effects in Imaging Systems

Tuesday 10:30 AM – 12:30 PM (2 hours)

Instructor: Michel (Mike) Frantz Molaire, Molaire Consulting

The majority of imaging systems consist of dispersed and/or dissolved image-active molecules in polymeric matrixes. The glass temperature  $T_g$  of the polymeric matrix, the characteristic of the imaging mixture (compatibility, miscibility, thermal history), and the operating temperature critically influence the imaging process. The free-volume theory provides a framework to analyze and describe the impact of various manufacturing processes on the imaging process.

This short course reviews the free-volume theory emphasizing the key and important concepts. Examples of free-volume imaging effects in photopolymerizable dry-film systems, photoresists, photoreceptor drums, sol gel overcoats and photochromic systems are presented. The course also looks at general imaging mechanisms that are susceptible to free-volume influences and techniques to overcome and minimize those effects.

#### Benefits

This course enables an attendee to:

- Learn about the free-volume theory.
- Appreciate the importance of the glass transition temperature  $T_g$  in amorphous coating systems.
- Understand physical aging of glasses.
- Learn about several free-volume effects in various imaging systems, including photoreceptors, photopolymerizable compositions, and sol-gel overcoats.
- Discover how to differentiate “free-volume trapping” from “intrinsic trapping.”

- Analyze the critical conditions for potential free-volume effects.
- Review techniques to minimize or eliminate negative free-volume effects.

**Intended Audience:** imaging professionals, formulation, coating and process scientists, and manufacturing engineers who want to become aware of a potential problem that only reveals itself to those looking for it. A basic knowledge of polymer science will be beneficial but is not required.

*Michel Molaire received his BS (chemistry), MS (polymer science), and MBA from the University of Rochester. His experience includes polymer synthesis, photopolymerization, molecular glasses, optical recording materials, electrographic masters, photoreceptors, pigment dispersions, conductive coatings, castable polyurethane, image transfer materials, and dip coating technology. He holds 57 US patents. Molaire is recipient of Kodak's C.E.K. Mees Award for excellence in scientific research and reporting, inductee of Kodak's Distinguished Inventor's Gallery, the African Scientific Institute Fellowship, past president and vice president of program, Rochester IS&T chapter.*

### SC24-T2: Intro to 3D Ink Jet Printing

Tuesday 10:30 AM – 12:30 PM (2 hours)

Instructor: Xavier Bruch, Hewlett-Packard Corporation

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 the fundamentals of 3D printing (additive manufacturing) 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).

*Xavier Bruch is Distinguished Technologist in Graphics Solutions Business at Hewlett-Packard, responsible for the technical management of future large format printing platforms for new markets. During the past 16 years, he has worked at Sant Cugat Hewlett-Packard large format R&D lab, creating, designing, and managing new large format digital printing projects, with a special focus on printing systems technologies, on which he holds more than 30 US patents. He is a mechanical engineer for Universitat Politècnica de Catalunya (UPC) and teacher at the Barcelona Graduate School of Economics.*

### SC25-T2: Role of Ink Jet in Commercial and Industrial Printing

Tuesday 10:30 AM – 12:30 AM (2 hours)

Instructor: Ronald Askeland, Hewlett-Packard Corporation

This short course examines products from HP, Canon, Epson, FujiFilm, Xaar, Kyocera, and Kodak. Ink jet is compared to electrophotographic, offset, flexo, screen, and rotogravure printing for markets beyond the consumer and office. Thermal, piezo, continuous, mechanical valve and electrostatic ink jet printhead performance parameters and ink/media interactions are examined for applications in large format, publishing, direct mail, photographic and package printing. Future trends in commercial/industrial printing are also discussed, along with the latest information from DRUPA'12.

#### Benefits

This course enables an attendee to:

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



**Intended Audience:** for those somewhat familiar with ink jet printing technology who want a better understanding of ink jet's role in the analog to digital conversion process.

*Ronald Askeland is a system architect in the Printing Technology Platforms division of Hewlett-Packard. He has 27 years of experience in thermal ink jet technology and has been awarded more than 50 US patents on ink jet inks and printing systems. He received his PhD in analytical chemistry from Colorado State University. He worked for HP in San Diego, CA from 1984 - 2011 and currently works for HP in Barcelona, Spain.*

### SC26-T3: Colorant Chemistry

Tuesday 1:30 – 5:30 PM (4 hours)

Instructor: Jeffrey Banning, Xerox Corporation

Very little work is being conducted in the area of new chromophore research in the dye industry. Instead, most dye research effort is being conducted in the modification or “tuning” of existing dyes, or dye classes in terms of shade, solubility and/or reactivity. This tutorial assists in the understanding such tuning processes. Using color (in presentations and handouts), the instructor teaches students about color chemistry with the aforementioned goal in mind. Starting with the concept of a light interacting with a prism, the instructor guides the students from an understanding of additive and subtractive coloration, further explaining the cause of coloration of a dye or pigment, and continues to the area of structure/property (color) relationships. An understanding of how one develops strategies for tuning/ tailoring the shade and other physical and chemical properties of a dye emerges through the course of the tutorial.

#### Benefits

This course will enable the attendee to:

- Understand the concept of additive and subtractive coloration.
- Recognize the common terms employed by color chemists and their literature.
- Understand the four classes of dyes based on the electronic origin of the color.
- Explain the concept of structure/color relationship, in the major classes of colorants.
- Predict shifts in shades (bathochromic/hypsochromic) based on structural changes/modifications within the chromophore.
- Discuss the major classes of chromophores employed in making dyes of various hues.
- Locate commercially available dyes and preps for synthetic strategies to many of them.
- Employ the aforementioned benefits to expand one's understanding (and capability) in developing strategies to tune/tailor dyes.

**Intended Audience:** scientists, engineers, technicians, or technical marketing persons with a chemistry/science background who need to know about the chemistry of colorants and who are likely to be new to the field; a year of general and organic chemistry is recommended.

*Jeffrey Banning is a Xerox Fellow in the Xerox Office Group (XOG), formerly Tektronix Color Printing and Imaging Division. He has worked in the areas of dye, polymer, and organic synthesis, as well as coatings and ink formulation at Milliken Chemicals, the BIC Corp., Tektronix Inc., and Xerox Corp. He holds more than 75 US patents in these areas and has scaled-up many dye intermediates and dyes, leading to many commercial products and several product lines. Banning began his career in color chemistry at Milliken Chemicals. It was there that he learned the “tricks of the trade” under many outstanding organic dye and textile chemists, as well as with frequent interactions with two world renown dye consultants: Max Weaver of Eastman Chemicals (retired) and John Griffiths of the University of Leeds. His educational background includes a BS in chemistry from Mankato State University (1983) and a PhD in organic chemistry from the University of North Dakota (1987).*

### SC27-T3: Digital Biofabrication

Tuesday 1:30 – 5:30 PM (4 hours)

Instructor: Thomas Boland, University of Texas El Paso

Digital and non-impact printing has found new applications in non traditional disciplines, such as MEMS and bioengineering. By exploiting non-impact printing approaches and new materials, it has become possible to pattern two- and three-dimensional structures that are biologically active. This course provides an introduction to the emerging science of biofabrication. It covers established and new digital fabrication methods, new materials, and processes that enable fabrication and manufacture a broad range of biologically active devices, systems, and structures.

#### Benefits

This course enables an attendee to:

- Identify different digital fabrication methods and biomaterials.
- List and compare different digital fabrication methods with application in the life sciences.
- Evaluate the technological issues and challenges of digital fabrication processes and materials.
- Understand the technology landscape, key players, and practitioners.

**Intended Audience:** engineers and scientists working in or interested in entering the interface of printing and life sciences.

*Thomas Boland is an associate professor in the Department of*

Bioengineering at Clemson University. He received his BS in chemical engineering from the Ecole Nationale Supérieure d'Ingénieurs de Genie Chimique in Toulouse (1990) and his PhD in chemical engineering from the University of Washington (1995). Following his PhD, Boland was a Postdoctoral Fellow at Pennsylvania State University and then at the Naval Research Laboratory. In 1999, he joined Clemson University as assistant professor, where he received tenure in 2005. Boland is an adjunct associate professor at the Medical University of South Carolina's College of Graduate Studies and is the director of a NSF/NIH-funded Bioengineering and Bioinformatics Summer Institute. His research interests are applying engineering principles to automate, predict, and build three-dimensional structures that show biological function. He is the author of more than 45 publications; a member of AVS, MRS, IS&T, and the Tissue Engineering and Regenerative Medicine International Society.

### SC28-T3: Industrial Inkjet Technology for Printing and Fabrication

Tuesday 1:30 – 5:30 PM (4 hours)  
Instructor: Alan Hodgson, 3M UK

This course is designed as a bridge between the NIP and Digital Fabrication conferences. It covers ink jet technology for both traditional printing and emerging fabrication applications. It achieves this by summarizing how the key elements of ink jet technology (printers, heads, inks and media) have developed, showing how this knowledge can be used in fabrication applications. Using case studies it considers the commercial and technical drivers and their contribution to the future direction of application development. It compares and contrasts the developments in printing and fabrication areas but shows the interdependence between them.

#### Benefits

This course enables an attendee to:

- List and explain the commercial and technical drivers for industrial inkjet in both printing and digital fabrication application areas.
- Gain awareness of how printers, heads, fluids and substrates interact to make an inkjet printing system.
- Gain an overview of current and future applications of industrial inkjet technology.
- Summarize the technology of inkjet printing and how this can be leveraged to best effect in the future.

- Be aware how new technology is affecting both fabrication and “traditional” printing applications.
- Identify the shows and conferences to attend to gain further awareness.

**Intended Audience:** this course is a broad overview aimed at engineers, scientists, and students. It is suitable for those working in organizations considering accessing new opportunities in industrial inkjet either as a supplier or a user. It is particularly appropriate for participants who are considering the further potential of ink jet and would like an overview of the relevant ink jet technologies in both traditional printing and fabrication applications. As such it aims to be equally accessible to the target audiences of the NIP and Digital Fabrication conferences.

*Alan Hodgson has 30 years experience in printed hard copy and a background in radio frequency electronics and image science. For the last four years he has worked for 3M in the UK on printed electronics and inkjet printing. With a combined marketing and technical background he can give technical issues a commercial perspective. He previously managed R&D and Technical Services groups active in industrial inkjet application development. Before 3M he worked on inkjet consultancy projects in both traditional printing and fabrication applications. Hodgson has a BSc in colorant chemistry and a PhD in instrumentation from the University of Manchester. He is a Fellow of the Royal Photographic Society as an Accredited Senior Imaging Scientist. In addition to IS&T, Hodgson is active in the Royal Photographic Society and Institute of Physics as a speaker and session chair. He is currently IS&T Executive VP.*

**SAVE THE DATE!**

**NIP29**

**Digital**

**Fabrication 2013**

**Sept. 29 - Oct. 3,  
2013**

**Seattle,  
Washington**

## Airport and Discounted Flight Information

**Airport Information:** The Jean-Lesage International Airport (YQB) is 10 miles from downtown—a 20 minute drive. There are nonstop flights from a number of cities, including Chicago, Detroit, Montreal, Newark, Paris, Philadelphia, and Washington, DC (Dulles). For more information visit [www.aeroportdequebec.com/en/](http://www.aeroportdequebec.com/en/).

Flights to Quebec City can be a bit pricey. While you'll forget the cost once you are there given how beautiful and hospitable the city is, IS&T is doing what it can to help you fight costs.

IS&T has partnered with UNIGLOBE Vision Travel Group to help delegates secure the lowest airline rates (delegates can save 5-30% off published rates). The discounted rates are valid 7 days prior to and 7 days post the official conference dates of Sept. 9-13, 2012.

There are a number of ways you can secure discounted rates:

- Call UNIGLOBE at 1-888-221-5221
- Emailing [airdesk@uniglobevision.com](mailto:airdesk@uniglobevision.com)
- Go directly to [www.aircanda.com](http://www.aircanda.com) and enter the promotion code QN9M3AF1 in the search panel to receive up to 12% off.

We encourage calling/e-mailing UNIGLOBE to hear about all the options they offer.

## Hotel and Transportation Information

A special block of rooms at a discounted rate is being held at a number of hotels in Quebec City. Please visit the IS&T website to download a PDF containing details.

### Transportation to/from Quebec City hotels:

**Taxi:** It is about a 20-25 minute drive from YQB to the Convention Centre and nearby hotels. Taxi stands are located in front of the international flights arrivals terminal, and at opposite ends of the domestic flight arrivals terminal.

According to [www.taxime.ca](http://www.taxime.ca), the average cost to/from YQB and the Convention Center and area hotels is \$40-\$50. According to [wikitravel.org/en/Quebec\\_City#Get\\_around](http://wikitravel.org/en/Quebec_City#Get_around) the taxi fare from Old Quebec to the airport is a flat fee of \$32.50. More info on transport can be found at

[www.tripadvisor.com/Travel-g155033-s302/Quebec-City:Quebec:Getting.Around.html](http://www.tripadvisor.com/Travel-g155033-s302/Quebec-City:Quebec:Getting.Around.html)

**Public Transportation:** Please note that there is no public transit or hotel shuttles to the airport, except an RTC public bus 78 that goes to and from the airport only a few times a day (\$2.75) from the downtown bus station.

**Parking:** Parking at the Convention Centre and hotels ranges from \$18-\$32/day. The Convention Centre parking garage is at 900 et 1050, René-Lévesque.

We know that changes in the imaging world  
have put some of our loyal attendees in difficult financial situations.  
If you are currently unemployed, but would still like to attend  
NIP/Digital Fabrication,  
please contact [dsmith@imaging.org](mailto:dsmith@imaging.org) to discuss your situation.

# NIP28/DF 2012 Technical Registration – page 1

**Register online at [www.imaging.org/nip](http://www.imaging.org/nip)**

First/Given Name \_\_\_\_\_

Last/Family Name \_\_\_\_\_

Title/Position \_\_\_\_\_

Company \_\_\_\_\_

Complete Mailing Address \_\_\_\_\_

Telephone \_\_\_\_\_ Fax \_\_\_\_\_

Email \_\_\_\_\_

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

**Guest/spouse registration includes:** breakfast on Monday and the Welcome and Conference receptions.

**To help ensure adequate space in session rooms indicate the days you plan to attend:**

\_\_\_ Mon \_\_\_ Tues \_\_\_ Wed \_\_\_ Thurs

**Please circle the session you primarily plan to attend:**

NIP Track 1    NIP Track 2    NIP Track 3    Digital Fabrication

**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 8/12	after 8/12	TOTAL
-------------------------------------	------------	------------	-------

**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, this year IS&T is offering 4 full conference registration options (plus student and one-day options). One for current IS&T/ISJ members, one for non-members that includes registration only, and—for the same price—two options for non-members that includes IS&T membership plus an online subscription to the Journal of Imaging Science and Technology (JIST) or IS&T membership plus an online subscription to the Journal of Electronic Imaging (JEI).*

___ Conference registration: IS&T/ISJ Member	\$730	\$830	\$ _____
___ Conference registration: non-member	\$850	\$950	\$ _____
___ Conference registration: non-member (with comp membership + JIST)**			
Membership begins by 10/1/12 and expires 12/31/13.	\$850	\$950	\$ _____
___ Conference registration: non-member (with comp membership + JEI)**			
Membership begins by 10/1/12 and expires 12/31/13.	\$850	\$950	\$ _____
___ IS&T/ISJ Student Member (ID required)	\$145	\$175	\$ _____
___ Student Non-member (ID required)	\$170	\$200	\$ _____
___ One-day	\$440	\$490	\$ _____
___ Short course only (check and proceed to short course selection area)			

Page Subtotal \$ \_\_\_\_\_

continued on next page

\* You will be contacted by the Print Gallery/Demonstration Session chair with a contract for you to sign.

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

## NIP28/DF 2012 Technical Registration – page 2

**Proceedings Choice** (one copy comes with your registration; check the version you'd like)

- NIP/DF Abstract Book with CD containing papers     NIP/DF Hardcopy book  
 **Extra hardcopy proceedings**     **Extra abstract book proceedings** @\$135/each    \$ \_\_\_\_\_  
 **Extra CD** (available only as addition to Hardcopy selection/purchase) @\$75/each    \$ \_\_\_\_\_

**Short Course Registration** (see page 14 for course descriptions)    **Member**    **Non-member**

- 2-hour** (add \$35/class after 8/12)    **\$160\***    **\$195\***    \$ \_\_\_\_\_  
 Check all that apply:     SC01     SC07     SC08     SC09     SC10     SC14     SC15  
 SC16     SC17     SC18     SC19     SC21     SC22     SC23     SC24     SC25  
**4-hour** (per class; add \$35/class after 8/12)    **\$235\***    **\$270\***    \$ \_\_\_\_\_  
 Check all that apply:     SC02     SC03     SC04     SC05     SC06     SC11  
 SC12     SC13     SC20     SC26     SC27     SC28

\*Students may take any class for \$50 (\$85 after 8/12. No additional discounts apply.)

OR

**Take two or more classes and receive 10% off the total price**

(enter two or more short courses on the line, fill in member or non-member price next to each, add together, and multiply by .90 to get your price; add additional lines if needed)

SC\_\_\_\_\_ \$ \_\_\_\_\_ + SC\_\_\_\_\_ \$ \_\_\_\_\_ + SC\_\_\_\_\_ \$ \_\_\_\_\_ = \$ \_\_\_\_\_ x .90 = \$ \_\_\_\_\_

**Membership**    **US address**    **Non-US Address**

- new** membership (expires 12/31/13):    **\$142.50**    **\$157.50**    \$ \_\_\_\_\_  
 annual membership renewal (expires 12/31/13):    **\$95**    **\$105**  
 Student membership (expires Sept. 30, 2013)    **\$25**    **\$25**    \$ \_\_\_\_\_

**join now and calculate fees based on member rates**

**Other**

- Guest/spouse registration (Name: \_\_\_\_\_)    **\$100**    \$ \_\_\_\_\_  
 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, fax to 703/642-9094, or  
 e-mail registration@imaging.org.

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 7, 2012. After that date, the cancellation fee is 50% of the total plus \$75. No refunds will be given after October 9, 2012. All requests for refund must be made in writing.**

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

**Digital Fabrication 2012/NIP28**



Society for Imaging Science and Technology  
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Springfield, VA 22151 USA  
703/642-9090; 703/642-9094 (fax)

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**Join us in Quebec  
September 9-13, 2012!  
and  
SAVE THE DATE  
Fabrication 2013  
for NIP29/Digital  
Sept. 29 - Oct. 3, 2013  
Seattle, Washington**