Cal Poly’s Graphic Communication faculty is initiating a new Master of Science degree titled Printed Electronics and Functional Imaging in January 2014. This degree will leverage Cal Poly’s 67 years of graphic arts education with a new graduate degree focused on emerging functional printing applications.

Functional printing focuses on function, not appearance. The human eye is more forgiving than electrons, so functional printing requires much greater precision, smoother surfaces, and frequently finer features than graphic printing. While the human eye overlooks poor production, functional printing requires better tools, better processes, better metrics, and better strategies. Cal Poly’s Master of Science in Printed Electronics and Functional Imaging focuses on the science of printing – achieving new products and applications by understanding and optimizing the rheology and morphology of conductive and functional inks. In some circumstances, functional printing can replace conventional silicon-based electronics. But in many ways, functional printing opens up a world of new products, many of which have yet to be conceived. Functional printing is the future of the graphic communication industry.
Why Cal Poly?

Cal Poly is recognized as one of the leading institutions in the United States for graphic communication education and research. This reputation is based on strong educational programs, a very bright student population, industry partnerships, a Learn by Doing approach, outreach and recognition, and a strong record of faculty scholarship. This reputation was built solely through undergraduate education. Adding a master’s degree to Cal Poly’s Graphic Communication Department, and focusing that education on emerging functional printing disciplines, positions us to be the leading academic institution in printed electronics, active and intelligent packaging, security printing, and other functional printing applications representing the future of the industry. Our undergraduate program will remain vibrant, focusing on graphic printing and media applications.

Cal Poly is a comprehensive university focused on science, technology, engineering and mathematics (STEM). As such, we have strong technical expertise and access to micro- and nano-scale tools. Our Materials Engineering program has a functioning silicon fabrication facility. Our Polymers and Coatings program has expertise in material formulation and deep knowledge of rheology and material flow. Our Packaging program has strength in active and intelligent packaging systems. Cal Poly’s Electrical Engineering and Industrial & Manufacturing Engineering programs offer vibrant degrees with strong research in conventional and printed electronics. As such, we are positioned with a supporting cast of STEM expertise to leverage our strengths in functional printing applications.

Our geography is strategic, too. Located just a few hours south of the Silicon Valley, and midway between Los Angeles and San Francisco, we are geographically centered near numerous innovative companies and research labs. We have been able to leverage our location by working with Bay Area companies on print trials and product testing. In addition, we have worked collaboratively with research groups from UC Berkeley and UCLA. We believe that our geography is strategic in building a future in graduate-level functional printing.
Recent History with Functional Printing

Cal Poly has been producing printed electronics, active packaging and security printing for some time. The accomplishments and projects Cal Poly has worked on in recent years include:

- Designed and managed the production of the February 2011 CANVAS Magazine cover, the world’s first entirely printed electronic cover.
- Designed and produced the conference demonstrator for IDTechEx Printed Electronics USA 2012 conference: electronic origami.
- Designed a conference demonstrator for IDTechEx Printed Electronics Europe 2013 conference: a temperature sensing drink coaster.
- Provided faculty to judge for the IDTechEx Printed Electronics USA Awards for 2011 and 2012.
- Designed and produced three-quarter pt microtype for security application.
- Printed oxygen barrier inks to increase product shelf life for food packaging.
- Successfully designed and produced electrochromic displays, electroluminescent displays, thermochromic displays (actuated by printed heating element), and currently working with piezo inks.
- Cal Poly faculty members were invited to present master classes and chair sessions at IDTechEx Printed Electronics USA and FlexTech Alliance Flex Conference.
- Currently working with UC Berkeley on flexo printed rechargeable batteries and a vibration sensor for remotely monitoring engine condition.
- Researched imaging capabilities for screen-printing meshes and flexo plates.
- Conducting research on printing of fine features by screen printing using low-viscosity inks.
- Cal Poly students gave presentations on the convention floor at IDTechEx Printed Electronics USA 2012.

Support From Industry

Since the department’s beginning in 1946, the printing and packaging industry has supported Cal Poly to ensure that it fulfills its important mission to maintain quality educational programs. During the past 25 years, it has done so through one of the largest support programs ever provided to a graphic arts program anywhere. Over the years, the Graphic Communication Department has had access to approximately $30 million in state-of-the-art technology and related support to provide expanded services to its students and to the profession.

Once again, we are reaching out to the industry to help us fulfill this new mission of education and research in functional printing.
These are only a sampling of the additions that have made Cal Poly’s Graphic Communication Department one of the best in the world. All of this has been supported with hundreds of thousands of dollars in software, supplies and services, and cash contributions from industry, alumni and friends of the department.

A partial list of industry supporters include:

- 3M
- Adobe
- Agfa
- Allison Systems
- Apple
- ATMA Champ Ent.
- Baldwin Technologies
- Beta Industries
- Color Resolutions, Inc.
- Daetwyler
- Dupont
- Dupont Teijin Films
- EFI
- Env. Inks & Coatings
- Epson
- Esko
- Kodak Trendsetter
- ESKO Automation Engine 12 workflow
- Esco CDI Secuflex 2530 imager (8000 DPI)
- Daetwyler gravure cylinder engraving system
- ATMA screen press
- Testing, prototyping and measurement equipment from TMI, ImageXpert, IGT and X-Rite.
- Digital presses/printers from Canon, Epson, HP, Konica Minolta, Memjet, Ricoh, Roland, Xante, Xeikon, Xerox
- Mark Andy
- Monsanto
- Muller Martini
- Olex Corporation
- QuadTech
- Quark
- Ricoh
- Roland
- Rotometrics
- SAPPI
- Simco
- Sun Chemical
- Testing Machinery Inc.
- Xante
- X-Rite
- Xerox

Future partnerships will focus on equipment and supplies devoted to Printed Electronics and Functional Imaging.
What specifically is Cal Poly doing with printed electronics and what are the needs?

Cal Poly has several initiatives commencing. Some are more formalized than others. All are strategic and are based on the premise that we have a long-standing undergraduate graphics program and we can build upon that program with a Learn by Doing graduate degree that is more scientific and more focused on emerging functional printing applications. We can educate and we can generate new knowledge through scholarship.

These initiatives include:

✦ An online graduate certificate program in printed electronics and functional imaging
✦ An in-residence Master of Science Degree in printed electronics and functional imaging
✦ Industry research and testing services provided in functional printing
✦ Student research and product development in functional printing
✦ Faculty research (grant-focused) in functional printing

As we ramp-up these initiatives, we are seeking strategic partners to place lab and production equipment at Cal Poly to educate, demonstrate and perform research so that we can provide direction for the industry in this next phase of functional printing. We are broadly looking for technologies to help with:

✦ Depositing ink with uniform ink films. We need printing platforms capable of producing fine features and repeatable layer-to-layer registration.
  ✦ Flexography
  ✦ Screen-printing
  ✦ Gravure
  ✦ Inkjet
  ✦ Dispenser printer
槽 die
Blade coating
Other coating and printing methods

Metrology equipment for measuring surface uniformity, ink film thickness, and modeling ink films at the micron scale.

Drying, curing, annealing and/or sintering capabilities.

We are particularly interested in improving our inkjet capabilities. We are seeking turnkey systems as well as components for research.

We are seeking an additive manufacturing (3-D printing) platform.

We are also looking for ways to improve our imaging capabilities for all different printing processes, particularly screen-printing, with fine-structured emulsions and direct-ablation capabilities.

At Cal Poly, we offer numerous benefits to companies interested in partnering with us. Being connected with Cal Poly certainly provides “goodwill” exposure, access to cutting-edge research, and possible tax benefits. Additionally, because of our recognition in the industry, companies look to Cal Poly to lead the industry with innovative solutions. Having equipment at Cal Poly demonstrates to the world that select suppliers offer world-class equipment that is essential for educating present and future leaders in the field. World-class technologies will be exposed to undergraduate students, graduate students, industry visitors, Graphic Communication Institute (GrCI) workshop and symposia attendees, and conference attendees. In addition, as we enhance our graduate laboratories, we will be showing the world the best production equipment available. Industry workshops and conferences provide significant visibility to those partnering with Cal Poly.

We have strong relationships with many industry publications and take seriously the importance of letting the industry know about our partnerships. You can be assured that all donations or equipment placements will be accompanied with one or more industry press releases and ample recognition at Cal Poly and during presentations at professional conferences.
Endowments

Endowments serve to secure the department’s financial undergirding and future fiscal viability. The Graphic Communication Department is one of the leading academic departments at Cal Poly in number of endowments. This is testimony of the industry’s ongoing support of what we do and positions us well for future growth and ongoing support. These endowments are invested and provide recurring revenue for supplies and small capital equipment and for program and department development. We are now offering named endowments specifically for our master’s degree program in printed electronics and functional imaging and seeking individuals interested in investing in a program that defines the future of the graphic communication industry.
Faculty, Staff, Students and Curriculum: ‘Heart and Bloodline’ of the Program

While well-equipped laboratories are essential for the viability of a functional printing program, the “heart and soul” of Cal Poly’s programs are its faculty, staff, students and curriculum. The faculty and staff are hardworking and dedicated to furthering the interests of students and the profession. Besides delivering a current and intensive instructional program, the graphic communication faculty are often found traveling around the country and world to some of the most important industry conferences, expositions, seminars and workshops, including DRUPA, FlexTech Conference, FTA Flexo Forum, IDTechEx Printed Electronics USA, Organic Electronics Association meetings, Print/Graph Expo, SGIA Expo, and numerous other conferences. In order to manage sophisticated state-of-the-art laboratories, well-trained faculty and staff are needed who have clear insights into the needs of the students and the profession, both now and in the future. Cal Poly students are exceptionally bright and of high caliber and expect Cal Poly’s faculty and staff to deliver high-quality instruction and services. We anticipate hiring additional faculty in the next five years to boost expertise in functional printing and to promote the research endeavors planned.

Advisory Board

The Graphic Communication Department Advisory Board is comprised of approximately 30 leaders in industry, education and associations. The board acts as an informal “accreditation” to ensure that the department’s programs are a reflection of what is presently needed in industry and what will be needed in the future. The board provides wisdom on what attributes graduates should possess and assists regularly in the department’s development efforts. Many of the board members have a presence in the department during special events and as guest lecturers and represent role models for our students. The common thread that runs through all board members is that they all have an interest in education and emerging aspects of the printing and imaging industry, a pulse on where the industry is heading, and a passion for what we do.

On behalf of our students, faculty, staff and alumni, we express appreciation for your consideration in joining Cal Poly as a “Partner in Education.”

For additional information or to discuss partnerships, please contact:

Dr. Malcolm G. Keif  
Graduate Coordinator, Printed Electronics and Functional Imaging  
805-756-2500  
mkeif@calpoly.edu

Printed Electronics and Functional Imaging program (graduate certificate and M.S. degree) website:  
http://printedelectronics.calpoly.edu

Graphic Communication Department (undergraduate) website:  
http://grc.calpoly.edu

Graphic Communication Institute website (industry testing, research and training):  
http://grci.calpoly.edu

Layout & Design By Kristen Dang