Thinfilm's printable memory labels are as thick as a human hair.
Thin Film Electronics ASA is an innovative company that specializes in printing integrated electronics, beginning with rewritable memory. Thin Film was the first to create this type of technology and is currently creating printable circuits that will include memory, sensing, display, and wireless communication. This technology can add rewritable data to any object, which has the potential to change the entire electronic product industry.

We spoke with Jennifer Ernst, Executive VP of Sales & Business Development for Thin Film, about the printable circuit technology, some of the unique applications they envision for it, and the company’s plan for global expansion.
“Thinfilm works with our customers and partners to understand market needs and then develop system designs tailored to their specific needs.”

How did you come into this position and what are the roles that you are currently focusing on?

Prior to joining Thinfilm Electronics ASA about two and a half years ago, I was at PARC, a Xerox Company, for about 20 years. My focus was on business development for various programs in Electronic Materials and Devices. One of the teams that I worked with was the printed electronics group. Significant work had been done at PARC on organic, printed logic. Thinfilm and PARC began working together in 2010. It was in that development relationship that I first met Thinfilm and saw the tremendous potential in bringing together PARC’s work in printed logic with Thinfilm’s core technology in printed memory.

I joined Thinfilm in 2011 as Executive Vice President of the sales and business development activities of the organization.

Can you tell us about the partnership of Thinfilm Electronics and PARC?

This partnership was an opportunity to begin commercializing printed electronics. Each partner brought about 15 years of background in this field. Thinfilm’s expertise is in printable memory products, PARC’s is in printing logic. Once we began marrying logic and memory on printed circuits, everything else is almost like adding a peripheral. We are connecting sensors, displays, and soon NFC into the circuits, to make simple sensor systems able to store small bits of data at very low costs.

The collaboration with PARC continues and they are now among our top 30 shareholders.

What makes this technology appealing?

It’s the cost-per-function profile. For example, on our website, you can find a demonstration of an electronic sensor label that monitors temperature and tells a user if a temperature excursion has occurred. We are targeting a market entry price of $0.50. We have just acquired the leading company in printed NFC and will integrate that functionality to communicate data from labels to smart phones and tablets.

For comparison, conventional electronic systems in this market are $11-$25 on up. Our systems are close to the price point of color changing temperature labels, but will be able to deliver higher functionality. Initially by being able to track multiple exposures, and then by adding the NFC communication, so data can be used by Apps and in services.

What is the current state of this technology and when will it be commercially available?

On our web site, you can see rolls of our printed memory, which is our current product. We are getting orders for this right now for applications in brand protection, and are working with some of the major toy companies to qualify for product.

The first integrated system products, containing sensing and display, will be available in sample quantities by end of year.

We also just announced that we acquired the industry’s only printed NFC technology, originally developed by Kovio, Inc. We have acquired all Kovio technology for both NFC and Electronic Article Surveillance, over 200 international patents, and a manufacturing facility with capacity of a few hundred million units per year.

Are these bi-stable displays?

The ones shown in our demonstrations are not; they are a very inexpensive electrochromic display that is semi-bi-stable. However, our designs are compatible with displays like those from E Ink. We can choose different display media depending on the application.

How does Thin Film work with its customers?

Thinfilm works with our customers and partners to understand market needs and then develop system designs tailored to their specific needs. We have been focusing primarily on Strategic partnerships. For example, we have a partnership with the Bemis Company, which is one of the largest flexible packaging manufacturers in the world. We’re developing intelligent packaging solutions as well as brand protection applications in flexible packaging and beverage labeling.

We also have a partnership with Hasbro. Toys are one of the first target applications for our memory-only labels.

Most recently we announced a strategic alliance with Brady, an international manufacturer of solutions that identify and protect premises, products and people, to bring our technology to the company’s identification product lines. Our initial work together will focus on electronic timing labels for applications in visitor and healthcare identification and tracking.

Our first commercial order is with an international luxury goods company, who will begin using our Brand Protection Solution in Q1 2014, as part of its next major product release. The solution will provide product authentication and assist in tracing grey market activity.
What is the biggest challenge in moving printed electronics closer to what traditional silicon-based electronics are capable of?

It’s important to note that we really aren’t trying to move closer to traditional electronics. That’s been one of the failure points in the printed electronics industry—trying to displace conventional technologies that have a 60 year headstart. For comparative purposes, we are only about the same level silicon was in around 1969. Instead, we are using printed electronics to address markets that are too cost-sensitive for conventional electronics.

To commercialize printed electronics, many pieces have to come together, from the materials level to the processes used for printing and curing inks. From commercializing the printed memory, we have significant experience printing fine lines and thin films. We are showing good yields in the printing process in volume production. Now we’re moving that know-how into the print processes for the transistors.

Do you still heavily invest in research, or are you now focused on transitioning to applications?

We are much more focused on the applications than on basic research. Our partnership with PARC is really about leveraging the 15 years of research that they have already done. We do work with a number of research institutions, like PARC and Acreo, but we focus on the product side—creating something that customers can place orders for.

What can you tell us about some of the products that we will be seeing in the next years?

Obviously, our printed memory is the first thing, as that’s in market and shipping today. The first thing you will see in our system products—those that contain additional functionality such as sensors and/or displays—will be simple systems like a timer label or temperature indicator.

The temperature sensor label that we are developing is used for monitoring shipments of perishable goods, such as pharmaceuticals and food shipments. The technology is positioned to offer an alternative between color-changing temperature labels, at one end of the market, and electronic data loggers that are 10-20x the price. Even today, Wal-Mart mandates certain temperature monitors in the shipment of the food that comes to its stores. With traditional electronics, the lowest cost system that can do that kind of temperature monitoring is about $5; the ones that are usually used are $11 and up. Compare that to a target of 30-50¢.

Our first generation of products is memory-only. The second generation, by year end, will be integrated systems containing memory, sensing and display. The third generation products will be NFC-enabled labels. This means near-field communications that are able to pull the data off the label using smart phones and tablets.

Even if you can get a color-changing label on a chemistry-based system to give you an indication, the thing that it can never do is transfer the data electronically to something else.

Can you elaborate more on some sensor applications?

We’ve recently completed a project funded by FlexTech for blood oxygen sensors. A program in ammonia sensors is also being funded by FlexTech this year. There are humidity sensors as well as different types of light sensors.

How are you going to promote this technology in the global market?

Yes, I already have teams in place in Japan, EU and North America. Globally, there is a growing interest in printed electronics. UK, Canada, Korea, Japan, Germany, European Union all have major programs in this area. There has also been a long investment in printed electronics in Sweden where our research and development site is located. In the US, FlexTech, the US National Consortium for flexible and printed electronics, is starting a dedicated users’ group forum for disposable electronics based on printed electronics.

What do you think about flexible electronics?

There are many ways to get flexibility. Most of them result in a more expensive circuit. In Thinfilm’s case, what we were going after is not flexibility, per se, but low-cost. Flexibility comes as a necessity for the printing process, but it isn’t the prime objective.

Is there any trending topic that will drive this technology over the next couple of years and where you’re expecting to go?

Yes, there’s a huge trend towards the Internet of Things (or Internet of Everything). Stanford hosted a “trillion sensor” conference in October. Gartner cites “Internet of Things” as one of the top 10 strategic trends of this decade. Analysts and companies alike are predicting markets in the trillions of dollars by 2020—Gartner $1.9 trillion, IDC $8.9 trillion, Cisco $19 trillion. Industry giants such as Intel, IBM, Cisco, Qualcomm and NXP are placing major bets on IoT, and the San Jose Mercury News calls IoT a technological transformation “as profound as the Industrial Revolution.”

Predictions for the number of sensor systems needed range from 10s of billions to trillions. Those numbers just can’t be achieved in conventional electronics. A paradigm shift is required, and we believe that’s printed electronics.

Low-cost, disposable sensor labels—able to autonomously collect information to later be read—are going to be key in this explosion. With over 400 million NFC-enabled smart phones already deployed, a number projected to grow to 1 billion by 2015, linking ubiquitous sensors on Thinfilm Smart Labels with the mobile platform creates a fluid and agile alternative to traditional data infrastructures. It is this agile network that will truly launch the Internet of Everything. That’s why I’m particularly excited about the work we’re doing at Thinfilm.

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