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Following on the heals of ICE Europe last March, we visited interpack 2017 in Dusseldorf, Germany, in May. Covering the same 18 halls occupied by drupa and K, interpack is clearly one of the largest packaging exhibitions in the world. Given the massive scale and our limited time, however, we focused our sights on discovering new trends in packaging materials.

We were particularly surprised to see so many BOPP and BOPET producers. According to Japanese materials producers and converters at the exhibit, cost is the most important factor in Europe, which helps explain the prevalence of BOPP and BOPET producers from relatively recent newcomers to the European market, such as Turkey, India, and Thailand. The aggressiveness of these newcomers hinted at the increasing competitiveness of the market, which, according to those we spoke with from Japan, makes it more difficult for more expensive, high-quality Japanese materials to find larger sales networks. Despite such difficulties, higher quality materials offer less problems and defects, and thus offer higher yields, which were factors that attracted high interest from areas of the European market that require quality. Similarly, exhibitors that focused on presenting unique applications or replacement applications attracted significant attention, whereas exhibitors that focused on existing markets that are already saturated, such as retort pouches and refill pouches, seemed to have difficulty in gathering interest.

Exhibitors presenting digital printing machines also seemed to have recognized the desire for something new, and went beyond promoting the potential of on-demand printing to offer more complete proposals that included on-demand lamination and packaging systems. In one example, a photograph taken on a smartphone is uploaded to the printing machine, which then produces a finished candy box printed with the picture within five minutes. This and other demonstrations hinted at the future potential of digital printing in the high-mix, low-volume packaging market, which is expected to explode in the future.

interpack 2017 also provided us with the opportunity to see some of the more common lifestyle commodities available in Japan in a global context. The impression we received was that many of the consumer goods taken for granted in Japan are still relatively unknown in the rest of the world. In this light, despite the difference in eating habits, for example, in different countries, as packaging in general begins to require greater functionality throughout the world, it is highly likely that Japanese technology will match well with these markets. As such, we intend to continue playing a role in conveying the potential of Japanese packaging technology to the world.
Balancing Economy and Quality Allows Nordmeccanica to Dominate the Global Solventless Laminator Market
Nordmeccanica S.p.A.

With More Than Half of Exhibitors and Visitors Coming From Outside Germany, ICE Europe Has Become One of the World’s Most Important International Converting Exhibitions

Packaging Materials Producers From Around the World Gather at interpack 2017

Expanding IMD and IML Decorative Molding Technologies to Automotive Component Applications Globally
Nissha Printing Co., Ltd.

Directly Forming Microscopic Structures on Surfaces to Texture Sheets During the Extrusion Process
Denka Company Limited

TOYOTA BOSHOKU Begins Supplying Samples of Its "High Impact-resistant Plastic" Resin Modifier
TOYOTA BOSHOKU CORPORATION

Replacing Velour Plating With Vacuum and Press Transfer Foil Eliminates the Need for Trimming
Chiyoda Gravure Corporation

High-speed, High-precision Lasers Reduce Heat Affects during Micromachining
Spectronix Corporation

An Interview With Tomonobu Takamizawa, President of Cosmotec: Marketing a Skin Decal That Does Not Use Water to the Consumer Market
Cosmotec Co., Ltd.

Mushiyoke Clean and a Unique PSA Make KAPETAN Insect Repellent Wallpaper a Reality
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Expanding IMD and IML Decorative Molding Technologies to Automotive Component Applications Globally

Today, automotive interior components are often made of plastic, which has led to a focus on improving the sense of class and quality, but it has also more recently led to a demand for functionality, such as a good sense of touch, fingerprint resistance, and scratch resistance. Two well-known technologies used to simultaneously decorate and mold such components in this way are In-mold Decoration (IMD) and In-mold Lamination (IML), both of which are synonymous with Nissha Printing Co., Ltd. (Nissha). Having been adopted by many of Japan’s major automotive component manufacturers, as well as companies around the world, the expanded range of IMD and IML applications has led to growing results in the automotive industry for Nissha’s printed film supply business. More recently, however, Nissha has gone beyond developing functional films and begun providing their own decorated molding services in areas that the major manufacturers tend to avoid, primarily technologically difficult molding and short-run component molding. Given the company’s increased global presence through the establishment of decorated molding plants in the US and Germany, Nissha sees a bright future for these new business areas.

Mobile Phone Decoration Technology

Nissha developed its IMD and IML technologies as a means of applying images and function to plastic products during the molding process. Specifically, functional and printed films are first inserted into a die-mold that is then injected with molten resin. In this way, these approaches are able to apply rich textual expressions to plastic products with complex three-dimensional shapes. Both IMD and IML are registered trademarks of Nissha.

Yasuhide Fukada, Deputy Manager, Product & Business Development, explains that Nissha offers IMD and IML as a four point system that includes films, equipment, die-molds, and process/molding technology. Nissha is essentially a printing company and their main business is printing and selling decorative films, but their IMD and IML technologies also required them to provide support for the die-molds and equipment in order for customers to mold high-quality, high-yield components. As the company expanded such support services, they established various technologies and began selling these together as a system. This was the start of IMD and IML, both of which have come to be used broadly in plastic molding plants around the world today.

IMD and IML first attracted sudden attention as decorative technologies for the mobile phones and laptop computers that exploded in number during the IT bubble at the end of the 1990s. Mr. Fukada explains that the awareness and use of IMD and IML grew along with the rapid increase in the number of decoration jobs related to the outer casings of IT equipment, such as mobile phones, smartphones, and personal computers. In particular, IMD and IML were widely adopted to decorate mobile phone display windows and to decorate and functionalize the outer casing of mobile flip phones. These developments led the company to see a sudden increase in mobile phone related jobs. As is true with mobile phones and smartphones, however, the cycle time for all IT devices is extremely short and the business environment fluctuates rapidly, which makes this a very difficult business field. Despite the high volume of work from the IT industry, in many cases jobs end in only six months or a year, even before problems can be fixed. In this way, Mr.
Directly Forming Microscopic Structures on Surfaces to Texture Sheets During the Extrusion Process

The key to forming decorative sheets with a moist or soft touch lies in the method used to create microscopic structures on the surface. During the 8th FilmTech JAPAN, held this past April at Tokyo Big Site, Denka Company Limited debuted its "NOBLETACT" decorative textured sheet, made using a technology that directly forms microscopic structures onto the surface of the molten film using an embossed roller during the resin extrusion step. The sheets can be used in secondary forming processes, such as TOM molding surface decoration, lamination, and printing. In addition to the various applications proposed by the company, including smartphone cases and book covers, the decorative sheets have already been attracting interest from automobile related companies around the world for use in front panels, door pillars, and other interior applications.

Denka developed their "NOBLETACT" decorative textured sheets using a unique (patented) extrusion-based microstructure forming technology.

Extruded sheet forming produces long webs of material by compressing the molten resin extruded from a T-die between a contact roller and a casting roller. Denka’s new decorative sheet forming technology modifies this approach by replacing the standard casting roller with a microscopic structured surface die-mold roller, which allows the approach to directly form the structure of the die-mold roller into the molten resin as it hardens into a solid. This forming method can be used with thermoplastics such as PS, PP, PE, and PVC, elastomer, and blends of these. The sheets can also be colored by blending the resin with pigments.

Denka Company Limited
www.denka.co.jp

Textured Surface Appearance

NOBLETACT Roll (left) and TOM Molded Sample (right)
High-speed, High-precision Lasers Reduce Heat Affects during Micromachining

Spectronix Corporation
www.spectronix.co.jp

As electronic devices become more advanced and miniaturized, micromachining technologies have attracted greater interest. A Japan-based manufacturer of industrial lasers, Spectronix Corporation develops, manufactures, and sells ultra-short pulse lasers for such micromachining applications. The company’s lasers, which generate picosecond pulse width lasers in the deep ultraviolet region (266 nm wavelength), improve the lasers ability to precisely cut composite materials, such as carbon fiber reinforced plastic (CFRP). Moreover, such short wavelength and short pulse width lasers are able to decompose substances at the atomic level, which reduces the influence of heat generation during machining, or so called HAZ (heat-affected zone). We spoke to George Okada, founder of Spectronix and the developer of these lasers, about the potential for laser based micromachining.

Single Wavelength, Directionality, Convergence
A laser, an acronym for “light amplification by stimulated emission of radiation”, is a type of artificial light that differs in several ways from natural light. Unlike natural light, which consists of various wavelengths, laser light consists of a single wavelength with excellent directionality (little light spreading). Moreover, the wavelength and phase (position of the nodes and antinodes of light) are aligned, so laser light has convergence and can be focused on a single spot when passed through a lens. In terms of machining, the smaller the spot diameter, the finer the machining accuracy.

In this way, lasers can be used to cut materials, drill holes, cut grooves, mark surfaces, and remove thin-films from a broad variety of materials, including metal, ceramics, resin films, glass, fiber reinforced plastic, and silicon. In the case of smartphones, lasers are used to pattern touch screens, drill holes on protective glass, and cutting LC films and LIB materials. According to Mr. Okada, lasers are particularly good at machining thin or small materials.

Lasers come in continuous wave (CW) types with a continuous light output, and pulse laser types with an intermittent light output. Micromachining uses pulse lasers, which can concentrate high energies in a short period of time. As a manufacturer of pulse lasers, Spectronix is particularly skilled at generating lasers in the 266 nm (deep ultraviolet), 355 nm (ultraviolet), and 532 nm (green) short wavelength regions, with ultra short pulse width in the nanosecond and picosecond*1 ranges. Lasers generated by the shortest wavelength (266 nm) laser oscillators are able to machine materials with minimum HAZ.

Drilling More Than 100 Holes Per Second on Ceramics
Another advantage of laser machining is its ability to finely machine materials at high-speed. Mr. Okada explains, for example, short pulse width lasers can drill more than 100 holes per second on brittle materials such as ceramics, or even write

*1 A nanosecond is one-billionth of a second, and a picosecond is one trillionth of a second.

George Okada, Spectronix Founder & CEO

July / August 2017  Convertech International
Cosmotec Co., Ltd., the Japanese laminator and die-cutter that developed COSMOTAC, an original functional film brand used in display protection films and solar cell backsheets, has recently been working to expand its sales routes for consumer products. Using the technology developed more than a decade ago for a decal that adheres to skin without using water, the company now aims to expand from a conventional business to business (B to B) company to include business to consumer (B to C) activities. The main issue in this move, however, is how to increase their name recognition in an unfamiliar market in which they have already begun moving to build new sales channels. We spoke to Tomonobu Takamizawa, president of Cosmotec, about the move.

–Please give us a brief overview of Cosmotec

Mr. Takamizawa: My father and current chairman, Yukio Takamizawa, established Cosmotec 28 years ago. Originally, my father studied polymers at the Tokyo Metropolitan University, and worked at the research center of a tape producer following graduation. After subsequently working at several other companies, he established Cosmotec at the age of 50.

From our start, our main business has been laminating, printing, and die-cutting polymer films and tapes, but we outsource all of the coating, slitting, and rewinding work. In other words, we produce and deliver die-cut and laminated components. We also operate in two business fields, producing and selling coated film rolls to other companies, and converting (laminating and die-cutting) and selling film components for our own brands and those of other companies. Although the vast majority of our clients are from the display field, our sales activities are focused on picking up the needs from any field.

At present, functional films and tapes for LCD and touch screens account for 80% of our business, making the display field the largest of our markets. In fact, volume still continues to grow despite falling prices. We did not necessarily target this field from the start, however. Rather, the rapid growth of the LCD industry just happened to coincide with our founding, or a few years later.

As LCD-related business grew, we built a plant in China and established a sales location in Taiwan to expand the scale of our organization. Currently, we have a production plant and sales location in China, as well as sales locations in Korea, Taiwan, and Hong Kong. Most of our China plant customers are Japanese-affiliated companies and local Chinese companies, and most of our work in China is die-cutting and laminating components for LCD and touch screens. More than half of our work comes from local Chinese brands, but this plant also supplies the adhesive tapes and functional films used by Japanese-affiliated and US PC manufacturers.

–How did you become interested in consumer products?

One consumer product we developed based on the technology
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Several years have passed since mosquito transmitted Dengue fever and Zika fever first made headlines outside of their origins in Africa and South America. Although homes can be protected from mosquitoes using electrical insect repellent devices, these are inconvenient because the cartridge must be replaced and they are difficult to use in commercial facilities in some cases. In this light, NICHIEI KAKOH CO., LTD. and KANSAI PAINT CO., LTD. developed "KAPETAN," an insect repellent adhesive sheet, which they exhibited during FilmTech JAPAN, held this past April at Tokyo Big Site. Developed by KANSAI PAINT, the insect repellent coating used in KAPETAN sheets irritates the mosquito's nervous system when the mosquito lands on the surface. The reverse side of the sheet is coated with a unique NICHIEI KAKOH PSA, allowing KAPETAN to be used as wallpaper.

Irritating the Mosquito's Nervous Systems
Mushiyoke Clean, an indoor insect repellent coating developed by KANSAI PAINT in 2016, contains a pyrethroid insect repellent. Pyrethroid is neither highly toxic to warm-blooded animals and humans, nor airborne, so pyrethroid will only affect the nervous system of insects that come into contact with the coated surface. Once inside, mosquitoes, winged ants, moths, and other flying insects tend to spend most of their time on walls and ceilings instead of flying. The coating relies on this behavior to prevent insects from approaching the walls, which makes it difficult for them to remain indoors. In Japan, the company has been promoting this coating for use in hospitals, community centers, shopping malls, and other large facilities, but they have also begun marketing the coating in Southeast Asia, South and Central America, and Africa. In particular, the demand is high in Brazil, which attracted global attention during the Rio Olympics last year for an outbreak of Zika fever, and in Kenya in East Africa with its strong economic growth. Likewise, the company is exporting the coating and licensing the technology to local paint companies.

Using KAPETAN as an Insect Repellent Wallpaper
The surface of "KAPETAN" is coated with Mushiyoke Clean, while the reverse side is coated with PSA, which allows KAPETAN to be easily applied to walls, for example. The 1 mm thick sheet has a four-layer structure (special coating/nonwoven fabric/acrylic PSA/release paper). The light release acrylic PSA is coated to the sheet using NICHIEI KAKOH’s patented MATRIX technology. Using this release paper coating technology, the PSA surface is formed into countless bumps aligned in the horizontal and vertical directions (matrix), which allows for easier
Balancing Economy and Quality Allows Nordmeccanica to Dominate the Global Solventless Laminator Market

Nordmeccanica is well-known around the world for its high-quality laminators, but has a particularly strong presence on the solventless laminator market. To discover the source of the company’s strength, we visited the company’s headquarters in Piacenza, Italy, and received a tour of their factory from Paolo Milani, Area Sales Manager at Nordmeccanica.

Nordmeccanica’s History
With more than 30 years of experience in the coating and laminating industry, Nordmeccanica was founded by Antonio Cerchiello, the current chairman. In 1998, Mr. Cerchiello passed the company on to his two sons, Vincenzo Cerchiello, the current technical director, and Alfredo Cerchiello, the current financial director, at which time the company embarked on a business policy renewal, starting it on its path to the strong growth the company sees today.

Today, Nordmeccanica’s headquarters are located on a 330,000 m² site that also includes three assembly plants, a test center, a component and spare parts warehouse, and an engineering center, at which approximately 300 employees work. Internationally, the company has expanded to include plants and service centers in the US (New York), South America (Buenos Aires), China (Shanghai), and India (Mumbai).

Mr. Milani explains that after they adopted their new organizational framework in 1998, the company has since grown to see annual sales of 100 million euros. The first step in its transformation away from a family business was its focus on reliable products and after-service, which has allowed them to smoothly build relationships with companies that they had not been able to work with before because of communication problems.

Nordmeccanica Headquarters and Plant (Piacenza, Italy)

Growth in Sales Revenue and Total Units Sold Since 1998
The high-end model controller Pursued usability function

**Outline**

- PEM-3000 is a controller which carries out meandering control of a web in combination with the sensor and a driving device of G series.
- The touch panel of the color liquid crystal was carried and universal operability is realized.
- The interface with external equipment, such as an external I/O terminal for controlling LPC from the outside and an analog output terminal for monitoring the state of a web, is equipped standardly.

**Features**

- The touch panel of a color liquid crystal can be operated intuitively.
- For external control, the input terminal for changing operational mode and the output terminal of alarm are equipped standardly.
- The analog output for monitoring the state of the web which the sensor detected is equipped standardly.
- The connection with a sensor or a driving device serves as a connector type, and can wire easily.
- A sensor is connectable to four channels. While using it as an object for meandering control, it can be used as an object for the monitor of a web.
With More Than Half of Exhibitors and Visitors Coming From Outside Germany, ICE Europe Has Become One of the World’s Most Important International Converting Exhibitions

ICE Europe
www.ice-x.com/europe/english/

Although drupa and K are well-known European converting related exhibitions, the only truly converting industry focused exhibition in the region is ICE Europe, held this year from March 21–23 at the Munich Trade Fair Centre. The maturing global converting industry has led to a greater need for converters and converting equipment manufacturers to take on changing demand, changing values, and the creation of new markets. Likewise, those in the converting industry are in a continuous search for what comes next. As an important sector of the global converting industry, Europe has become one of the best indicators of trends for the rest of the world in terms of printing, coating, laminating, slitting, and all of the other fundamental converting technologies.

Half of Visitors Hail From Outside Germany

Held every two years, ICE Europe offers a location for the converting industry to discover the latest in coating, laminating, slitting, and other related converting technologies. Now in its 10th edition, this year the exhibition hosted 430 companies from 28 countries, with the majority of exhibitors coming from Germany, Italy, the UK, Switzerland, the US, France, and the Netherlands. The 6,850 visitors hailed from 68 countries, with the majority coming from Germany, followed by Italy, Austria, Poland, Switzerland, the UK, France, Spain, the Czech Republic, and the Netherlands. Despite total visitors and exhibitors being 2% lower than the previous edition, which saw the highest totals in the exhibition’s history, the high degree of international participation showed that ICE Europe is increasingly finding itself as a forum for international business. Specifically, the 2017 edition saw extremely high international participation, with only 45% of exhibitors and 49% of visitors coming from Germany.

Visitors also came from a wide range of industries, from packaging and plastic, to printing, paper, textiles, nonwoven, chemicals, and automobiles. Similarly, technologies on display ranged broadly, from coating and laminating to slitting, rewinding, materials, control, testing, printing, finishing, and drying and curing.

Scenes From ICE Europe 2017

RK PrintCoat Instruments Ltd.
rkprint.com
Manufacturer and distributor of coating machines for development and testing
Exhibit: Reel-to-Reel VCML Lab/Pilot coater (web width: 300 mm, web speed: 70 m/min., optional tension control)
Duplex Turret Slitter Rewinder (SDT-926) and other equipment

NICELY MACHINERY DEVELOPMENT CO., LTD.
www.nicely.com.tw
Taiwanese slitter manufacturer
Exhibit: Packaging tear-tape slitter with thread winder (web width: 600 mm, unwinding roll diameter: 600 mm, slit width: 2 mm, traverse range: 250 mm, speed: 150 m/min.)

Atlas Converting Equipment Ltd.
www.atlasconverting.com
UK converting equipment manufacturer; acquired Titan Converting Equipment Ltd. in 1981
Exhibit: new IR series web inspection system (IR60 web width: 600 mm, cantilever type transport rollers)

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Please contact us via e-mail at:
info@fuji-shoko.co.jp
One of the world’s largest packaging related exhibitions, interpack 2017 was held in Dusseldorf, Germany, from May 4–10. The event filled 18 halls, and hosted 2,865 companies from 168 countries. Of the 170,500 visitors, 74% came from outside of Germany. The international scale of interpack hinted at the huge number of materials producers operating globally, where many standard film producers from Turkey and India, for example, have notably expanded into Europe. Meanwhile, Japanese producers focused on exhibiting functional materials, detailing the specific advantages of such materials and the many potential applications. In particular, many of these new functionalities are being paired with eating habits of different cultures around the world to open up new fields in the food packaging industry. Although the event spanned the entire range of fields in the packaging industry, this report provides a sampling of materials related companies. The next edition of interpack will be held May 7–13, 2020.

**ACTEGA (Germany)**

Overview: Primarily operates in the US and Europe, but has a location in China. Products include coatings (top coat, water-based/UV varnish, heat resistant, barrier, etc.), inks, adhesives, sealants, etc.

**CCL Label (US)**

Overview: Primarily produces consumer packaging and health care packaging, providing decorative films and adhesive/extrusion films for functional/information labels.

Exhibit: Easypack shrink band film for bundling 4 and 6 packs of plastic bottles.

**PROPAK (Turkey)**

Overview: With 290 employees and a 32,000 m² facility, PROPAK exports products to more than 30 countries. The company operates a 10-color gravure machine, an 8-color flexo machine, 5 laminators (max. width: 1,330 mm, solvent/non solvent, 4-layer lamination), and a hot melt coating machine (max. width: 910 mm)
JAPAN PACKAGING COMPETITION Winners Tests the Bounds of Packaging Design

2017 Japan Packaging Competition

The winners of the 56th JAPAN PACKAGING COMPETITION (2017), an event organized by the Japan Federation of Printing Industries to select the best industrial and consumer packaging concept designs commercialized and marketed in 2015 and 2016, were announced on April 18, 2017. Of the 150 items entered for selection, 44 winners were chosen after careful consideration by a 12 member committee chaired by Michio Miyazaki, professor emeritus at Chiba University. We have selected a few of the most interesting concepts to introduce to you here.

Meiji Co., Ltd.: meiji THE Chocolate

Minister of Economy, Trade and Industry (METI) Award

In addition to reproducing the appearance of kraft paper on matte, uncoated paper via printing, Meiji used different stamping foils to produce colorful designs on the chocolate packaging to express the six types of aromas and flavors. The uncoated paper also reduces the environmental impact of the packaging.

UPICIA CO., LTD.: THE BOOK OF TEA

The museum

METI Commerce and Information Policy Bureau Director Award

Each of the tea bags for the 50 different flavors of tea sold in this box are printed with 50 different paintings, while the box itself is designed to look like a book. In this way, the package concept is designed to allow consumers to enjoy their tea while appreciating the paintings.
Food packaging holds a variety of capabilities, including ensuring food hygiene, preserving freshness, and offering attractiveness, but it also provides the potential to shorten cooking times using a microwave oven, act as a means of reducing kitchen work and solving labor shortage problems, and offer new menu options in cooperation with food producers. FP Corporation, a Japanese food tray producer, displayed the latest in food packaging at "FPCO Fair 2017", a packaging event held by FP Corporation at Tokyo Big Site this past March for supermarkets and other retailers.

Prepared Foods With Fresh Ingredients
Held once a year for retailers and distributors, FPCO Fair displays the latest in packaging, and present supermarket sales floor reproductions in an easy to understand manner, including showcases lined with actual packaged foods. The show also displays effective sales methods using POP, menu proposals for different seasons and events, and products that have actually improved sales.

One such example was a prepared dish consisting of fresh vegetables and meat that is specifically made for microwaving. Although the fresh contents require a relatively long cooking time of 5 minutes (at 500 W), the resulting flavor is somewhat different than cooked prepared foods. The menu includes pork and Chinese cabbage pots, kimchi pots, stewed hamburg, curry in a whole fresh onion, and butter corn. These uncooked prepared meals can be sold by simply lowering the temperature setting of conventional chilled prepared food cases. The slightly higher price range also allows for potentially higher sales revenue. The dishes are sold in small black pot shaped containers made of foamed polystyrene (PS) "Multi FP (MFP)" and transparent PP cups with the same transparency as OPS, both of which have a heat resistance of 110°C and have excellent oil and acid resistance.
Aging societies, shopping refugees, food loss, sustainability, and other changing factors affecting the food industry are driving the increased importance of the packaging field. In this light, the Japan Food Packaging Association held its regular research meeting in April to introduce the latest in next generation packaging, including new strategies for glass bottles, 100% biomass resin films, and shelf-life extending packaging technology.

**Glass Bottles for Commodities and Premium Goods**

Keiichi Takahashi, marketing director at Nihon Yamamura Glass Co., Ltd., spoke on the future of glass bottles. According to the Japan Glass Bottle Association, the total shipment volume of glass bottles peaked in Japan in 1990 at 2.4 million tons. Although volumes have continued to decrease since, in 2015 premium beer sold in glass bottles drove shipments to rebound 2.4% compared to 2014. In 2016, however, shipments fell again to reach 1.125 million tons, or half the 1990 peak volume. Today, glass bottles only account for 2% of the packaging market as a whole, so Mr. Takahashi states that the glass bottle industry must rediscover what consumers look for in glass bottles to energize the industry.

According to Mr. Takahashi, today’s glass bottles are segmented into two extremes, those used for daily goods and other commodities, and those used for premium goods. In terms of commodities, he says that ultra-lightweight glass bottles should be positioned to compete with cans, plastic bottles, and pouches by promoting their high reliability (safety and sustainability).

On the other hand, premium goods require bottles that appear extraordinary, luxurious, and fashionable. In Japan, some examples include glass jars used to sell pickles, jam, sweets, and salads, whereas the popularity of coconut oil and other healthy oils, as well as increasing exports of high-grade sake varieties, offer a hint at the future of glass. These premium goods targeted glass bottles are decorated to set them apart, as seen with spirits already sold in the US and Europe. Some of the more common examples of decoration increasingly used in Japan include Japanese paper-like coating, combined coating and hot stamping, half deposition films (which both reflect light and allow a tiny amount of light to pass), and combined coating and hot stamping techniques.

**Goal of 100% Biomass**

Chikao Morishige, general manager of the Film Production
The world around us is full of industrial products made of relatively thin materials, including paper, textiles, plastic films, thin-film glass, nonwoven fabric, and metal foils. Although this variety shows that these materials are essential to our daily lives, they are also critical in furthering the development of high-tech industries that will eventually form the core of the global economy. Some examples from the IT, energy, and medical fields include optical films for flat panel displays, solid polymer membranes used in fuel cells, and artificial biological membranes for medical applications. During the manufacturing process, however, we call these materials webs.

Web manufacturing technology relies on the converting technologies of coating, laminating, and printing, as well as on web handling technology (here we include unwinding, slitting, cutting, drying, and rewinding, etc.). Among these, coating and printing have established themselves as cutting-edge technologies, for which academics have shown great interest. In contrast, web handling technology has conventionally been refined through production plant experience; although the technology itself has reached a fairly advanced level, its academic understanding is poor.

At the strong behest of the industry, the author has spent the past 20 years working to theoretically understand the physical phenomena related to web handling, and predicting and preventing the problems that occur during manufacturing. Our research has been studied widely in Japan by industries that utilize web handling technology, and has been praised for the help that it has provided in eliminating defects and developing new products.

On the other hand, we have also received strong interest from around the world in publishing our results in English given the desire to understand the strength of Japan’s web handling technology. Given that the theoretical research into web handling began outside of Japan, we are elated to be able to publish an English version of our work as it will allow us to repay our debt to those who came before. At the same time, nothing would make us happier than to see this work contribute to the opening of new horizons for readers around the world involved in web handling technology.
Designing Attractiveness: Going beyond the standard expectations for quality performance

72nd Society of Packaging Science & Technology, Japan, Symposium
www.spstj.jp

The need for strength and barrier properties are not the only demands being placed on packaging. One other important factor is the attractiveness. In this light, the 72nd Society of Packaging Science & Technology, Japan (SPSTJ), Symposium looked at ways of designing attractiveness into different types of products as a reference for the packaging industry. During the symposium, experts introduced the latest in product design concepts, including Delight Design, the use of natural laws of beauty, and rapid, reliable 3D modeling systems.

Clarifying the Hidden Needs of the Consumer

The 21st century is seeing limits on material satisfaction lead to a shift in focus towards spiritual fulfillment. In this light, Dr. Koichi Ohtomi, Research Fellow at the Department of Precision Engineering, University of Tokyo, says that there is now a demand for “Delight Design”, an approach that provides products with “attractive qualities” that go beyond the basic design and better design qualities required for mass production. For example, Dr. Ohtomi says that when he was involved in the development of a vacuum cleaner at a major appliance manufacturer, the different aspects of development—namely the vacuum cleaner principle, method, and design—were all developed independently by different individuals. Although this is the standard manufacturing approach in Japan, in reality he says all aspects of development should ideally be handled by one person, otherwise all of the design information must be indexed and coordinated.

He goes on to explain that in the conventional approach a hair dryer, for example, will be considered complete if it meets the selected physical and performance properties, including air volume, temperature, weight, power, use of ions, and noise level. Under the design concept of Kansei (sensibility) Engineering, a hair dryer is considered complete if it is “comfortable” to the customer’s sensibility. Likewise, under the concept of Delight Design, the hair dryer is considered complete when its attractiveness to the consumer is added to these other factors.

Delight Design Allows for Attractive Quality

Dryer Based on Delight Design

Three Design Approaches

- Satisfied Customer
  - Delight Design
  - Basic Design
  - Cost and Performance

- Dissatisfied Customer
  - Emotion
  - Reliability
  - Problems occur when this is ignored

- Unfulfilled Demand
  - Hit products are born here
  - Reliability
  - Safe/Secure

- Fulfilled Demand
  - Better Design
  - Mass-production, Mass-consumption
  - Unending price competition

Koichi Ohtomi
To help converters, gravure printing companies, and gravure cylinder makers transition more smoothly from electro-mechanical engraved cylinders to laser-imaged cylinders, THINK LABORATORY CO., LTD. has recently added the “New FX4” and “New FX5” to its New FX series of fully automated laser gravure cylinder making systems. In addition to the existing “New FX3”, the broader lineup targets a wider range of needs.

The “New FX4” can be adapted to use cylinders from existing electro-mechanical engraved cylinder making copper plating equipment and copper base layer polishing equipment. Meanwhile, it still uses the same coating, laser imaging, etching, and chrome plating units as the New FX3. In other words, the New FX4 is essentially a New FX3 without the copper plating and copper polishing units. As such, the New FX4 is able to make the same number of cylinders per day (80) as the New FX3. In contrast, the “New FX5” is equipped with two coating and chrome plating units, which allows it to produce 110–120 cylinders per day. The printing cylinders made in these machines have shallower cell depths than electro-mechanical engraved cylinders, which means they use less ink and thus release less volatile organic compounds (VOC) to the air. As such, THINK LABORATORY has set its sights for the two new systems beyond Japan, and foresees demand coming from countries like China and India, which are faced with severe air pollution.

The New FX3, FX4, and FX5 are also designed to produce both high printing stability 250 lpi solvent-ink cylinders and high resolution 5–12 µm cell depth, 250–300 lpi water-based ink cylinders. This flexibility has led to a strong demand to shift to laser cylinder making. THINK LABORATORY expects its latest models to lower the initial investment barriers and thus stimulate the use of laser gravure cylinder making systems.

Since June, THINK LABORATORY has been demonstrating the high productivity of the New FX5 at its plant in Kashiwa, Japan, producing 120 cylinders every 23 hours.
Applying T-die Extrusion to Increase the Limestone Content of Paper-like LIMEX

TBM Co., Ltd.
www.tb-m.com

As a replacement for paper, which is made in a wet process using pulp, TBM Co., Ltd. developed its new inorganic-resin composite paper-like sheet called LIMEX using a water-conserving dry-process. Specifically, the approach blends polyolefin with limestone at a weight ratio exceeding 50% and directly forms the material into sheets in a twin-screw extruder without first forming the material into pellets. The approach has attracted sudden interest for its ability to allow countries with limited water and wood resources to produce paper-like materials. In November 2016, TBM entered a basic agreement with TOPPAN PRINTING CO., LTD. to jointly develop an expanded range of applications for LIMEX. We visited TBM last December and spoke to Yuichiro Sumi, Chairman of the Board of Directors, about the potential for LIMEX.

The Limits of Blown Film Extrusion

Following a career at Sanyo-Kokusaku Pulp Co., Ltd. (currently Nippon Paper Industries Co., Ltd.), Nippon Paper Industries (senior managing director), and Otake Shigyo (administrator and CEO), in 2010 Mr. Sumi began advising Nobuyoshi Yamasaki, the CEO of TBM. At the time, Mr. Yamasaki was involved in the sale of imported stone paper (calcium carbonate-high-density polyethylene composite sheets). After his requests to improve the shortcomings of stone paper, including their heavy weight (much heavier than paper), thickness variation, and dusty surface, fell on deaf ears, he went straight to Mr. Sumi as a paper professional to come up with a solution. Mr. Sumi looks back at the time, explaining that he spent the first year brainstorming and eventually recognized at the start of 2011 that it would be difficult to improve upon the blown film making method. In particular, the pellet making and blown film making methods were patented by producers outside of Japan, so he gave up on this method. Ultimately, he came up with the idea of using a T-die to form the film and a stretching process to form tiny voids in the film to produce an opaque white sheet.

The blown film making method, which blows air as it extrudes the melted resin through a ring shaped die to expand the film into a tube that is then cooled and slit at either side to form a film or sheet, has relatively low facility costs and is suited to producing general-purpose films for plastic bags, for example. The melt resin extrusion volume and tube draw speed determine the film thickness, however, so there are many variables. In contrast, the T-die method, which extrudes the melt resin from a linear die orifice and cools the resin on a casting roller, has relatively high facility costs and a long line length when stretching is included. The film thickness, however, can be adjusted during the melt resin extrusion stage, so this method results in less variation than the blown film method. Mr. Sumi explains that the blown film method also has poor reproducibility because stretching the film in the length and width directions relies on film drawing and blown air. In contrast, the T-die method has excellent reproducibility when forming a film with a density of 0.7, for example, because it stretches the film in the length and width directions after the film is fully formed. For this reason, Mr. Sumi set out to develop the new paper-like material using the T-die method.

Avoiding Waste

Development was a challenge, however. Although limestone (calcium carbonate, CaCO3) is often mixed into garbage bags at a weight ratio of under 40%, the goal of Mr. Yamasaki and Mr. Sumi was to achieve a calcium carbonate filler to resin weight ratio of greater than 50%. After their requests for help were rejected by two major T-die extruder manufacturers, Mr.
High-density water-based flexo reverse printing on OPP film was demonstrated at the end of 2015 using TOYO INK Co., LTD. AQUA LIONA Inks and an Asahi Kasei E-materials (today, Asahi Kasei Corp.) plates. The demonstration used two types of promotional images printed using process colors and containing the names of the cooperating companies. The demonstration was held at Kinyosha Printing Co., Ltd.’s Ooguchi Factory in Aichi, Japan. Given that this was the early period of high-density printing, the results had a few problems. We will use these printed samples as an example of a series of image quality analysis results, and analyze the cause of the slight image deterioration to consider what can be done in response. Photos 9 and 10 show the printed samples.

Here, the importance of the K data is slightly lower, so we omitted these data to avoid complexity in the chart.

10.1 Color Density Curve Example for High-density Water-based Flexo Printing on OPP Film

Figure 11 from Section 9.3 (May/June 2017, p. 104) shows the
About the Author

In 1965, Shohei Masui began working for Sumitomo Chemical Company, Limited. Engaged in research and development of plastic materials and molding technologies, Mr. Masui was involved in the development and commercialization of glass fiber composite materials, injection press molding technology, and skin material lamination/integration molding technologies, among others. After later working for LPM Co., Ltd., Mr. Masui established the MTO Technology Research Laboratory in 2005. Today, he speaks, writes, and provides technical support to individual companies, primarily in the fields of decoration technology and CFRTP molding technologies as a technical consultant. He has provided his services globally in countries such as Taiwan, Korea, and China. He has also authored many works focused on areas related to plastic decoration techniques.

6.5 Printing

Printing is a decorative and information conveyance technology that is used in an extremely broad range of applications.

As shown in Figure 95, the standard printing methods include screen printing, offset printing, gravure printing, and flexographic printing, whereas other direct printing methods include pad printing, inkjet printing, and holographic printing. As explained in Chapter 2 Section 1.2 (Convertech & e-Print July/August 2016), there are also indirect printing decoration methods in which a printed film is formed onto the item.

As mentioned previously, although direct printing methods were commonly used in the past, there has been a shift to indirect methods because of the need for process rationalization, shape conformity, and solutions to environmental problems. From the perspective of responding to high-mix, low-volume production, however, the advancements in direct printing methods have allowed some cases to go back to direct printing. The development of UV inkjet printing has also expanded the range of plastic shapes that can be directly printed (explained in Section 6.5.1).

By modifying the printing plate, SHUHOU CO., LTD. has developed a technology for 3D curved surface printing that can be applied to high-mix, low-volume production, which it has expanded into a variety of different combinational technologies (explained in 6.5.2 (1)). Moreover, TAKANOHA INDUSTRIAL CORP. has developed a technology for 3D curved surface printing using gravure printing (explained in 6.5.2 (2)). Other developments include digital offset printing and full-surface 3D shape one-shot printing.

6.5.1 UV Inkjet Printing

UV inkjet printing is a non-contact direct printing method that uses UV curable ink, which polymerizes when exposed to UV light and instantly cures to adhere to the substrate surface. Because UV exposure instantly cures and adheres the ink to the substrate immediately after printing, UV curable inkjet inks can be printed on a variety of materials, including plastics. Moreover, the inks do not contain any volatile organic compounds, so are also environmentally friendly.

As shown in Figures 96 and 97, the range of plastic shapes that can be directly printed with UV inkjet printing has expanded. MIMAKI ENGINEERING CO., LTD. offers a variety of improved models of UV inkjet printers. Over the past few years, these UV inkjet printers have seen significant advancements...
and vacuum deposition and printing combinations offered by Daiichijushi Industry.137

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Contact Type Desk-top Film-Sheet Thickness Measuring System

**TOF-4R**

**TOF-5R**

**TOF-6R**

* Export permission is necessary. (Japanese Govt.)

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**Specifications**

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**Precise Thickness Measurement and Control**

**YAMABUN**

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**Exhibit**

IPF JAPAN 2017
Date: October 24-28, 2017 Venue: Makuhari Messe
In this part of the series we have been introducing roll-to-roll production systems. In the previous session, we considered the conversion of vacuum processes to roll-to-roll. In this session, we will look at converting the component packaging process for the completed flexible circuit to roll-to-roll.

In the case of rigid printed circuits, the component packaging process is highly automated and is increasingly high density. Although flexible substrate component packaging on a mass-production scale often utilizes the facilities designed for rigid printed circuits, these facilities cannot be used without some modification, and certain measures must be taken, such as preparing specialized tools. Roll-to-roll packaging processes also have problems related to operations in addition to technical problems, so at this point, roll-to-roll packaging processes have only been applied to a limited set of applications.

11. Adopting Roll-to-roll Systems for the Main Processes (continued)

(6) Component Packaging in the Roll-to-roll Process

In the case of rigid printed circuits, component packaging automation has nearly been perfected, which allows for the packaging of high volumes of advanced micro-components at high speed. The specific packaging process consists of solder paste printing, component mounting, reflow, inspection, and repair (Fig. 111 and 112). Here, inspection processes include electrical inspection and visual inspection. The circuit infeed, outfeed, and packing processes are also highly automated.
1. Introduction

Typical mobile communications devices, such as smartphones and tablets, are expected to become increasingly functional, thinner, and lighter. These advancements have triggered the need to pursue higher densities for the IC packages mounted inside such devices. Naturally, higher densities will require finer semiconductor circuit patterns, but will also lead to the application of 3D packaging, an approach that layers multiple chips inside the IC package. Given that thinner chips are the fundamental technology for 3D packaging, 3D packaging will require the development of a stable thin chip production process and the materials to enable thin chips. Semiconductor miniaturization has also led to a shift away from standard wire bonded face up packaging and towards face down packaging, a typical example of which is flip chips. Flip chip packaging is advantageous in that the chips occupy a smaller volume and have highly reliable electrical connections. Because the entire chip is not encapsulated in resin, however, these chips are susceptible to external impact and are likely to break.

In response to these problems, the flip chip backside is screen printed or spin coated with a protective paste coating. This approach results in several new problems, however, including low productivity and difficult thickness precision control. In response, we commercialized “Adwill LC Tape”, a new backside coating tape that solves the above mentioned problems and simplifies the fabrication process. In this session, we will introduce our LC tapes and look at the latest development trends.

2. Application Process

Like adhesive tape, LC tape is a pressure-sensitive adhesive (PSA), where applying heat after the tape is affixed to the silicon wafer will cause the PSA to undergo a morphological change into an adhesive. Figure 1 shows the structure of this tape and Figure 2 shows the LC tape application process.

(1) Grind silicon wafer and (2) remove back grinding tape (BG tape)
(3) Remove LC tape release film (low-release strength) and apply the backside coating layer to the ground silicon wafer surface. Next, peel off the remaining release film (high-release strength)
(4) Thermally cure to adhere the backside coating layer to the silicon wafer
(5) Laser mark the backside coating layer surface
(6) Apply dicing tape (DC tape) to the surface of the backside coating layer
(7) Dice wafer into individual chips and (8) pick-up
(9) Bond chip to the substrate using soldering balls

The package is completed via these processes. The conventional method, in which a paste is coated to the silicon wafer to form a coating film, is problematic in that the film thickness is difficult to control, the yield is poor, and the productivity is low. In contrast, LC tape offers the excellent thickness consistency of a tape and simplifies the application process, which in turn realizes high film thickness precision and high yield.
1. Introduction

The average life expectancy of someone living during the Roman Empire is believed to have been in the early 20s, and by the 19th century the average global life expectancy was still only in the 30s. Over the past 100 years or so, however, the average life expectancy has reached the 70s. Claiming that this increase is due solely to advancements in polymers would be presumptuous, but it is not too much to say that the major advancements in medical equipment during and following World War II are at least one contributing factor. Moreover, when discussing these major advancements in medical equipment, we cannot ignore the development and industrialization of synthetic polymers. For example, the PVC used in catheters has been industrially produced since the 1920s, whereas the PE used in medical bags was developed in the 1930s, the PET used in artificial blood vessels was developed in the 1940s, and the PP used in disposable hypodermic needles was developed in the 1950s. Meanwhile, PMMA prosthetic eye lenses were first transplanted in 1949 by Ridley et al. These polymers (plastics) have become such an essential material in our everyday lives that they are even commonly found in cheap discount stores today. In other words, the fact that polymers found in cheap discount stores can be used to save lives in medical situations means that if Japan, with its expertise in “craftsmanship”, is able to develop unique, smart polymers, we may be able to develop previously inconceivable treatment methods. In this series, we will provide an overview of a new “craftsmanship (material development)” that aims to realize medical treatments that will be available to anyone at any time and at any place. In the first session, we will introduce a fiber sheet that can be used for drug administration.

2. What Are Smart Polymers?

The key material we will introduce in this session is called smart polymer. Smart polymer is the general term for polymers that...
cutting-edge medical technologies have significantly improved survival rates, but except where early detection is possible and surgical options are available, there are still no effective treatment methods. Existing standard treatments are based on three pillars—surgery, radiation therapy, and chemotherapy. Meanwhile, more recent research into and development of new treatment methods—such as immunotherapy, hyperthermic treatment, and gene therapy—has led to the availability of new practical medications. In particular, hyperthermic treatments, which use the fact that cancer tissue is susceptible to heat, have shown good prospects when used together with chemotherapy, for example. In this light, the authors have developed a nano-fiber sheet that can simultaneously generate heat and release anticancer drugs (Fig. 3).

Specifically, the sheet's temperature-responsive nano-fibers are impregnated with magnetic nano-particles that cause the fiber itself to generate heat when an external AC magnetic field is applied. At the same time, the sheet releases the encapsulated anticancer drugs.6, 7 Using tumor-bearing mice with human lung cancer cells to investigate the anti-cancer activity of these fibers, we showed that applying an AC magnetic field significantly reduces the growth of cancer tissue. More specifically, by applying an AC magnetic field for 15 minutes one time per week over a continuous treatment period of two months, we were able to reduce the size of the cancer to less than one-tenth (Fig. 4). At this point, we compared these results to those of separate self-heating and anticancer drug administration, whereby we showed that simultaneous treatment had the highest lethal effectiveness. In this way, we can use nano-fibers to effectively apply a hyperthermic treatment and chemotherapy simultaneously, which have been difficult to apply at the same timing in a localized area until now. Furthermore, this allows us to maximize the medicinal effect of conventionally used, relatively inexpensive anticancer drugs. These results also show a high anticancer behavior even at a lower dosage (low side effect) than standard. As such, we expect the nano-fiber sheet to be used widely as a new cancer treatment.

4. Closing

A "drug of our dreams," “Nivolumab” has caused a stir on TV recently. Although the results are epoch-making and the anticancer drug has attracted attention as a potential Nobel Prize winner, aspects beyond the new drug’s medicinal effect have also led to national level debate. The reason for this is the cost of the drug, which at only one administration every two weeks comes to ¥35 million per year. Considering that the number of people who die from non-small cell lung cancer is around 60,000 per year, the insurance burden would in theory expand by ¥2 trillion per year if this drug were used for all patients. Considering that pharmacy dispensing medical expenses in Japan are approximately ¥7 trillion today, we see that this one anticancer drug has, in fact, the potential to explode Japan’s medical expenses. In this way, we have come to a point where we must seriously consider how to shift away from the current medical system in which curing more diseases results in a continuous increase in debt. We strongly believe that Japan can use its expertise in "craftsmanship" to overcome this situation. Already, many polymer materials are used in medical devices, where the majority of these are made of the same general-pur-
pose polymer materials seen in cheap discount shop plastic goods. By applying even small ideas to conventional general-purpose polymers to create new functions (intelligence), we should be able to realize medical care that can be used by anyone at any time and at any place.

**References**


1. Introduction
In the previous session, we introduced a high yield production technology for "Glycol Lignin", a new raw material with excellent properties made from a biomass resource unique to Japan, namely Japanese Cedar. The production system can also be installed in mountainous areas, which offers the possibility of directly contributing to regional revitalization policies. During the development of this series of fundamental technologies and the search for applications, the authors were presented with the chance to begin a program that would bring them closer to realizing this concept. This was the Strategic Innovation Program (SIP) organized by the Cabinet Office, Government of Japan. In 2014, the Council for Science, Technology and Innovation acted as a command center and took the lead in establishing SIP and going beyond ministry frameworks and traditional field divisions to realize scientific and technical innovation. The topic of lignin was adopted as a "Technological Innovation for a Biomass-use System Lead by Regional Lignin Resources" within SIP’s "Technologies for Creating Next-generation Agriculture, Forestry and Fisheries". The authors formed the "SIP Lignin" Research Consortium to take charge of the lignin topic. SIP Lignin is currently composed of 26 members (5 national institutes, 9 universities, 12 private companies). The bench-scale plant introduced in the previous session was also built by SIP Lignin. Our task now is to investigate ways of optimizing the bench-scale plant and to develop products based on the resulting Glycol Lignin.

2. Glycol Lignin Properties
The Glycol Lignin introduced in the previous session is a type of glycol-lignin, a lignin-PEG derivative made from coniferous tree lignin and polyethylene glycol (PEG). The PEG realizes capabilities that are not seen in lignin isolated during conventional alkali pulp production processes. PEG is a unique polymer that can easily penetrate wood biomass and that can easily replace water. These properties have allowed it to be used as a wood preservative. In one example, PEG was used to impregnate old wood as a means of ensuring the long-term preservation of a cultural asset. In this case, a wooden Swedish warship built during the beginning of the 17th century was impregnated with PEG for display as a cultural asset to show the country’s history. In theory, PEG impregnation should have protected the wood from biological deterioration and should have offered long-term preservation, but it was shown that, however little, the wooden warship was decomposing. The wooden warship helped Sweden become a major European power in the 17th century, and symbolizes the era in which the country controlled the Baltic sea. As such a national treasure, decomposition posed a major problem, so many scientists were tasked with discovering the cause. Before his research on Glycol Lignin, the author’s research into the decomposition of cellulose and other sugar components in PEG had shown that decomposed sugar generated acidic compounds. Later, Professor Westermarck of the Luleå University of Technology, who had been looking into the cause of the decomposition seen in Sweden’s wooden warship, cited the author’s paper and proposed a theory stating that the cause of the decomposition mechanism was sugar-sourced acidic compounds. The author had conducted his research in a heated environment, so the conditions were quite different. Although he mentioned to Professor Westermarck that the mechanism in the warship might be different, in the end the author’s paper was chosen over the author’s opinion. Meanwhile, when we produce Glycol Lignin, we add a trace amount (0.2–0.3%) of sulfuric acid as a catalyst in order to drive the acidic decomposition of wood and convert the wood into a state from which lignin can be extract-
20. Review: Automatic Control Textbooks and Practice (continued)

20.7 Element and System Properties

(3) Dead Time

Several examples of fundamental process elements found in textbooks on control include first-order lag elements, second-order lag elements, and dead time elements, where transfer functions and Bode diagrams are used to explain the properties of each. In the previous session, we introduced the concepts required to handle first-order lag and second-order lag in web and strip handling processes. In this session we will explain the concept of dead time.

(3.1) What Is Dead Time?

Figure 464 shows a first-order lag element step response, a type of dead time often referred to in textbooks.

As shown in the figure, the output begins to change \( t \) seconds after the input changes. This idle time \( t \) is defined as dead time. Dead time has a fundamentally different nature to the first-order and second-order transfer lag introduced in the previous session, so dead time cannot be handled in the same manner as lag.

Figure 465 shows two neighboring rollers in a web or strip handling process. Here we assume the upstream roller is the web or strip input position and the downstream roller is the output position, where the distance between the rollers is \( m_i \) (m), the distance between the edge position sensor and the downstream (output) roller is \( m_{i1} \) (m), and the distance between the
Correct for meandering, based on pattern criteria!

**Uses pattern matching**
The system takes basic positions from within the entire image (such as the line, edge, pattern and text) and stores them in memory, detects web meandering and sends out correction signals.

**Uses ZNCC (Zero-mean Normalized Cross-Correlation)**
Stable detection is assured, even if there are variations in external light and print density.

**Easy Search function**
Simply specify the reference position from within the entire image and press the Search button to record the reference position in memory and start the detection.

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1. Microelectronics and Adhesion

1.1 Introduction
The development of electronic devices has driven remarkable progress in silicon lithography. In the lithography process, the substrate is etched using a polymer film mask, which primarily uses photoresist. As the design scale of such devices has become smaller, however, there has been an increasing need to ensure adhesion between the resist pattern and the substrate. We can directly analyze pattern adhesion at the microscopic level using atomic force microscopy. In this chapter, we will introduce the adhesion analysis method developed by the author and an example, as well as demonstrate the effectiveness of this method. In this session we will look at the lithography process and the resist pattern adhesion factors.

1.2 Lithography
Some of the increasingly important lithography technologies used for very-large-scale integration (VLSI) include X-ray, electron beam, and ion beam technologies. More recently, however, we have seen striking developments in ultraviolet photolithography.

Figure 4.1 shows the typical photolithography process flow. In this case, the circuit pattern for each LSI layer is baked into the resist film through a mask using ultraviolet light ($\lambda=200$–500) emitted by a high-pressure mercury lamp. More specifically, this process can be divided into six steps: (1) substrate formation, (2) adhesion enhancement, (3) resist coating and prebake, (4) exposure, (5) development, and (6) deep ultraviolet (DUV) exposure and postbake. The semiconductor substrate is generally processed in this order.

(1) Substrate Formation
Including SiO$_2$ and WSi$_2$, LSI can be made from approximately 15 different types of inorganic materials, which are formed into a film via chemical vapor deposition (CVD), sputtering, and thermal oxidation. The resulting film thicknesses range from 0.01–1 µm, where the films have a thermal history ranging from a few hundred to more than 1,000°C.

(2) Adhesion Enhancement
In this step, the substrate is first thoroughly dried and hydrophobized, after which the surface is coated in resist. In this way, adhesion enhancement serves to prevent coating variation and to prevent the resist film from peeling off during the development and etching processes. This treatment takes place at a temperature exceeding 200°C, and uses evaporation coat-
Bobst Italia Makes an Impact at Gravure Innovation Event  
Bobst  
Italy  
bobst.com  

Stirring and dynamic were the words buzzing through the two days dedicated to the gravure innovation event “Extending the scope, new technologies for gravure” held on 11th and 12th May 2017 at Bobst Italia, in San Giorgio Monferrato, Italy. Indeed the company put together an exciting and dramatic programme to demonstrate its advantage in leading innovation through constant evolution of its product range.

The demonstration started with the press rapidly achieving a speed of 500 m/min printing in reverse with solvent-based inks on a 17 micron BOPP film to produce a typical high-end high volume confectionery pack, followed by an automatic splice on the rewinder at full speed. The audience noted the low level of noise that was experienced as the machine reached the higher demonstration speeds; a 5 dba reduction has been enabled by the incorporation of a new sound dampening technology in the dryers. The Twin Flow air circulation design of the semi-floatation dryers is a first for the industry. The dual impingement and floatation technology is not new for BOBST, which has made it one of the hallmarks of its laminators and coating machines. However, BOBST is the very first manufacturer to apply it on a gravure printing press, generating an increase of up to 15% in drying performance. The press then came to a stop for a sample to be cut out and taken to the lab to measure the level of solvent retention.

A pre-washing sequence was performed on board and the flexibility in job preparation and ink logistics of the Twin Trolley was then demonstrated. The machine resumed printing after the TAPS sequence, BOBST renowned automatic pre-setting system, and speed quickly went up to 500 m/min. All the while, up-close images of the various on board operations and animation of working principles were shown live to the audience on a huge wall screen. In addition, dedicated screens on the machine were showing data relating to the extraordinary performance of the register accuracy and correction speed during the ramp / up down, as well as the press’ low level of energy consumption. After the press came to a stop, the presenter went up to the two upper decks, which now make it possible for the operator to access both the dryer and the ventilation systems from the catwalk, before reading the outcome of the lab analysis on the printed sample. The result showed a solvent-retention level below 6.6 mg/m² on both days!

Finally, the demonstration of the CL 850D also focused on a value added packaging–enhancing application that reflects current market demands. From a technical point of view, the in-register coating of a matt lacquer on a pre-laminated composite substrate – 17 µm printed BOPP and 15 µm metallized BOPP film – highlighted the exceptional performance at speed variations of the BOBST Registron® system: after a splice at the speed of 400 m/min the register was back generating only 60m of waste!

At the close of the day, satisfaction was high at Bobst Italia. “A customer who tells you that the event was great, and that he looks forward to the next one, puts the seal of success on the Open House” comments Michele Vitiello. “We are happy to have showed our customers how technological excellence continues to thrive at BOBST but also to see how our know-how, experience and commitment to our corporate values, are instrumental in sustaining their loyalty”, he concludes.

BOBST Italia’s gravure innovation forum and open house was attended by 180 guests, including 150 converters coming from numerous countries worldwide.

FPA 2018 Student Flexible Packaging Design Challenge Competition Call for Entries is Now Available  
Flexible Packaging Association  
U.S.  
www.flexpack.org

In its 14th year, the FPA Student Flexible Packaging Design Challenge has become a prestigious competition within the flexible packaging industry.

The Challenge honors flexible packaging solutions developed by students. Flexible Packaging is used to package a wide variety of items. From retail food to medical and pharmaceutical products, the packaging possibilities are endless. The only limit is imagination!

The Challenge for students is to develop a flexible package solution that addresses a packaging issue, such as consumer convenience or the protection of food. The
package should advance the use of flexible packaging; make an improvement over an existing flexible package; convert a non-flexible package into a flexible package; package a new product or package a product that is not currently available in flexible packaging.

Students are asked to submit a concept outline prior to the actual development of the flexible packaging prototype/bench sample. The concept outline will be evaluated and when approved, students may begin development of the package prototype/bench sample. Students may work on the design in conjunction with their packaging schools. FPA members may be available as mentors to students advancing to the flexible packaging prototype/bench sample development round.

The deadline to submit a concept outline is September 15, 2017. The student or team of students who develops the first place winning entry will receive $1,000, and the second place winning entry will receive $500.

Maxcess Announces Innovative Tension Control Solutions from MAGPOWR
Maxcess
U.S.
www.maxcessintl.com

MAGPOWR launches three new product offerings: The CSR Cantilevered Tension Sensing Roller, the ISR Integrated Sensing Roller and a larger Thin Load Cell.

Maxcess, a global leader in innovative products and services for web handling applications, today announced the release of three advanced tension control products from MAGPOWR. Announced are the CSR Cantilevered Tension Sensing Roller, the ISR Integrated Sensing Roller and the TLCB, a larger size of the Thin Load Cell.

“With the ISR and CSR Tension Sensing Rollers, we are building upon the strengths of our precision roll knowledge from Webex and MAGPOWR’s deep understanding of tension control to create two unique rollers that will be faster, easier and less expensive to install than a separate roll and tension sensors,” said Chris Harper, Global Product Manager for MAGPOWR Tension Control. “For the TLCB Thin Load Cell, we took a popular European-style load cell that allows for minimal machine space requirements and created a larger size, which has been a major request from our customer base.”

All three tension control solutions will further cement MAGPOWR as an industry leader in innovative tension control solutions.

“With the release of the ISR and CSR Idler Rolls, we are beginning to take advantage of the combined strengths of our legacy brands,” said Greg Jehlik, CEO of Maxcess. “By bringing together more than 40 years of experience in tension measurement and control from MAGPOWR with more than 40 years of precision roll design and manufacturing experience from Webex, the ISR and CSR will add vital product to our tension control offering.”

Pre-Registration visitor is now open for ProPak Myanmar 2017, taking place from 21-23 September 2017 at MEP at Mindama, Yangon, Myanmar.
www.propakmyanmar.com

ProPak Myanmar 2017 is the leading international trade exhibition in Myanmar for businesses in the food, drink, pharmaceutical, processing, and packaging industries. ProPak Myanmar 2017 will present new ideas for business through new technologies, services, and trends from the world’s best companies.

We welcome any news and new product releases related to the converting industry, and will post these on this page and on our website. Please contact us at: “news@ctiweb.co.jp”
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