

Alternative chrome plating technology without use of hexavalent chromium compounds gets displayed at JAPAN PACK show along with IJ printers for flexible packaging

THINK LABORATORY

THINK LABORATORY continues on the path of technical development and market creation with a view to establish “FXIJ”, a series of water-based ink-jet (IJ) printers for flexible packaging, as its new staple product next to “New FX3”, a fully-automated laser gravure cylinder-making system whose production and sales has been the company’s flagship operation. The fruit of such efforts by the company was put on display

on the occasion of “JAPAN PACK 2023” held in Tokyo from 03 to 06 of October, 2023. As to New FX3, a gravure cylinder produced with a plating process that employs trivalent chromium compounds was unveiled from among the options proposed by the company as alternatives to the conventional process of chrome plating based on hexavalent chromium compounds, calling attention to the fact that the development is en-

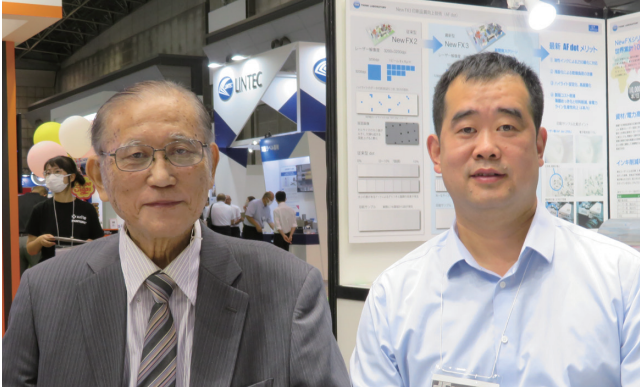
tering the final stretch. Also on exhibit were “AF dot” screen that enhances the highlight suitability of solvent-based gravure printing as well as a DLC (diamond-like carbon)-coated gravure printing cylinder aimed at the electronic materials industry. In regard to FXIJ, the company’s display reckoned up a total of thirteen advantages that this printer series affords in tapping the Japanese market and also exhibited product samples from the most recent round of commissioned manufacturing, apparently in a bid to emphasize IJ’s potential applications in the printing market for flexible packaging.



INHON Laser’s gravure cylinder-making area (top) and New FX3

INHON Laser’s gravure printing business

On the first day of the event, our reporter visited the company’s display booth to come across a party led by Mr. Kai-sheng Wang, head of the eco-friendly cylinder-making business division of WUXI INHON LASER TECHNOLOGY (INHON Laser). INHON group is owned by the same family as the one that controls Ting Hsin International Group, China’s biggest food-related enterprise, and INHON Laser, now engaged in the gravure cylinder-making business, was founded in 2016 and



Mr. Tatsuo Shigeta, President of THINK LABORATORY (left) and Mr. Kaisheng Wang, head of the eco-friendly cylinder-making business division of INHON Laser



Samples of RFID's antenna circuits printed by use of INHON Laser's gravure cylinders

launched operations in the following year. INHON Laser currently possesses five lines of New FX3, THINK LABORATORY's fully-automated laser gravure cylinder-making system, in its cleanroom environment that conforms to the cleanliness Class 1000. These lines produce an annual total of 60,000 gravure printing cylinders that are then supplied to various printing applications such as flexible packaging, medical product packaging, tobacco packaging, shrink packaging, decoration, building interior and exterior finishing materials, and RFID.

At the time of introducing New FX3 into INHON Laser, "the support extended by THINK LABORATORY across the gamut from prepress to cylinder-making enabled us to launch full-fledged manufacturing and supply of cylinders in six months or so", says Mr. Wang. He also mentions that "our mainstay is gravure printing cylinders to be used on film, and we now supply Tingyi (Cayman Islands) Holding Corporation (MASTER KONG), China's biggest instant food manufacturer, with all the printing cylinders that they use".

In answer to the reporter's question on the benefits of New FX3 known to produce FX-eco cylinders with shallow engraving and high LPI (lines per inch) values, Mr. Wang points to "help-

ing to reduce ink usage by adopting high-solid inks. Raising MPM (meters per minute) level, which counts heavily in China where price control carries a lot of weight and so the length that is printable with one cylinder is crucial. Also, the higher levels of resolution compared with those of electronic engraving make the printed record less prone to be imitated".

The aim of Mr. Wang's inspection trip this time is to "learn about the technical evolution in film printing". More specifically, the team's main interest seems to be gathering latest information about polychromic printing, in view of the fact that "in China, where great value is put on color vividness, demand is rising for multi-colored printing, typically with seven to nine different colors, on packaging materials, even in cases where only five or six colors would suffice if the same material was used in Japan". Meanwhile, "the shift toward water-based printing will also proceed" in China's gravure printing industry according to Mr. Wang, who goes on to say that "we are also conducting tests on water-based gravure inks. The water-to-alcohol ratio at the time of printing is eight to two. We have successfully printed on a film packaging material at a rate of 400 meters per minute. Tingyi, the instant noo-

dles maker, is even preparing itself for an across-the-board switchover from solvent-based inks to water-based ones", sharing an update with the reporter.

With many of China's printing cylinder makers still engaged in electronic engraving, "our company is the only cylinder maker in China that operates solely on the basis of THINK LABORATORY's laser gravure cylinder-making system. We intend to provide the market with gravure cylinders that are compatible with water-based inks by leveraging our cylinder-making technologies and systems and also funneling our future efforts into such existing resources", says Mr. Wang, expressing his aspirations.

Mr. Wang brought with him a number of printing samples such as packaging materials for napkins for newborns, sanitary napkins, detergent, sweet snacks, dried laver, tea products, coffee products, and cookies, lids of instant noodle cups, family-sized bags in which sembei (Japanese rice crackers) is sold at supermarkets toward the end of the year, and also antenna circuits for RFID. To the reporter's surprise, some of the soft packaging samples bore names of global brands and Japan's national brands. With RFID, INHON laser enjoys overwhelm-

ing presence in China, commanding “a 90 percent domestic market share in printing cylinders for antenna circuits”. On a side note, flexible packaging applications account for some 50 percent of INHON Laser’s current sales of gravure printing cylinders, while RFID applications account for 10 percent.

Trivalent chromium-based plating

THINK LABORATORY has been making, as its package of proposals to eliminate the use of hexavalent chromium compounds, R&D efforts under each of the three approaches shown below, disclosing their progress every time the company participates in a trade show as an exhibitor:

Method using a non-toxic, trivalent chromium-based plating solution;

Method utilizing the process of dry coating with DLC (diamond-like carbon) – displayed at TOKYO PACK held in October 2022; and

Method without the use of any plating process or etching process, which is called TSEF (Thermal Sensitive Etching-Free) – displayed at Converting Technology Exhibition (CONVERTECH) held in February 2023.

On this occasion, the company displayed a gravure printing cylinder made up by use of the trivalent chromium-based plating solution together with some printing samples produced by means of the same printing cylinder. “With the cylinder presented this time, we have eliminated the problem of un-

even plating detected in the previously displayed version that was also plated using trivalent chromium compounds. If our development efforts proceed at this pace, we should be able to unveil the completed product at the upcoming CONVERTECH session taking place from January 31, 2024”, comments the company.

In contrast to the conventional plating process where the chromium component within a hexavalent chromium compound is deposited as a plating film of zero-valent chrome metal on the copper surface through electrolysis of sulfuric acid and chromic anhydride, the newly introduced, trivalent chromium-based plating process ensures workers’ safety during the plating operation, eliminates the risk of runoffs of hexavalent chromium fluid from factories in the event of an earthquake disaster, and also reportedly improves the electric current efficiency by 60 to 70 percent, helping to reduce the time required for the plating process.

Thirteen advantages that FXIJ makes available

The FXIJ series of water-based IJ printers for flexible packaging has three models on offer:

“FXIJ type 500” has an effective printing width of 512mm and can accommodate a 600mm-wide film roll;

“FXIJ type 1000 FullAuto” has an effective printing width of 1,032mm, can accommodate a 1,100mm-wide

film roll, and also has an added feature of a turret mechanism that enables automatic splicing of films; and

“FXIJ type 1000 FullAuto SP” has a head configuration comprising six lines, namely, WKCMY + W including an additional line of white (W) IJ head. This configuration enables one unit of this model to single-handedly conduct both “surface printing” and “reverse printing”.

At THINK LABORATORY’s booth, a panel was hung to elaborate on a total of thirteen advantages that FXIJ makes available to printing companies, citing as specific numerical data as possible. As to “labor-saving and amelioration of work environment”, for instance, the panel analyzed a case of having to print on a 4,000-meter roll. While the conventional gravure printing equipment would require three operators as well as two indirect workers (to perform work such as preparation of the printing cylinder and toning of gravure inks) in order to handle the task, FXIJ enables a single operator to complete the same task within the same time frame. Adopting FXIJ also means introducing the turret mechanism into the feeding and winding processes, which opens the door to a maximum printing output of 20,000 meters per day including unmanned night-time operation. This is no small attraction for a work-site team plagued with short-handedness, especially when they know that a week’s worth of training makes even a beginner capable of operating FXIJ. The IJ



A nearly finished gravure printing cylinder produced with trivalent chromium-based plating process



FXIJ type 1000 FullAuto SP

Inks used with FXIJ are all water-based, making the work environment free of solvent odor and therefore less hazardous to would-be female operators. Further, dedicating the relevant plant wholly to cylinder production by use of FXIJ should liberate the management from the burdens of exposure prevention measures with the buildings and of the safe disposal of volatile organic compounds, helping to trim down the overall operational cost.

Another key advantage is “Reduced usage of film base materials and reduced ink loss”. The conventional gravure printing method ends up consuming as much as 300 to 400 meters of film for the purpose of checking on color reproduction and registering. The need to carry stocks of film rolls of different widths just in case a lot switching dictates a change in the printing width adds to the inventory level and cost. Furthermore, every occasional use of

spot colors requires a switchover of gravure inks, a burden which drives up the rate of ink loss over the whole cycle including storage and disposal to more than 10 percent. With FXIJ, in contrast, no adjustment burden is incurred from advance film printing, and no waste ink is produced since the entire print task is completed within the process color

range.

Other advantages of FXIJ illustrated on the panel included, among others, “a wide array of supported base materials”, “high-quality color image with 1,200dpi resolution”, “lower running costs”, “ultra-long endless printing”, “whole-surface variable printing”, “ability to correct streaky and uneven

FXIJ model lineup

Model		type 500	type 1000 FullAuto	type 1000 FullAuto SP
Specialty		For reverse printing only	For reverse printing only (splicing is possible)	For both reverse printing and surface printing (splicing is possible)
supported base material width		600 mm	1100 mm	
effective printing width		512 mm	1032 mm	
supported printing roll length		12000 m	12000 m × 2	
supported base material	type	PET shrinkable film, non-woven fabric, A-PET film or sheet PVC long sheet, embossed sheet, paper-based materials		
	thickness	12 - 300µm		
ink	type	water-based pigments for IJ		
	number of colors	five colors (CMYK)		
	anchor coating	not necessary		
IJ head	ejection method	piezoelectric actuation method		
	resolution	1200 × 1200 dpi (CMYK)		
	configuration	KCMYW	WKCMYW	
printing speed		30 - 70m/min(subject to fluctuation depending on the base material and /or the image to be printed)		
drying		Either by combination of a heat pump and hot-air drying or by a dryer unit based on various heat sources		
printer dimensions	W	7000mm	10000mm	18500mm
	D	2500mm	3500mm	3500mm
	H	3000mm	3000mm	3000mm



Preproduction samples made by use of FXIJ



Examples of the commercial products actually produced at BMF

printing”, and “internally produced anchorless inks”.

FXIJ is also the core of BMF (business model factory), located on the premises of THINK LABORATORY’s headquarters, where leading-edge contract manufacturing operation

with the use of water-based IJ is under way to produce flexible packaging and packages on demand from over thirty corporate customers in Japan. Corporate logos of twenty-three out of the thirty-odd customers were shown on the panel hung at the company’s

booth. Those logos represented familiar names from confectionery, soy sauce, pet food and adhesive tape industries as well as supermarket and hotel chains, etc., illustrating FXIJ’s steadily growing presence among well-known brands.



THINK LABORATORY

New era of new gravure Proposal.

Fully Automated Gravure Cylinder Making System

New FX 3

400m/min high speed supported
25% ink reduction

Improve on crawling
Improve on highlights



<https://youtu.be/lnmvzwaqfkk>



Inkjet Printer
for Flexible Package

Ink Jet Printer for Water Based Ink only CMYK+W

FXIJ type 1000 FullAuto 1200dpi



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