

The latest on IJ printer for flexible packaging and fully automated cylinder-making line for gravure printing

THINK LABORATORY

At CONVERTECH 2023 held in Tokyo in February, THINK LABORATORY CO., LTD. presented product samples printed with the latest model of its FXIJ water-based inkjet (IJ) printer for flexible packaging, as well as samples printed with the printer which the company is working on its development. The company also introduced the NewFX3 laser gravure cylinder-making system, the core of its business, which proposes automation from cylinder making to storage and retrieval, reduction of copper oxide consumption in plating through shallower cells on the cylinder, and the use of Diamond-like Carbon (DLC) as an alternative to chrome plating.

Realizing shortcuts in the packaging supply chain

FXIJ type 1000 FullAuto SP, the latest model of water-based IJ printer, is ca-

pable of setting film rolls of 1100 mm in width, with an eye on film widths of over 1000 mm, which is considered the standard in the soft packaging gravure printing industry. With a maximum printable width of 1032 mm, it is currently the world's widest water-based IJ printer for the food packaging industry. It is also equipped with a turret mechanism for automatic film splicing. By adding a white (W) IJ head line to the conventional model to create a six-line head configuration (WKCMY+W), this model can perform surface printing in the order of W→K→C→M→Y, and back printing in the order of K→C→M→Y→W in order to laminate film to the printed surface in the post-process. Of course, if the same substrate is used, switching between surface and reverse printing can be done without stopping the printer.

The wide range of substrates handled includes PET film, OPP film, ONY film, cellophane, PET shrink film, non-woven fabric, A-PET film and sheet used for food trays, PVC long sheets for exterior painting work, and

embossed sheets, with thicknesses from 12 to 300 μm, being the most versatile water-based IJ printer on the market. Furthermore, printing on paper-based materials is also possible.

The water-based pigment ink used for this printer is manufactured by THINK LABORATORY at its own plant, and one type of ink is sufficient for both surface/reverse printing and printing on film/paper materials. No anchor coat is required. As for the colors, five are used, CMYK for process colors and W; however, features of gold and silver colors, which are highly demanded for flexible packaging, can be attained by laminating aluminum vapor deposition film after printing. For paper-based materials, it is not necessary to print W if the material is white.

The printing speed is 30-50 m/min for film and 50-70 m/min for paper-based materials. "Some printing sites have asked for at least 100 m/min, so we are developing the system to achieve this. On the other hand, considering the operational efficiency of gravure printing presses and the time required for preparation and cleanup, the current level of speed is sufficient," commented Tatsuo Shigeta, president.

In the Japanese market, several companies are involved in water-based gravure printing, all printing at 120-150 m/min. If the operation rate of the press is 50%, the actual printing speed is at 60-75 m/min, so it can be said that the speed issue has been cleared to some extent. Also, if users of packaging ma-



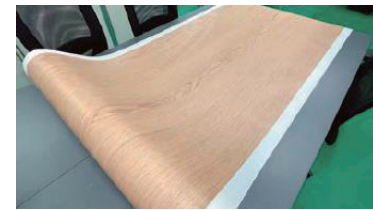
FXIJ type 1000 FullAuto SP

FXIJ Lineup

Models		type 500	type 1000 FullAuto	type 1000 FullAuto SP
Features		For reverse printing only	For reverse printing only Paper splicing possible	For both reverse printing / surface printing Paper splicing possible
Substrate width		600mm	1,100mm	
Effective printing width		512mm	1,032mm	
Printing roll length		12,000m	12,000 m x 2 rolls	
Substrate	Type of substrate	PET film, OPP film, ONy film, cellophane PET shrink film, non-woven fabric, A-PET film and sheet PVC long sheets, embossed sheets, paper-based materials		
	Thickness	12 - 300µm		
Ink	Type	Water-based pigment for IJ		
	Number of colors	5 colors (CMYKW)		
	Anchor coat	Not required		
IJ Head	Dispensing method	Piezo drive method		
	Resolution	1,200×1,200dpi (CMYK)		
	Composition	KCMYW	WKCMYW	
Printing speed		30 - 70m/min (varies depending on substrate and pattern)		
Drying		Heat pump + hot air drying or drying units with various heat sources		
Printing machine Size	W	7,000mm	10,000mm	18,500mm
	D	2,500mm	3,500mm	3,500mm
	H	3,000mm	3,000mm	3,000mm



Printing and Molding
Sample of A-PET Sheet



Printing sample of long PVC sheet

Cost comparison of copper oxide required for copper plating thickness per gravure cylinder (face length 500 x length 1000 mm) in 2019 and 2022

Copper plating thickness	Copper Oxide Price	
	2019	2022
	Price Base Year	Soared about 40%
100µm	100%	140%
80µm	80%	114%
60µm	60%	85%
40µm	40%	57%

materials install water-based IJ printers and print on their own, they can short-cut the existing supply chain, so I think further improvement in speed is not necessarily a must.

Companies that have installed FXIJ have already printed packaging materials for a considerable number of products, which are often seen in convenience stores, supermarkets, and other retail outlets.

10,000 gravure cylinders to be produced per day worldwide

By the end of the fiscal year 2022,

Reduction of solvent-based gravure ink by a certain converter by using shallower plates

Plate type	solvent-based gravure ink		Solvent	
	Amount used (g/m ²)	Reduction ratio	Amount used (g/m ²)	Reduction ratio
Electronic engraving plates	5.19	-	6.61	-
NewFX laser plates (Location A)	4.76	8.32%	6.16	6.74%
NewFX laser plates (location B)	4.31	16.96%	4.92	25.57%
NewFX laser plates (location C)	4.62	10.98%	5.28	20.12%
Average of laser version at 3 locations	4.56	12.08%	5.45	17.48%

Note: Comparative data for the same picture

NewFX, a fully automated laser gravure cylinder making system, will have achieved a cumulative total of 100 units installed in Japan and overseas, with a maximum production volume of 8,000 cylinders per day worldwide. Combined with the 30 units of the existing FX Laser model, more than 10,000 gravure printing cylinders will be produced per day. The largest converter in China has installed five units of the NewFX3 and is operating at full capacity with a daily production of 350 cylinders, as one of the examples of utilizing the system.

In the latest introduction, a completely unmanned line linked with au-

tomatic storage and cylinder surface inspection has realized the ultimate in saving labor. By using robots to load and unload cylinders, a stable daily production rate of 80 cylinders per day is achieved by maintaining a constant 24-hour robot working time.

In addition, a flexible packaging converter has provided proof data that the copper plating thickness can be reduced from the usual 80 to 100 µm to 40 µm without any problem by using laser-engraved cylinders, whose cell depth is around 14 µm. That works as a measure to reduce the soaring cost of consumables.

A comparison of ink usage be-

tween electro-mechanically engraved and laser imaged cylinders at three of the user's printing plants that have installed NewFX has shown that all sites have achieved a reduction in ink usage. "Compared to the electro-mechanically engraved cylinder, the laser-imaged cylinder used an average of 12.08% less solvent-based gravure ink and 17.48% less solvent when printing packages with the same design," said THINK LABORATORY.



DLC-coated gravure cylinder instead of chrome plating used for printing tests

Development to replace hexavalent chromium underway

As an alternative to hexavalent chromium used in chrome plating, THINK LABORATORY is developing chrome plating using non-toxic trivalent chromium plating solution, which, in addition to being safer without hex chromium, has proven to be 60-70% more current efficient and faster in plating.



Print sample with DLC coating



THINK LABORATORY

New era of new gravure Proposal.

Fully Automated Gravure Cylinder Making System

New FX 3

400m/min high speed supported Improve on crawling
25% ink reduction Improve on highlights



<https://youtu.be/lnmvzwaqlfk>



Inkjet Printer for Flexible Package

Ink Jet Printer for Water Based Ink only CMYK+W

FXIJ type 1000 FullAuto 1200dpi



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NewFX is evolving day by day

Another method is the use of chrome-free DLC. At TOKYO PACK 2022, held in Tokyo in October 2022, a gravure printing cylinder that had been dry-coated with DLC after copper plating were exhibited, as well as samples of back printing using these cylinders. Cylinder-making conditions were 250-350 lines for the K cylinder with a depth of 8 μm , 250 lines for the CMY cylinders with a depth of 8 μm , and 250 lines for the W cylinder with a depth of 10 μm . Samples were printed at 100 m/min

using VOC-less water-based gravure inks from THINK LABORATORY and OPET Film for water-based printing FE2001 by Futamura Chemical Co., Ltd. on a gravure press manufactured exclusively for water-based printing by ORIENT SOGYO Co., Ltd. and installed at Chukyo Kagaku Co., Ltd.

“We are on verge of developing a DLC film coating technology that will significantly improve the printing characteristics of water-based gravure printing and provide excellent

water repellency. We are confident that our highly concentrated, alcohol-free water-based gravure ink will be able to achieve sufficient print resistance without any hazing. This technology enables a dry process that eliminates the chrome plating and subsequent polishing processes that have been long-standing concerns in gravure plate making. We aim to bring it to practical application by the end of 2023,” says Shigeta. The president has high hope for the project.