

Printing

Chrome-free DLC Coated Cylinders *FX-eco Cylinder Reduces Ink Usage by 25%*

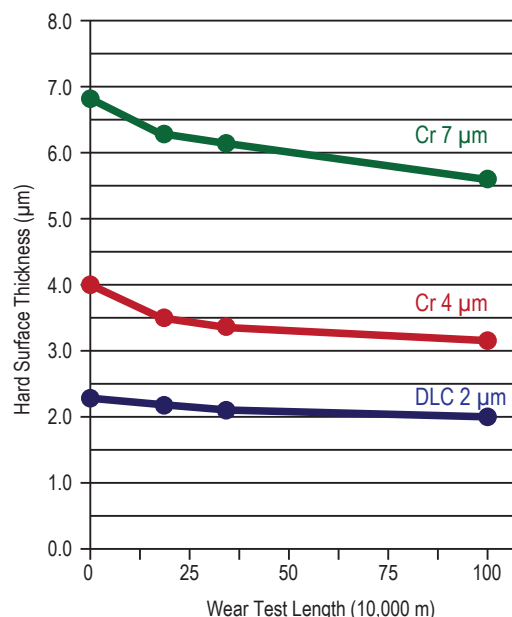
Held this past June, the theme for the 1st 2013 Study Meeting of the Japanese Society of Printing Science and Technology Gravure Research Group, was “Evolving Gravure Printing.” At the meeting, Tatsuo Shigeta, president of THINK LABORATORY, presented under the title of “Next Generation Gravure Cylinder Making Technology.” THINK LABORATORY offers a fully automated laser cylinder making line for printing cylinders aimed at a wide range of applications, from food and pharmaceutical packaging to electronic components. The main themes of his talk were diamond like carbon (DLC) coating, a replacement technology for chrome plating, a common issue in the gravure printing industry; 10-16 μm cylinder depth FX-eco cylinder ink and VOC reduction testing; and the “New FX” fully automated laser cylinder making line.

Gravure cylinders are typically plated in chrome to protect the surface of cells formed into the copper surface. Because strict control is required when handling chrome plating*, however, the development of a replacement material with a hardness equal to that of chrome plating has been a priority. Even so, there has yet to be a decisive solution. As one potential replacement material, THINK LABORATORY was the first in the world to propose DLC, and has been proceeding with various approaches to commercialize the concept.

The surface hardness of DLC is twice that of chrome plating at more than 2,000 HV. When wear testing chrome plating of 4 μm , chrome plating of 7 μm , and DLC coating of 2 μm , after one million meters in a wear test machine under the same conditions, the wear rate of DLC was far less than that of the chrome plating.

At the end of 2012, they installed a massive vacuum chamber for applying DLC coating in their plant. The chamber is able to simultaneously DLC coat twenty 1,100 mm long hollow flexible packaging printing gravure cylinders.

*1 The hexavalent chromium used in the chrome plating bath is subject to strict regulations, as with lead and cadmium, given its high toxicity as a carcinogen and ground water pollutant. The EU Restriction of Hazardous Substances prohibits the inclusion of hexavalent chromium in electrical and electronic components and recommends replacement with chromate processing using less toxic trivalent chromium. The hard chrome plating formed via plating itself is chromium metal, so is not subject to regulation.

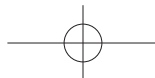


Chrome and DLC Wear Comparisons by Thickness
Change in DLC thickness is less than that in chrome plating thickness

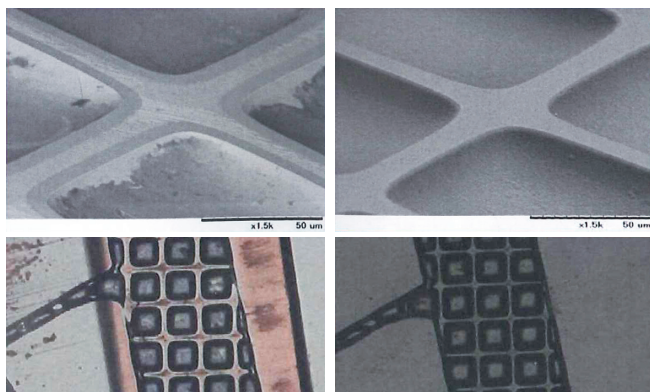
Using DLC coated gravure cylinders and water-based gravure ink, Bourbon Corporation, a major Japanese snack manufacturer, has produced test packaging for its strong selling “Alfort.” The printing quality was high enough that when samples were displayed at Convertech JAPAN 2013, visitors commented they could not tell the difference from those packages printed with standard chrome plated cylinders.

The latest model of the “New FX” fully automated plate making line has individual sealed copper and chrome plating tanks and uses two robot arms to move cylinders between processes. Degreasing, copper plating, copper polishing, ultrasonic cleaning, room temperature positive photoresist coating, 6,400 dpi high-resolution laser imaging, development, etching, resist stripping, chrome plating, and chrome paper polishing are all fully automated. Moreover, compared with their FX80 system, the installation area of W10 × D16 m is half, copper plating thickness is half, and chrome plating is half as thick. As such, power usage is halved and because the copper dust generated during whetstone polishing is recovered, water treatment costs are reduced to one-third. The entire system can be run by a single operator, and can even run without an operator during the night.

When combined with an appropriate ink, the gravure cyl-



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Wear Testing Comparison Results

Copper is visible with 7 µm (top left) and 4 µm (bottom left) or plating while copper is not observed with 2 µm DLC coating (top/bottom right)

inders made with the New FX have a dot area of 90% even at 200 lines per inch and a cylinder depth of 10 µm for the cyan, magenta, and yellow cylinders and 14 µm for the black cylinder. Because the cylinders achieve a density equal to that of standard solvent gravure or existing water-based gravure printing, the cylinders are also able to reduce the usage volume of ink and ink diluents (solvents). THINK LABORATORY

has named this type of printing cylinder "FX-eco."


A comparison of VOC emissions concentrations via continuous measurement at CHIYODA GRAVURE's Itako plant was made using CMYK + W (white) 5-color reverse printing of the same image on OPP film (supplied by FUTAMURA CHEMICAL CO., LTD.) at a speed of 200 m/min for 4,800 m. The two test cylinder combinations were the FX-eco cylinders (200 lines, 10 µm cell depth CMY and 14 µm cell depth K cylinders) with Belle Color solvent gravure ink (SAKATA INX) and engraved cylinders (175 lines, 40 µm cell depth cylinders) with Belle Color ink. Results show that the printing quality of the two combinations was basically the same, but the FX-eco cylinders reduced ink usage and VOC emissions by 25% compared with the engraved cylinders.


One example of the use of the New FX outside of Japan is the Ukraine based converter UKRPLASTIC. Having already installed two automated laser plate making systems, one of which is a New FX, they currently make 150 cylinders per day.

HANDOO PACKAGE CO., LTD., Korea's largest cylinder maker, has also installed a New FX. In tests using Korean ink, data show that ink usage is reduced by 18% compared with standard engraved cylinders.

THINK LABORATORY CO., LTD.

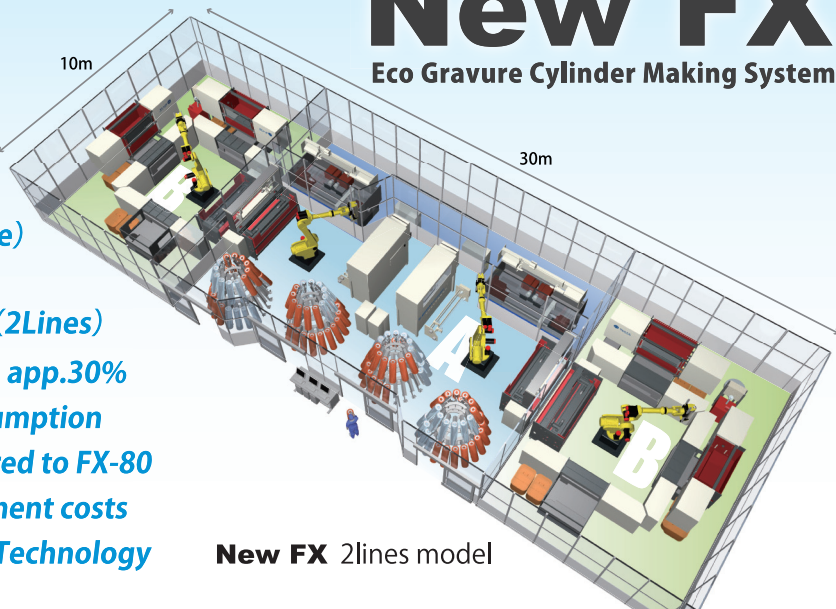
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**THINK LABORATORY**



Save Ink Energy Space

80 cylinders / day,
15 minutes / 1 Cylinder (1Line)
160 cylinders / day (2Lines)
Management by 1 operator (2Lines)
FX-eco cylinder decreases ink, app.30%
50% reduction in power consumption
50% reduction in area compared to FX-80
66% reduction in water treatment costs
6400dpi Laser & DoubleTone Technology



New FX
Eco Gravure Cylinder Making System

New FX 2lines model

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