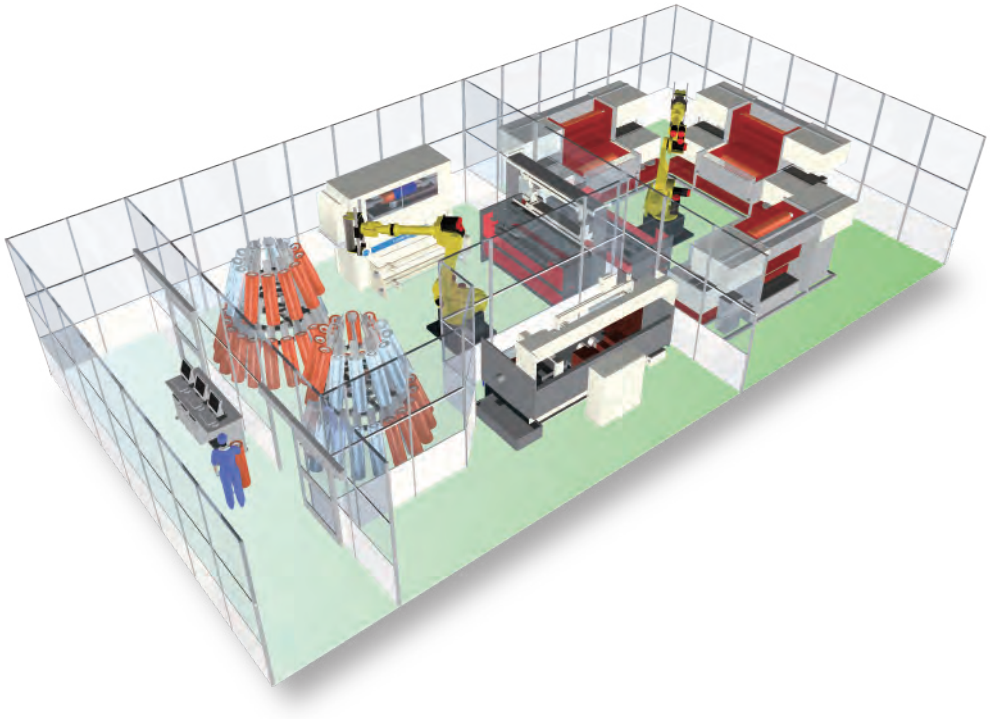
THINK LABORATORY

FX eco project

New FX 2
Technical Information



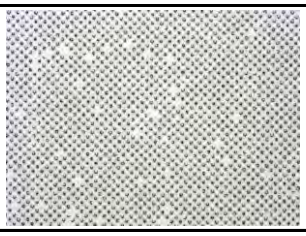
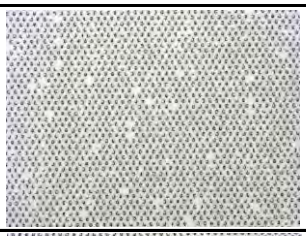
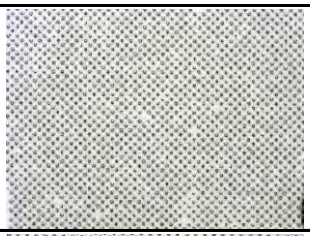
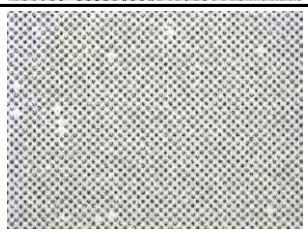
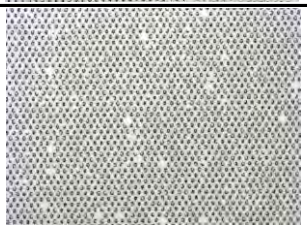
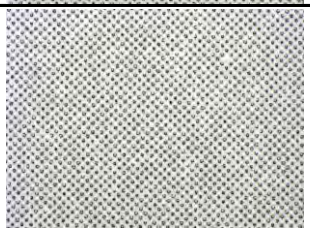
www.think-lab.com

150617

2015. 8. 5

[subject] better ink transfer at highlighted area by etching improvement

[how to] optimizing etching status (such as flow rate, temp, nozzle) made possible to have lower cell depth at highlghted area and wider cell for better ink release to substrate.

	NewFX ordinary etching res. 175 lpi cell depth 14μ	HELL K500 Elongate 175lpi	NewFX improved etching res. 175 lpi cell depth 14μ
highlight area 1 reflected density D=0.21			
highlight area 2 reflected density D=0.25			

pict : micrograph printed sample (x50 times)

Printing condition:

ink T&K TOKA Pixess Rice Ink BK 18sec front print

proof Heaford pressued at 3t, speed of 40m/min

paper Synthetic paper, Karrel

Result:

Compared the improved ethcing with ordinary etching, we have a great improvemen on ink transfer at highlighted area.

2015.5.9

Productivity of New FX2

Condition

Process : Cu Ballard to Cr
Cu thicknecc : 80μm, Cr thickness 8μm
Cu current density : 33A/dm2 , Cr current desity 40A/dm2
cylinder size : face length 1100mm,
circumference 500 - 590mm
cylinders in A Zone having one hour maintenance and
23 hours of production in total
collecting data of 30 cylinders to estimate daily productivity

*consumed 9:00-10:00 as daily maintenance, thus there is a gap between id13 and id14 for inlet and id6 and id7 for outlet

Daily Productivity

83 cylinders / day

	Start Time	Finish Time
1	04:45	07:46
2	05:03	08:06
3	05:22	08:23
4	05:39	08:40
5	05:55	08:55
6	06:12	09:11
7	06:27	10:51
8	06:43	11:09
9	06:59	11:33
10	07:15	11:51
11	07:34	12:06
12	07:47	12:22
13	08:04	12:38
14	10:00	12:57
15	10:09	13:12
16	10:26	13:28
17	10:46	13:44
18	11:01	14:01
19	11:17	14:17
20	11:31	14:35
21	11:47	14:50
22	12:11	15:08
23	12:19	15:22
24	12:35	15:38
25	12:51	15:54
26	13:07	16:11
27	13:23	16:27
28	13:40	16:43
29	13:56	16:55
30	14:12	17:16
40	16:54	19:58
50	19:35	22:39
60	22:17	01:21
70	00:58	04:03
80	03:40	06:44
83	04:29	07:33

2015.8.5

[Analysis Support]

We are fully equipped with following analyzing tools at 4F of our main factory.
We use following tools to support No.1 to our customer for the fastest feedback of your trouble.

[ICP (Inductively Coupled Plasma) Emission Spectrophotometer]

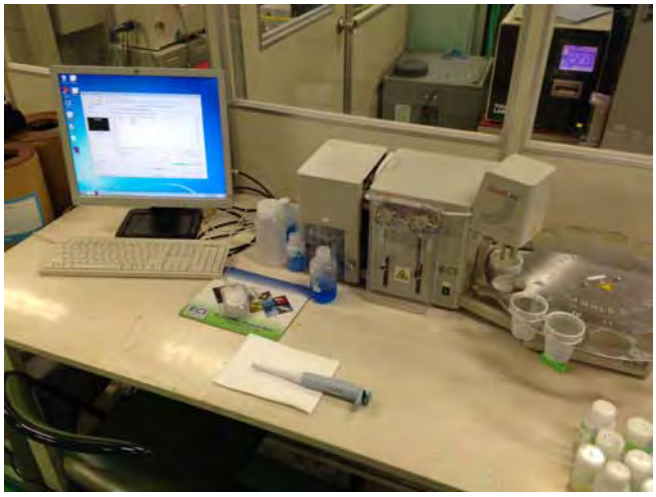
model : PS3520UVDD II (Hitachi High Tec Science)
target : impurity defects inside the chemical composition analyzed sample
a) analyzing concentration of calcium, magnesium, silicon in chemical
b) chlorine, impurity metal in cu chemical composition
c) chlorine, impurity metal in cr chemical composition

trouble sample :
"not a good Cr plating" as we analyzed the Cr plating chemical, we found out that the Cr plating chemical contained 301ppm of Cl which usually do not contain in the tank

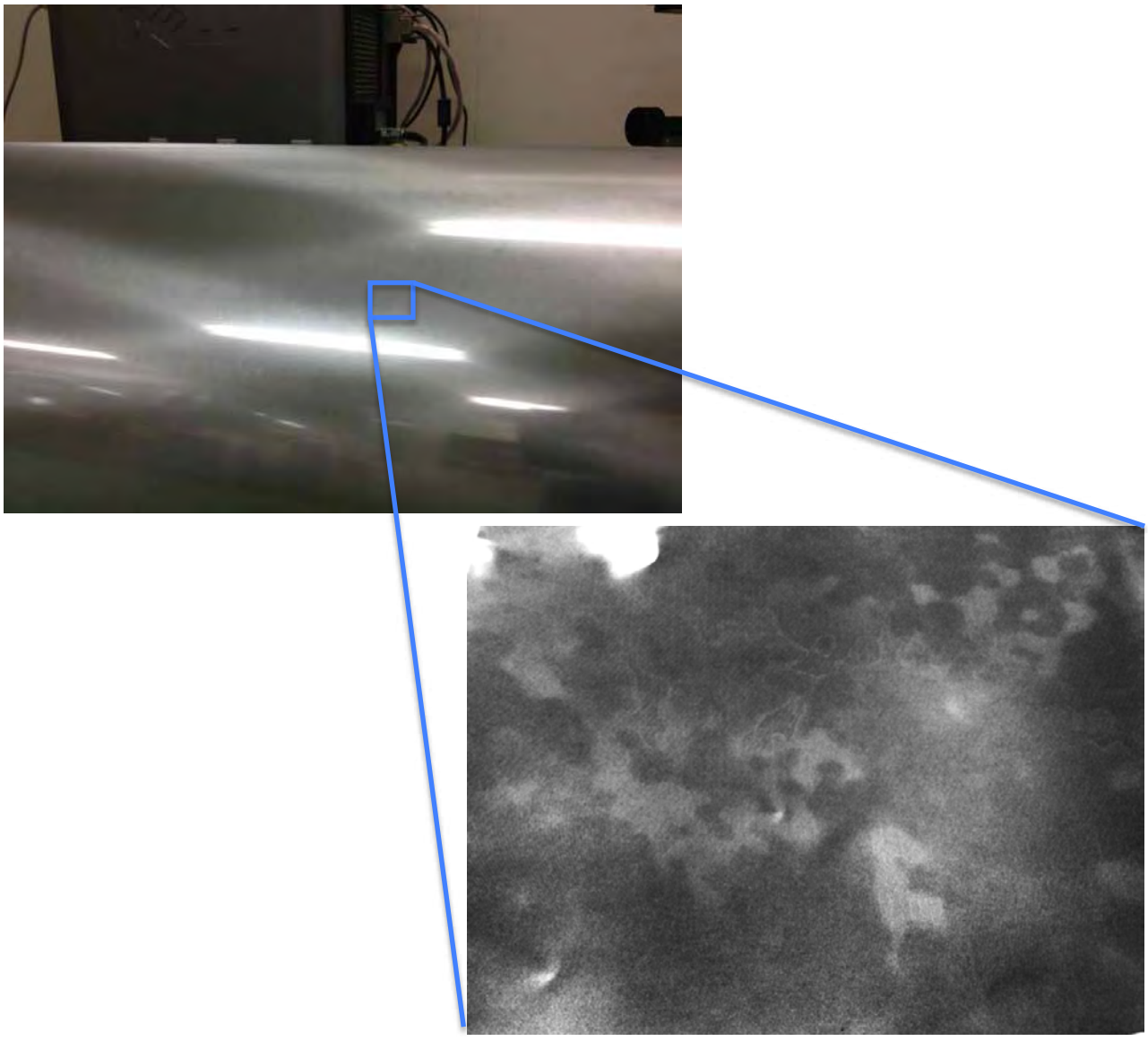
Elements	density (ppm)
Al	76.5
B	3.3
Ca	180
Cu	1109
Fe	72.3
K	501
Mg	32.4
Na	2747
Ni	below measurement value
P	1.1
Pb	33.1
Si	51.6
Ti	6.6
Zn	below measurement value
Cl	301

[CVS (Cyclic Voltammetric System]

model : CVS QL-10EX (ECT Tecnology)
target : measuring concentration of additives
in chemical analyzed sample
a) analyzing concentration of cu additives



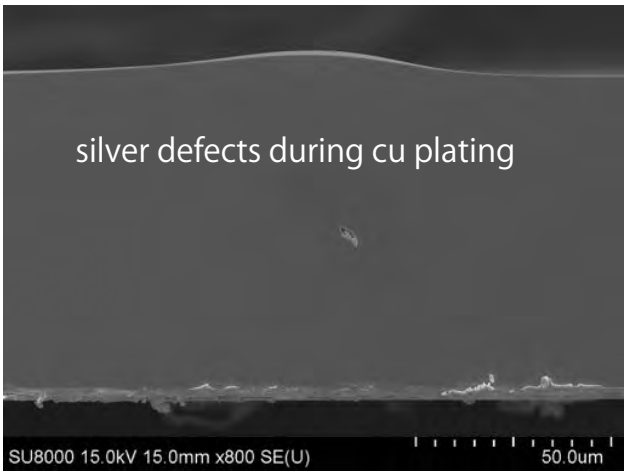
trouble sample :
unevenness of Cr plated, analyzing result of Cu additive clearly showed the unbalanced Cu additive composition

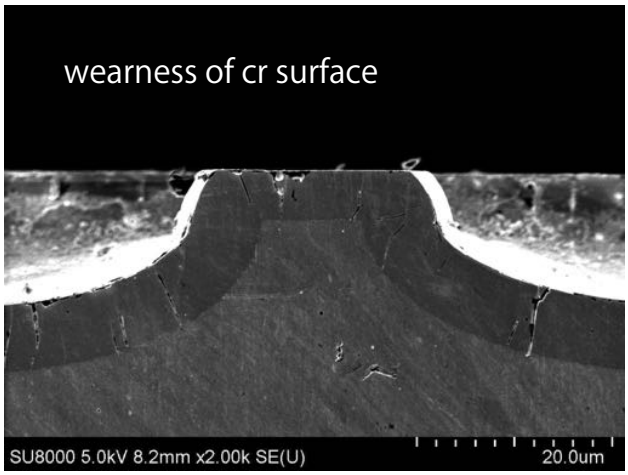


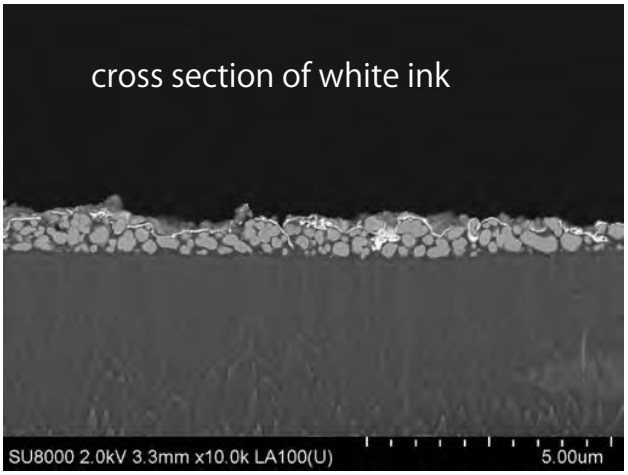
--Ballard Inspection--

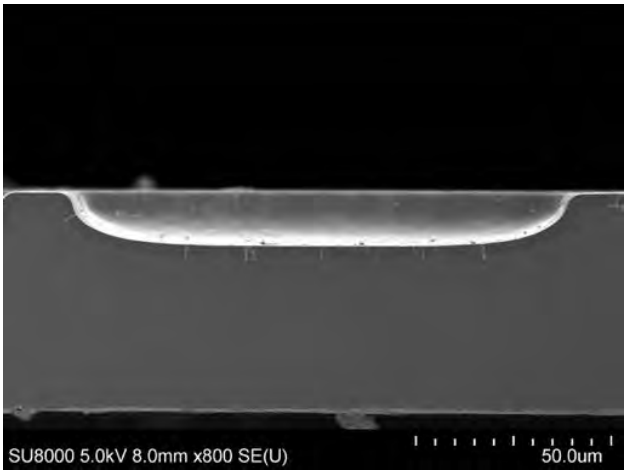
[SEM-EDX]

model : SU8020 (Hitachi High Technologies)
E-max (Horiba)
target : micro analysis
analyzed sample
a) defects during plating process
b) defects during coating photoresist process
c) wearness of cr surface
d) thickness of ink
e) cross section of printed ink on substrate



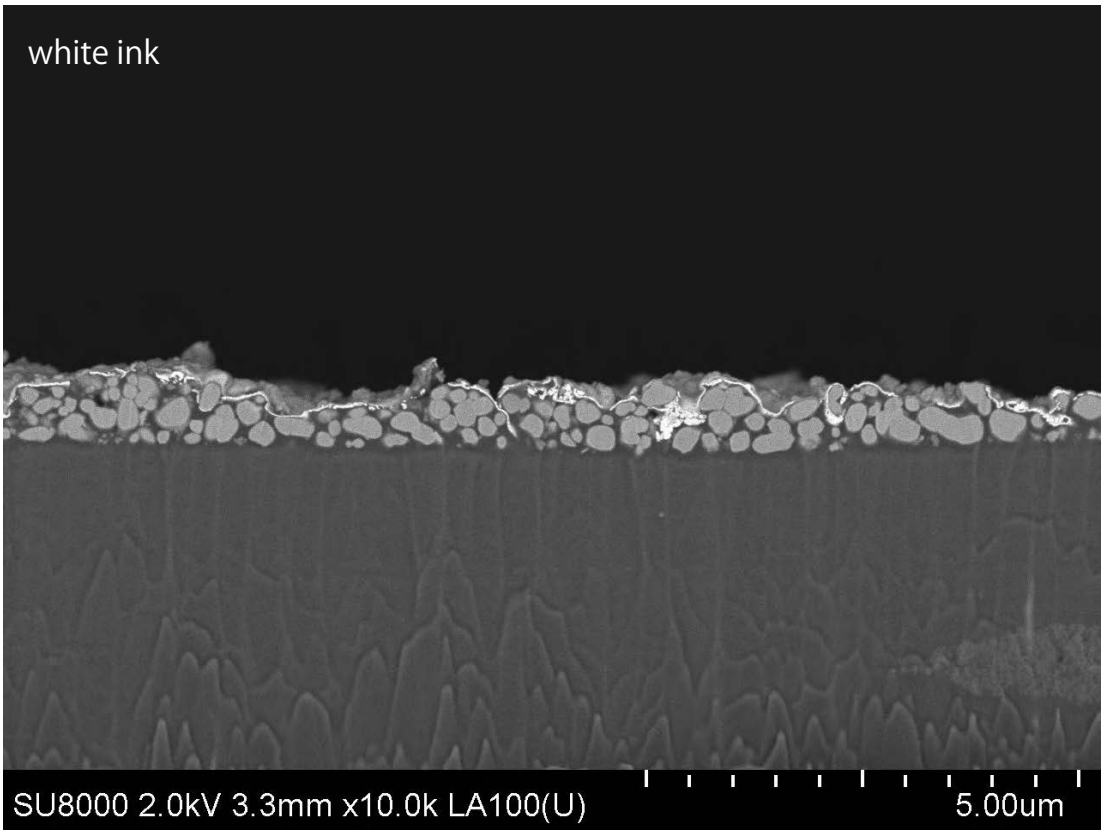


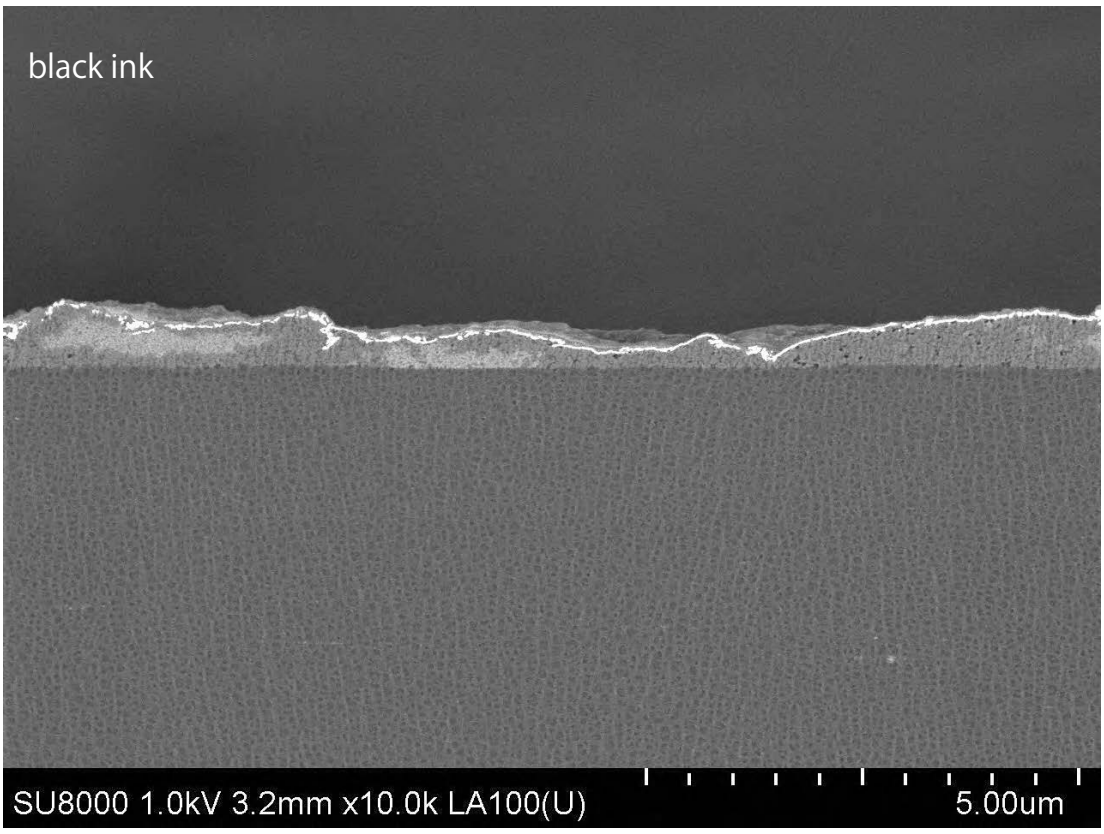




investigating printed sample for a smooth printed ink transfer on substrate

cross section of a printed sample





2014.5.10

【Advantage of using platinum anode at Cr unit】

lower the voltage

Voltage become half compared with original lead type

Producing 6000 clylinders a month will reduce 260,000.- JPY cost of elecrtical from your bill

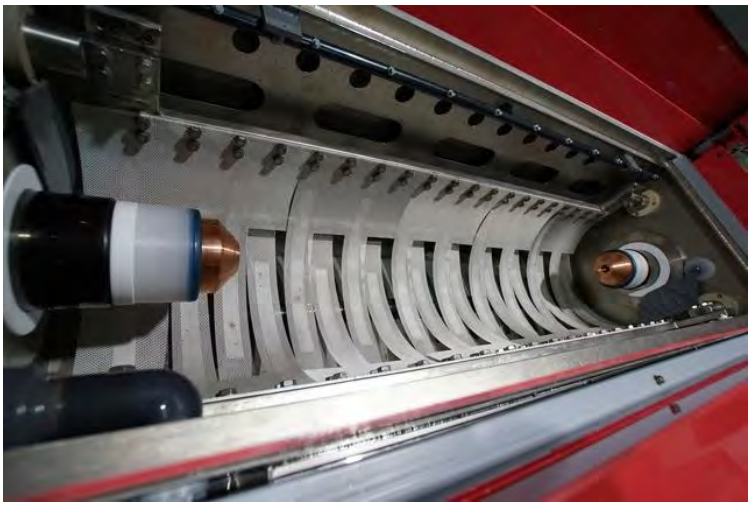
	lead anode	platinum anode
voltage	12 V	6 V
electrical cost	73 JPY	30 JPY
cost of anode	5 JPY	30 JPY

※current density 30A/dm2
※cylinder size 540mm x 1100mm
※cr plate thickness 6um

wide area of anode

By using cross anode, area of anode is more than double the size of max cyliner, 942mm x 1400mm. increasing the anode size will also suppress the increase of the concentration of trivalent chromium ion.

【 cross-mesh anode 】



better plating quality

By using lead anode, it generally turns to lead chromate inside the tank. This is the cause of surface defects and pinhole. Eventually, more work on cr polishing needed

2014.5.10

[supplying lead ion into Cr plating solution]

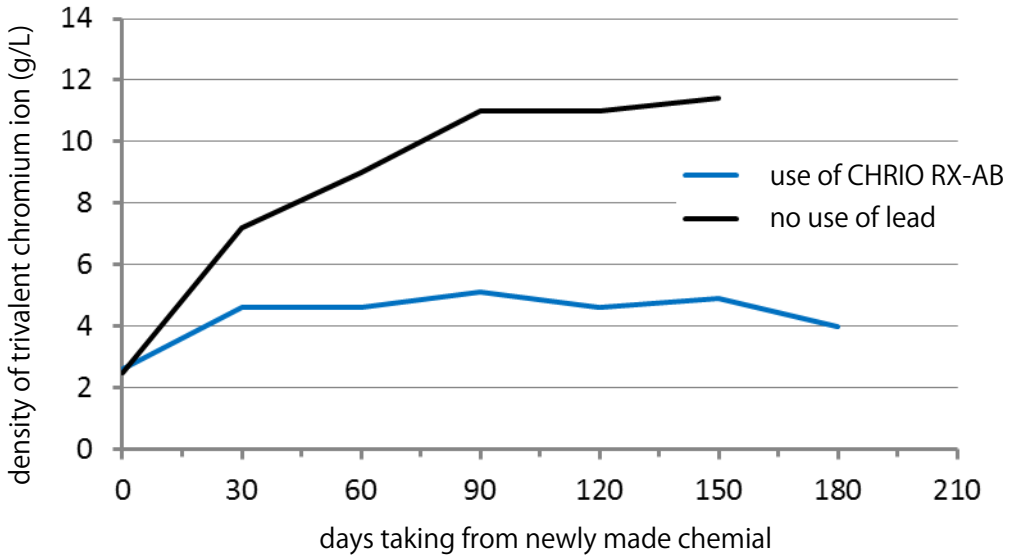
To control the Cr plating solution with insoluble anode, it is necessary to have lead ion inside the solution. Commonly, either lead auxiliary electrode or solid lead oxide is used but now we have developed supplying liquid lead ion, CHRIO RX-AB.

Density control of Trivalent Chromium

Cause of low plating efficiency or burning edges is by density ascend of trivalent chromium in cr plating solution. Up to now, to prevent density ascend of trivalent chromium, one of the following was necessary to decrease the value

	countermeasure	problem
①	use lead auxiliary electrode	lead chromate will be accumulated
②	add powder of lead oxide and test run	solubility of lead oxide is low test run takes few hours

Replenish of CHRIO RX-AB is either by total amount of electrolytic of number of plated cylinders. There is no need to make the test run but it will keep density of trivalent chromium at 5g/L.



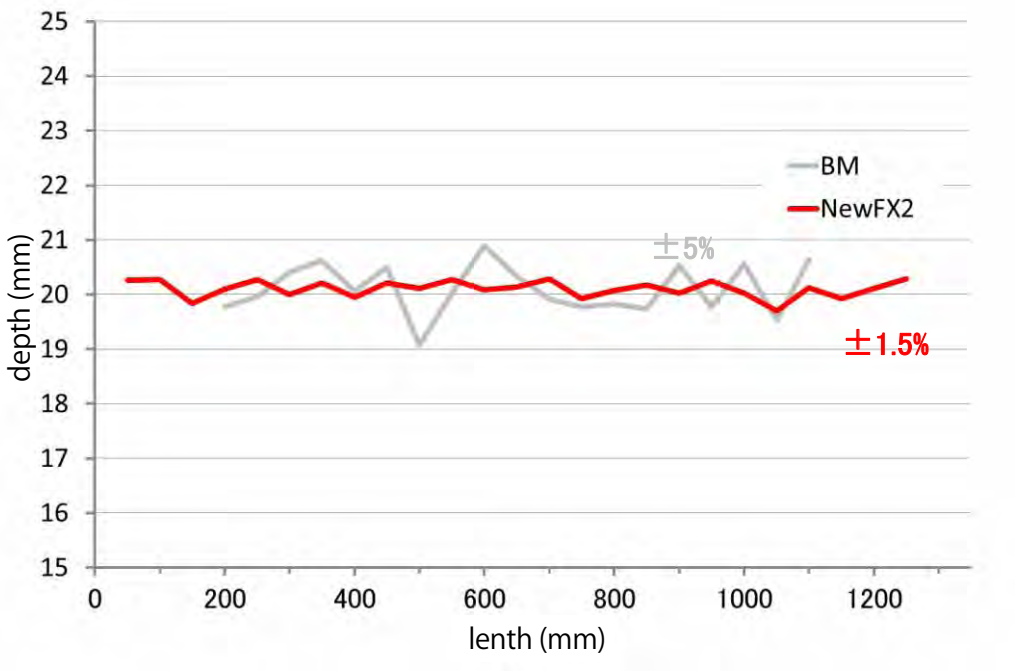
2014.5.10

【NewFX2 etching】

At New FX2, we optimized all possibilities to cause depth variation over the cylinder which we improved a huge difference compared with our old unit.

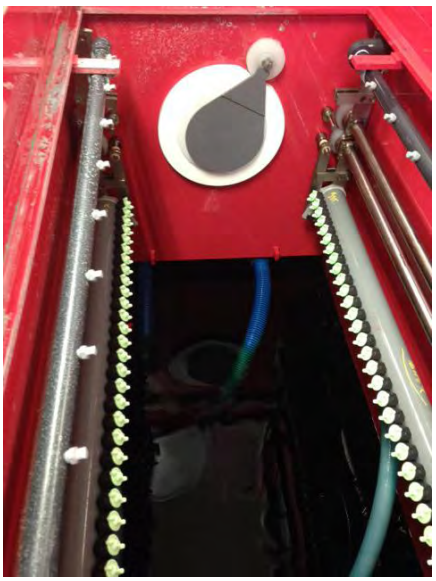
huge improvement on depth variation

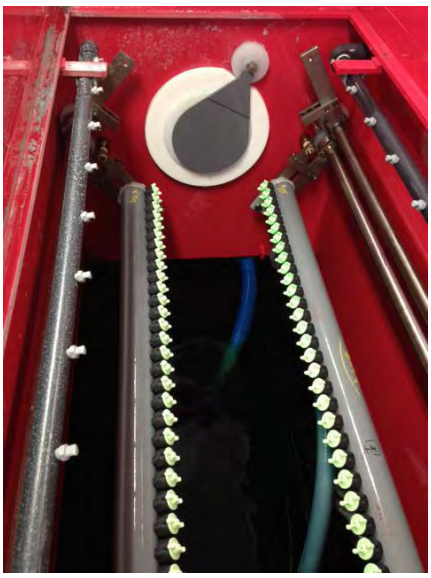
Depth variation became in a range of ±1.5% which we could only achieve ±5% in old unit. What we optimized are such, “Optimized the etching spray nozzle ”, “Optimized the spraying distance” “Optimized the position and spray structure” and so on which all influence the depth variation. All these factors are optimized to achieve depth variation of ±1.5%

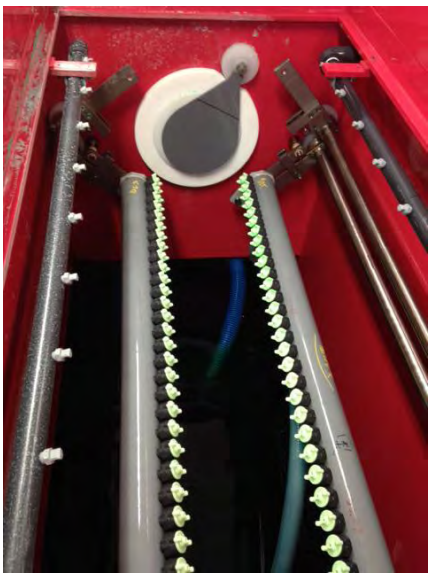


etching spray pipe optimization

By using a servo motor to control, etching spray pipe keeps the same optimized distance from the cylinder surface. Distance from the cylinder is all linked to the size of cylinder.



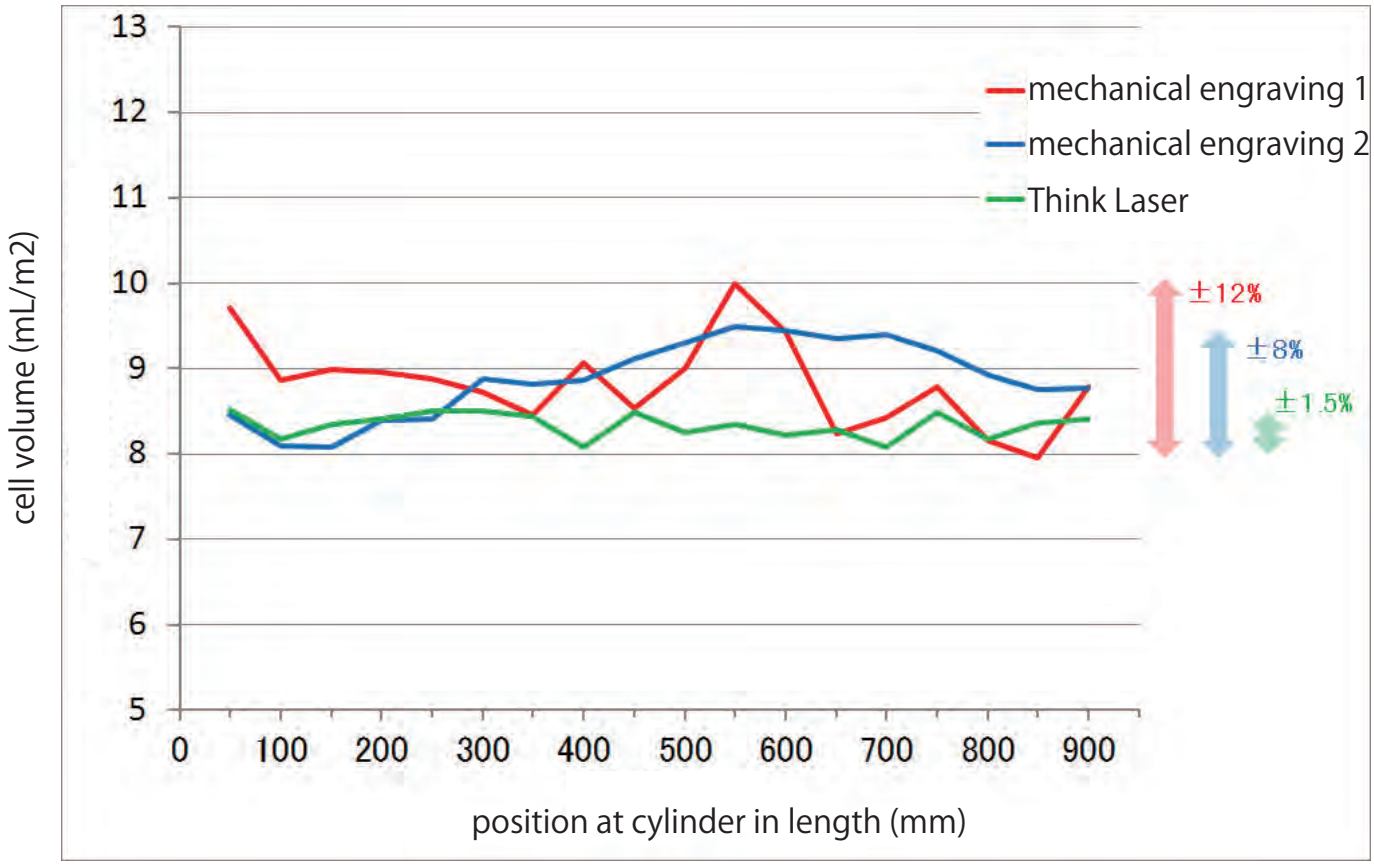




技術データ140206

Cell Volume comparison test with Think Laser and Mechanical Engraving

Think Laser with New FX2 system achieved +/- 1.5% of difference in cell volume over the cylinder



141005

Ink Reduction Test with Think Laser, FX-eco with standard ink

Print Date : 5th July, 2013
Printing : Sungil Chemical,
Cylinder Production : Handoo, Ink : Samsung ink
Production : 8,000m Printing Speed : 170m/min
Cylinder specification : Engraving (175lpi),
FX-eco (cell depth of 17μm)

SUMMARY
Ink reduction test with Think Laser and Engraving for 8,000m. Result of Think Laser reduces 13.2% of ink with same printed quality.

1) Result of total amount of ink usage after printing 8,000m

mechanical engraving (total ink 57.25kg) data provided by Handoo

FX-eco (total ink 49.69kg)

-13.2%

2) result of smoothness and white density (used Spectro Dens by Techkon)

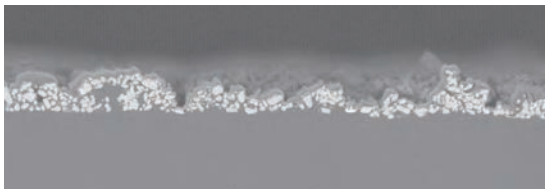
SAME

value of Lab is almost same. judges given by 5 printing operators by eye are also same

		Engraving		FX-eco
■ Black Backing	(base : L 10.45 a - 0.91 b 0.53)	L : 73.36 a : - 1.71 b : - 3.76	≒	L : 73.04 a : - 1.74 b : - 3.77
□ White Backing	(base : L 93.67 a - 0.76 b 3.12)	L : 92.19 a : - 0.53 b : - 2.08		L : 92.72 a : - 0.55 b : - 1.78

3) surface roughness (used NewView 7000 by Zygo) measurement field : 700μm x 520μm

Engraving average roughness : 494nm



random ink transfer and rough

FX-eco average roughness : 150nm

thin/smooth

equal ink transfer and smooth

Overall Result

	Engraving	FX-eco
use of ink	x (impossible to reduce)	√ (possible to reduce by few tips)
smoothness / whiteness	√ (density by consumed ink)	√ (density by -13% less ink)
surface roughness	x (rough)	√ (falt and smooth by 1/3)