The influence of accelerated ageing on colour difference of conventional and hybrid ink prints varnished with different amount of coatings

IC 09, Ghent

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Introduction

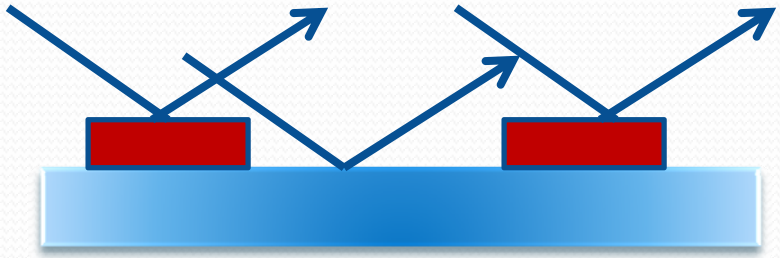
- The increased use of overprint and spot varnish in the graphic arts
- Used for protection and visual enhancement as well for value added printing
- Emergence of new type of varnishes and inks (hybrid, UV)
- A strive for consistent quality control in the area of correct colour reproduction

Coating and varnishing

- Varnishes are applied directly to the substrate by rollers or coating forms in a coating unit.
- With the applied varnish some properties of the surface are changed and thus the amount of the reflected light.
- With the variations of the coating amount these changes modify differently the properties of the prints.

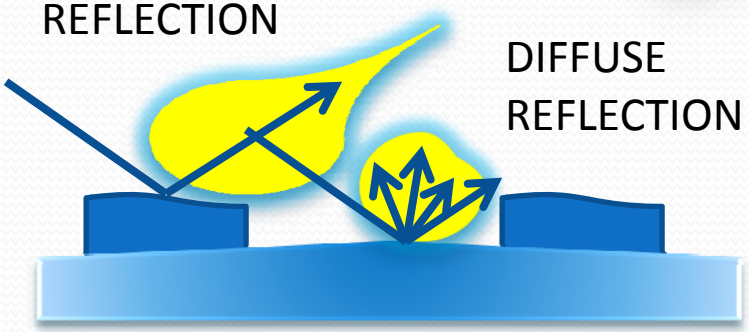
Print surface

SPECULAR REFLECTION

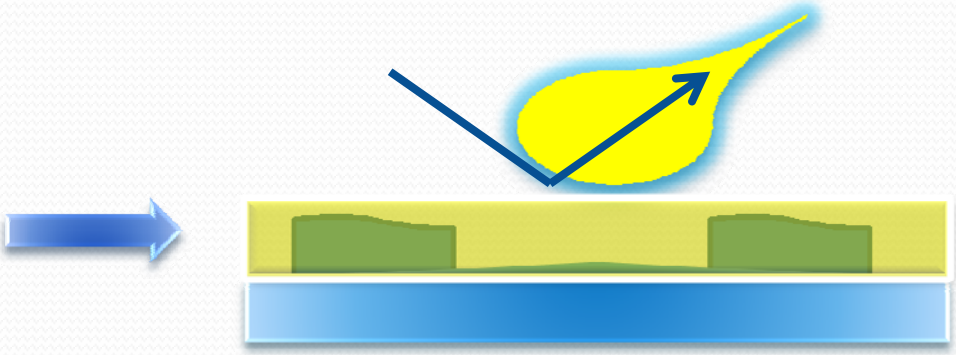


SPECULAR REFLECTION

DIFFUSE REFLECTION



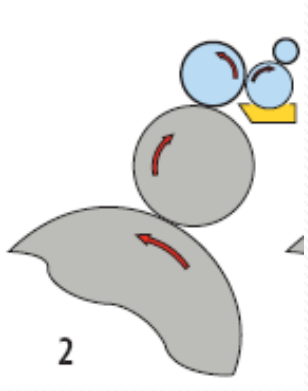
COATING



ADDITIONAL SPECULAR REFLECTION

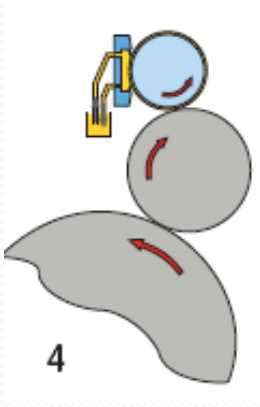
Thickness and amount variation

Roller type of coaters



- Thickness and amount variation by nip, or speed of the rollers
- Heavy amounts and very tick

Anilox coaters



- Thickness and amount not influenced by speed – constant volume.
- Amount defined by the anilox roller engraving value

Appearance and protection

- Aside from aesthetic appearance factors, liquid coatings and varnishes can offer a range of desirable rubscuff, water, chemical, packaged product and light (fade) resistances.
- Tougher products are those that are based on cross-linked chemistry where tight knit dry films are developed when the liquid products are fully dried or cured.

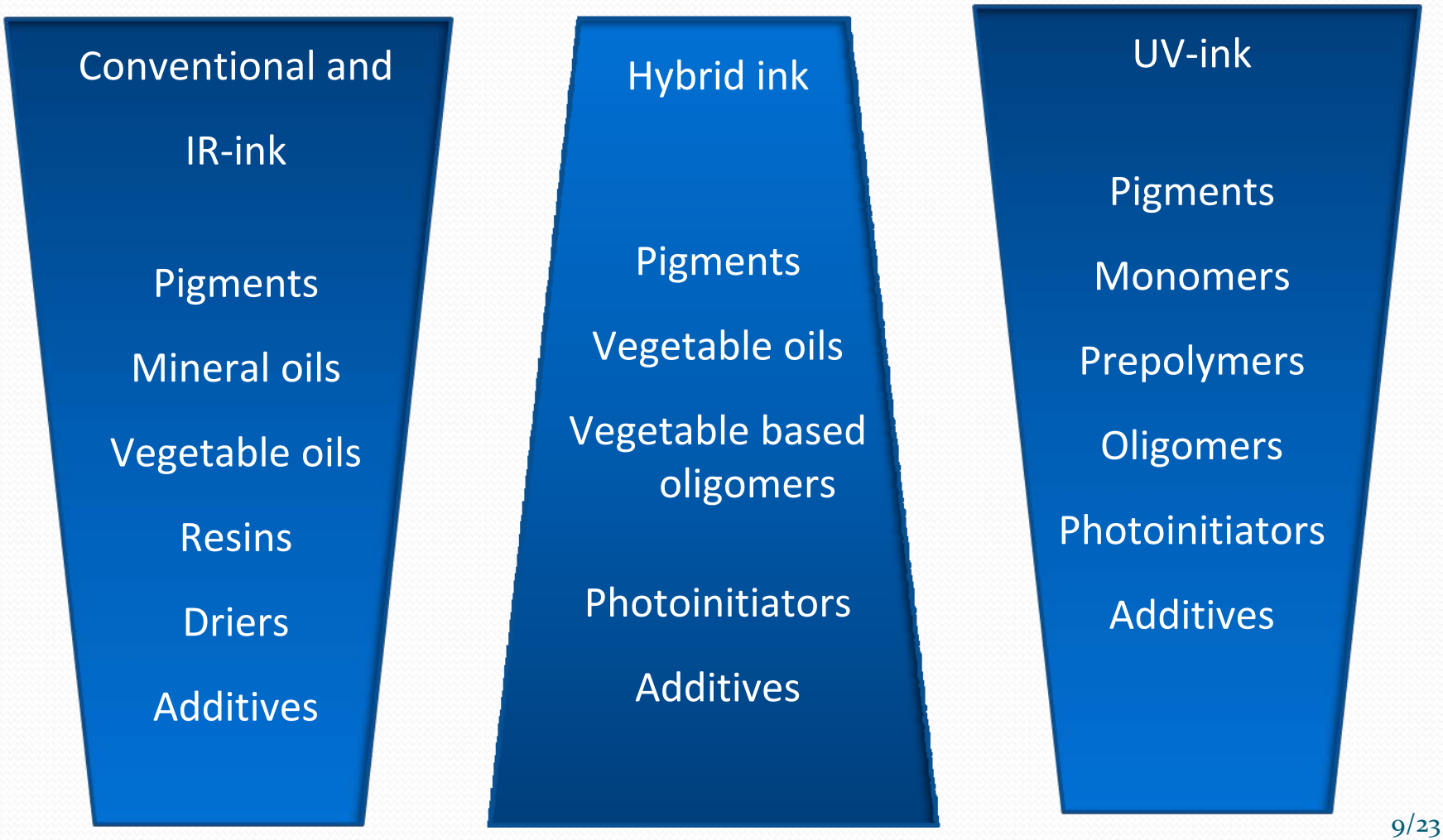
Aqueous Coatings

- Aqueous coating:
- *Polymeric resin ,Wax and/or silicone*
- *Surfactants,Additives*
- Solvents, defoamers and optical brighteners.
- 60-70% water, 25-35% solid content and 5% additives
- Quick drying, applied by chambered doctor blade anilox roller system
- 2-4 g/m^2

UV Coatings

- Radical and cationic UV coatings
- Synthetic resins with embedded photoinitiators
- Recommended application by anilox roller
- 100 % dry solid content
- Quick low energy drying
- Similar amount as aqeous when using same anilox roller.

Inks conventional vs. hybrid



Ageing

- A frequently occurring direct contact with water or a permanently high humidity of air combined with elevated temperatures and direct sun exposure also affects the printed ink negatively.
- Coatings formulated and stated as resistant to these influences – protection.
- No yellowing typical to oil based varnishes – but some photo initiators can cause yellowing.

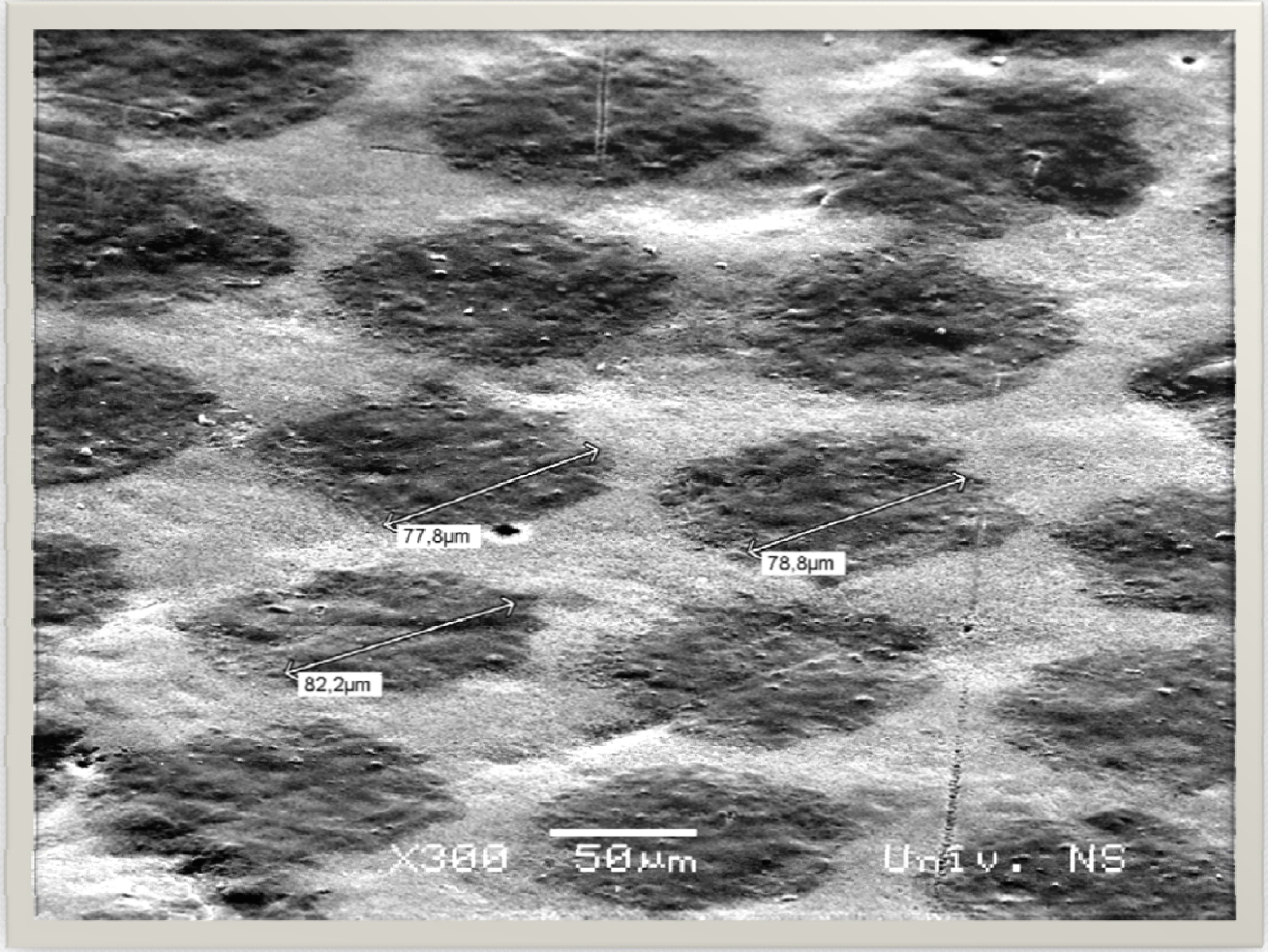
Methods and materials

- KBA Offset press with additional coating unit (inline)
- Anilox roller with 60L/cm and 90L/cm
- Glossy coated paper Type 1 according to ISO 12647-2 (2004)
- Sun Chemical Hartmann World Series inks
- Prestofix Hochglanzlack H6055/55 glossy aqueous and Prestofix Mattlack H260/55 matte aqueous coating

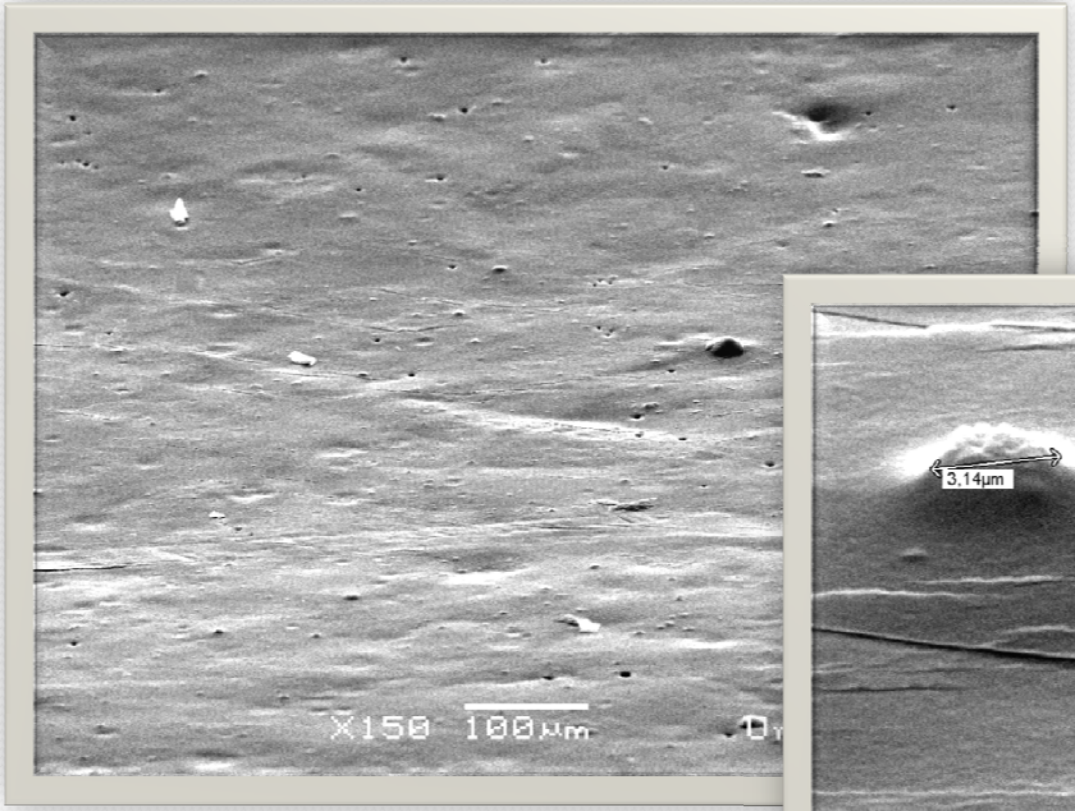
Methods and materials

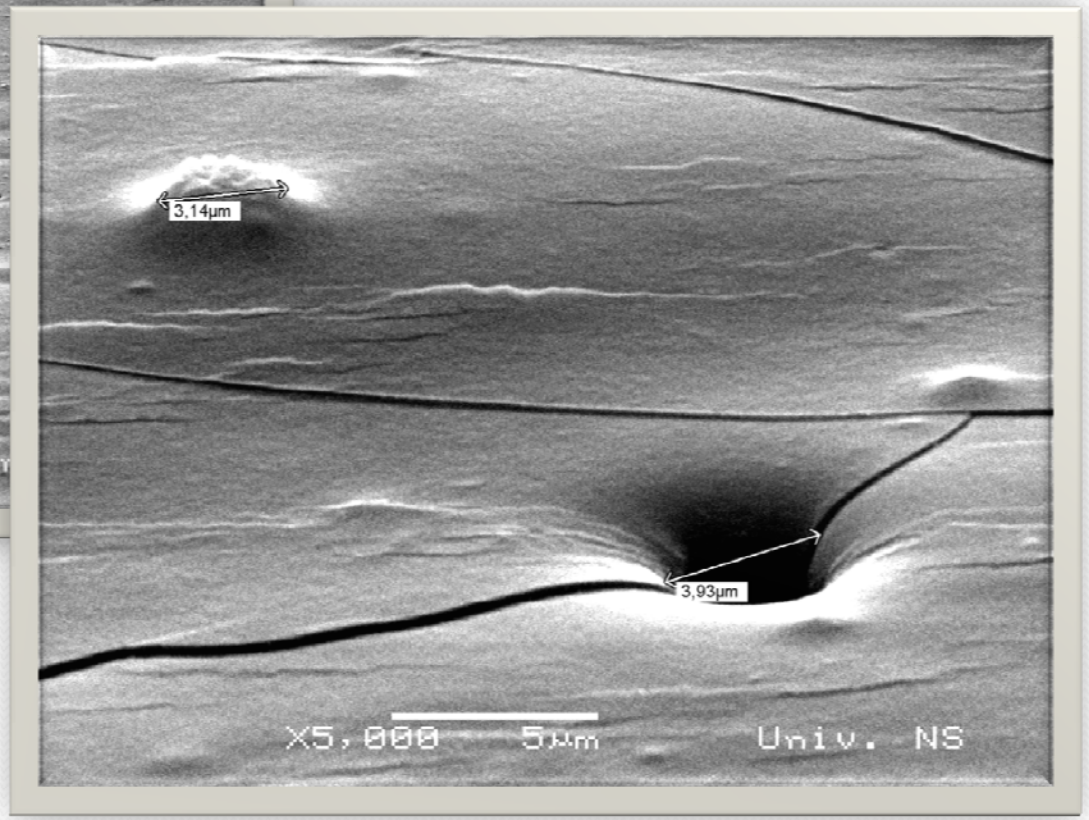
- Sun Chemical HyBrite Inks
- Sun Chemical Glossy UV coating
- Moist heat treatment by SIST ISO 5630-3:1997; Part 3
- 80°C, 65% relative humidity
- 1,2,3,6 days
- Colour difference calculation D50 and 2^0

Samples with no coating

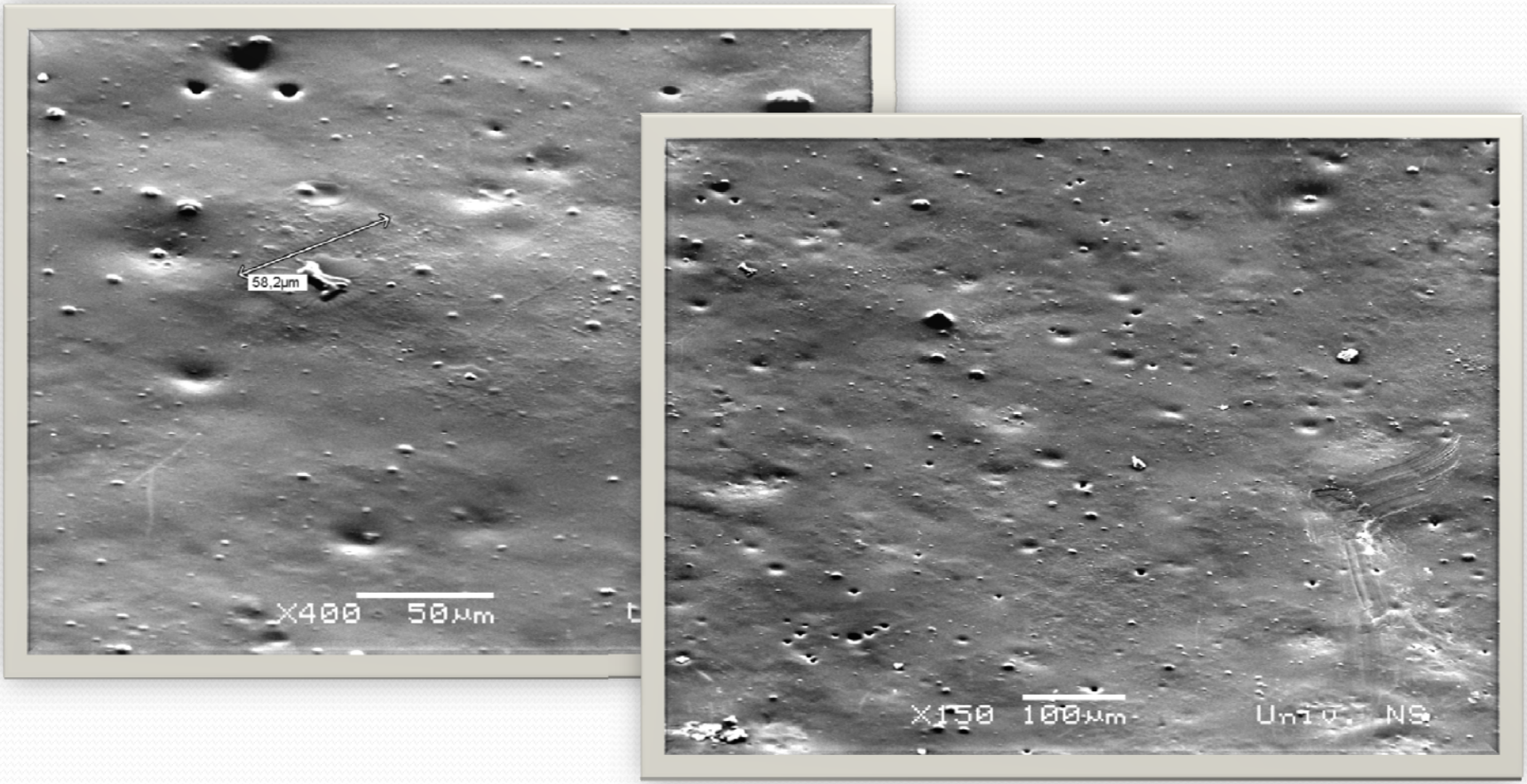


Glossy aqueous 90L/cm

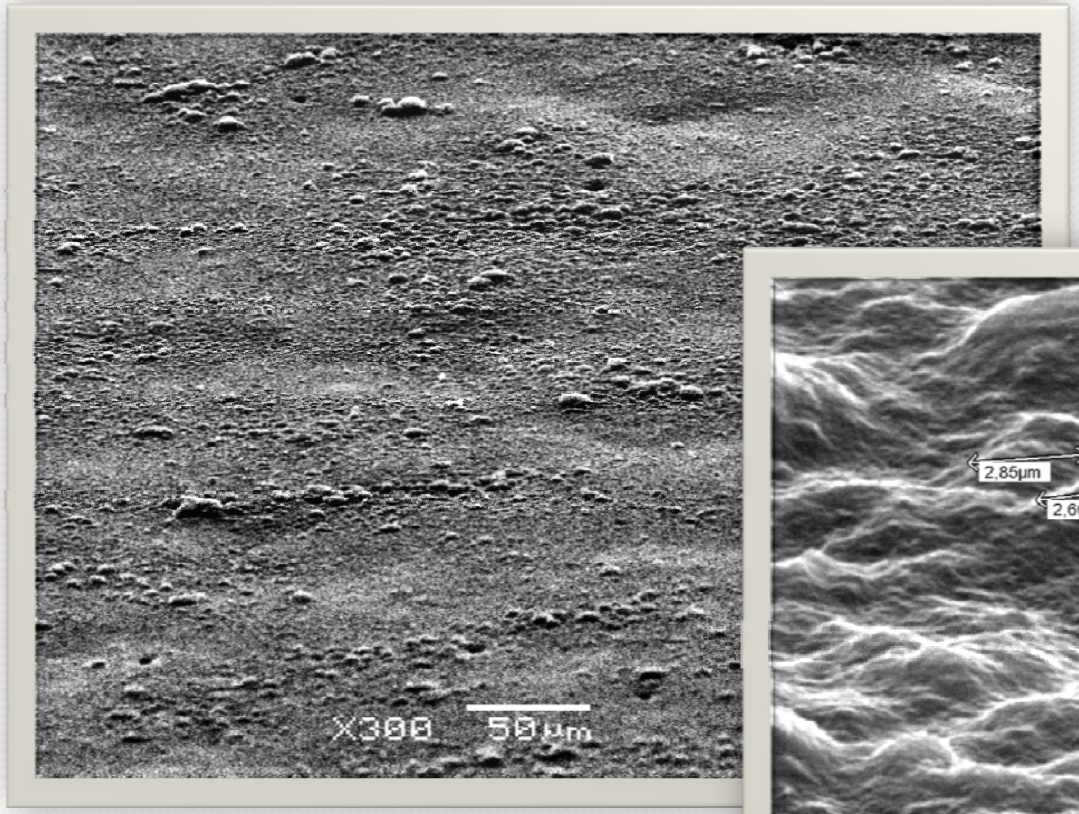


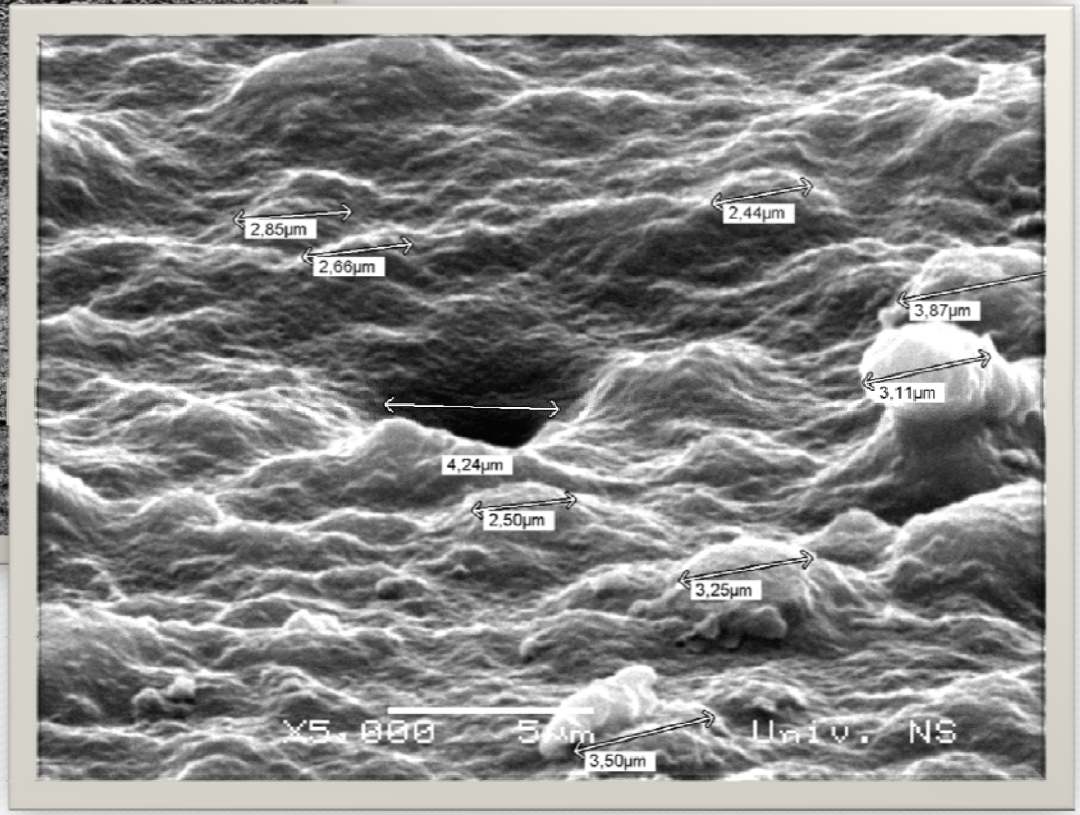


Glossy aqueous 60L/cm

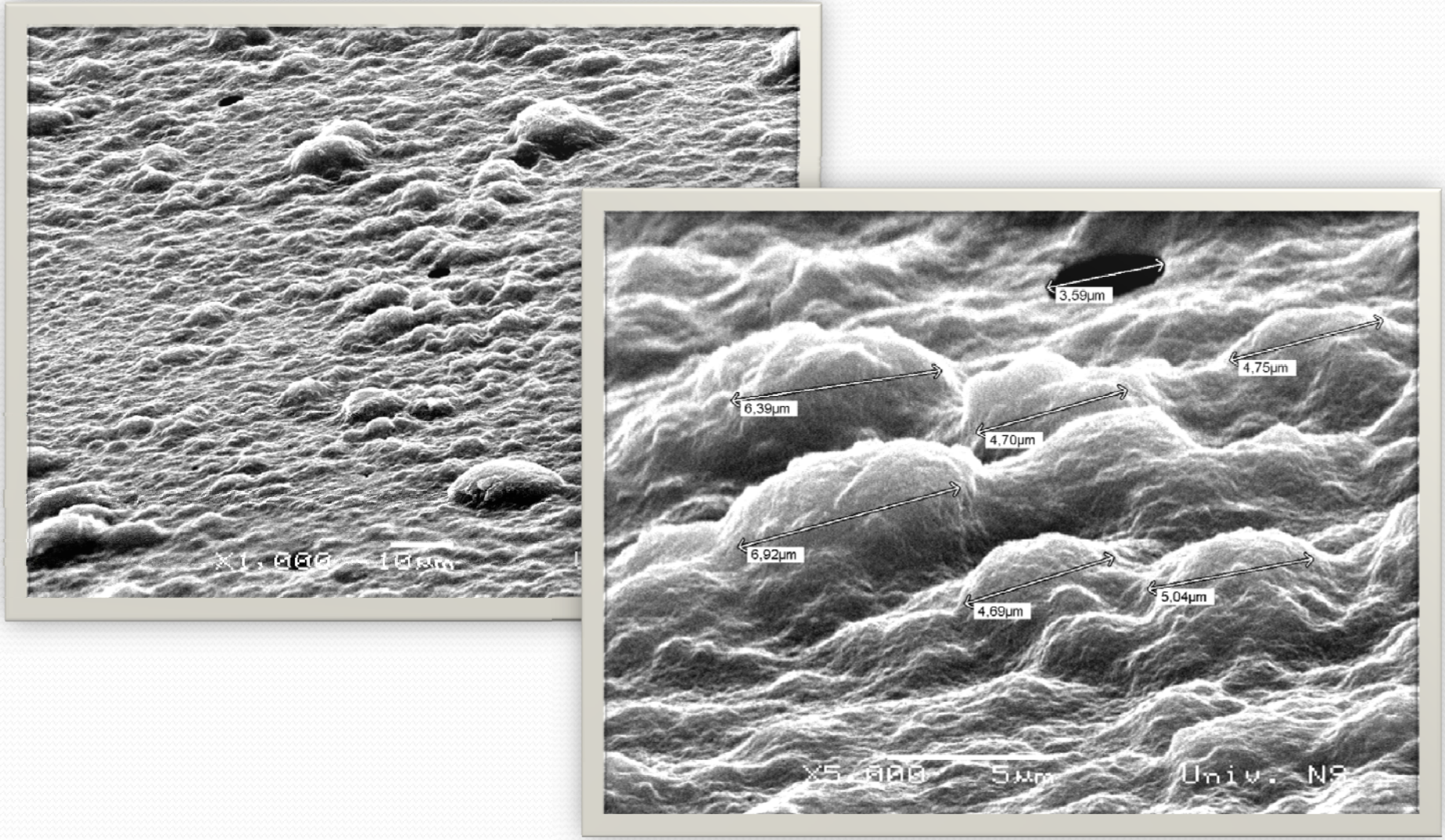


Matte aqueous 90L/cm

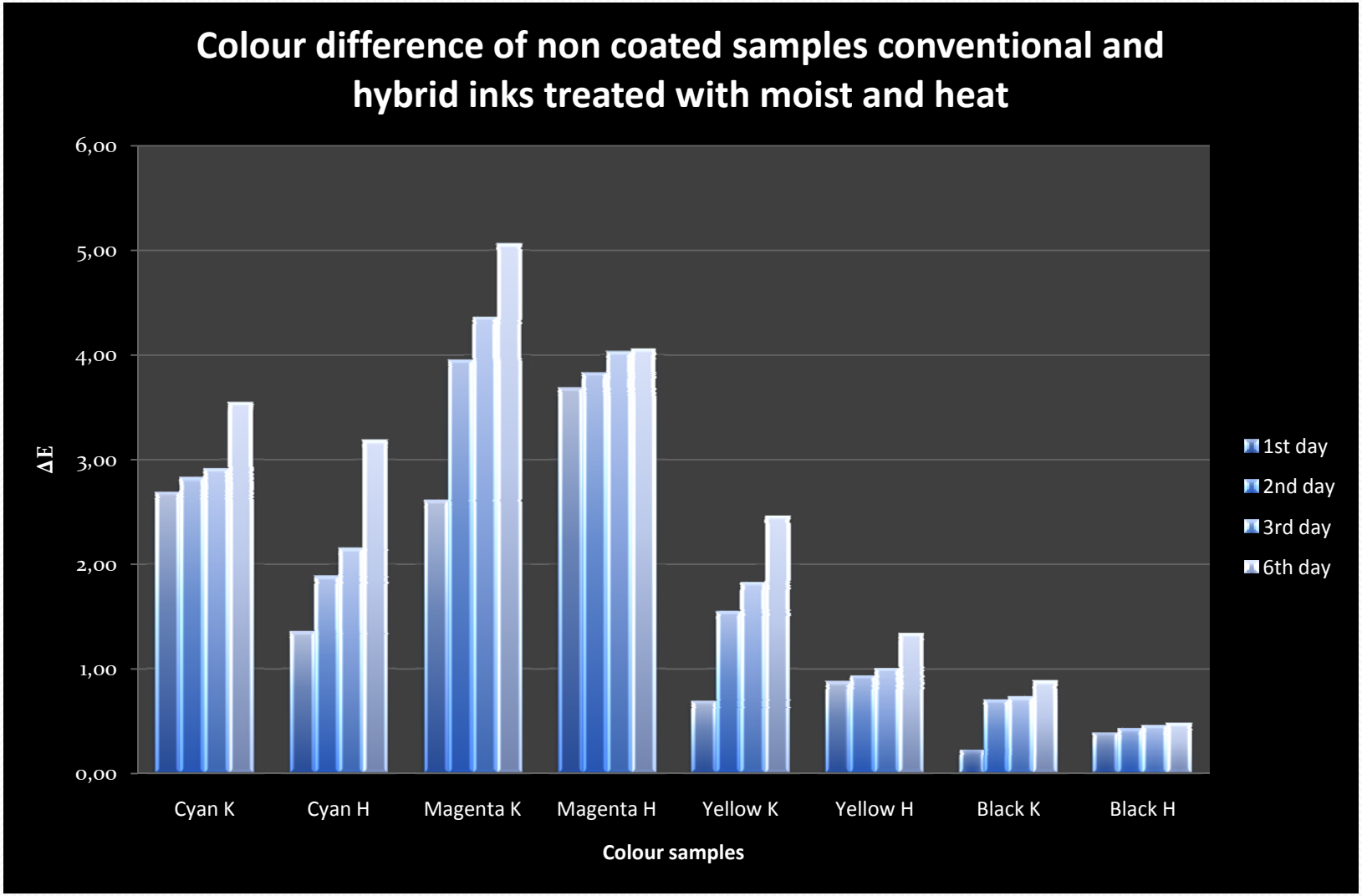




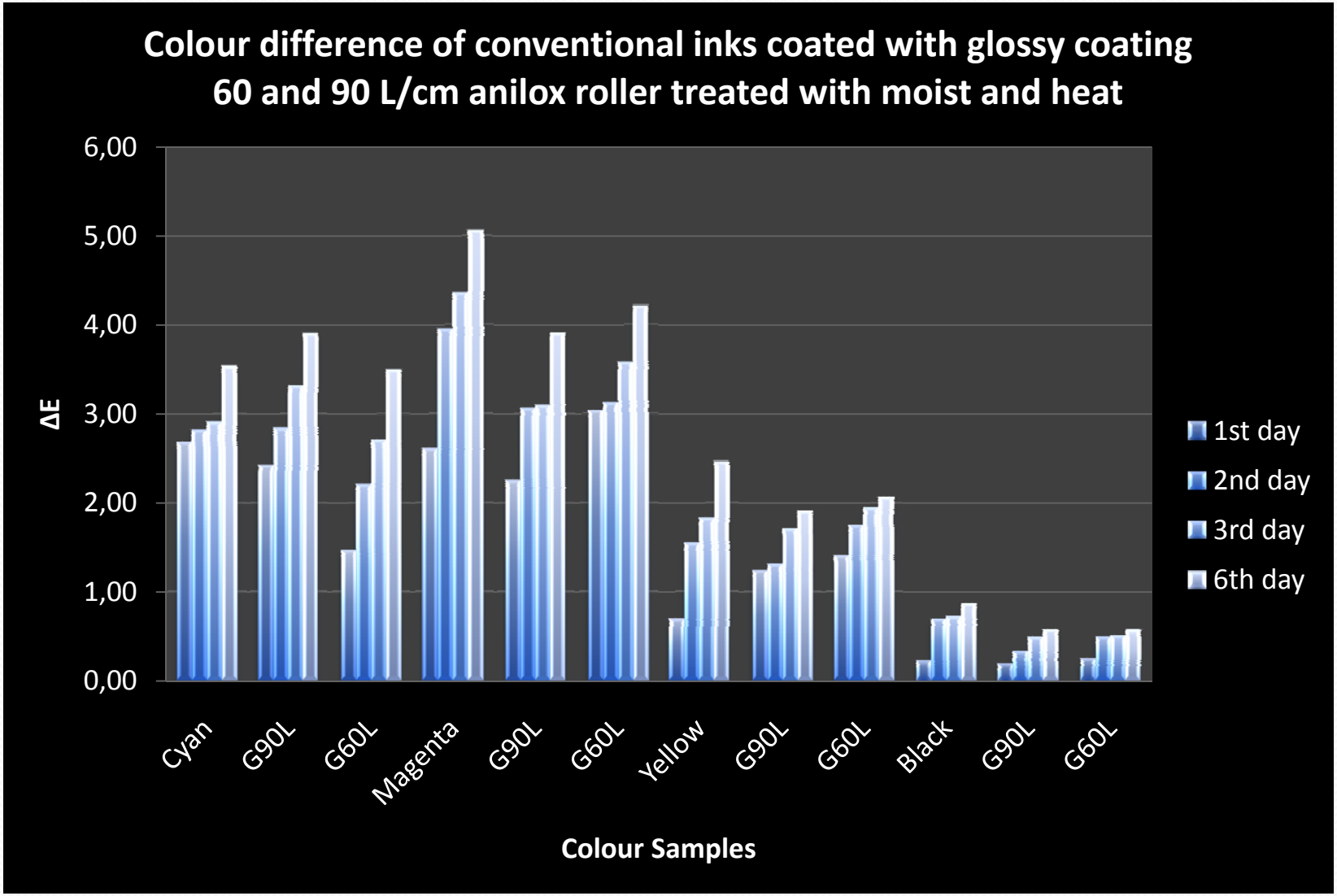
Matte aqueous 60L/cm



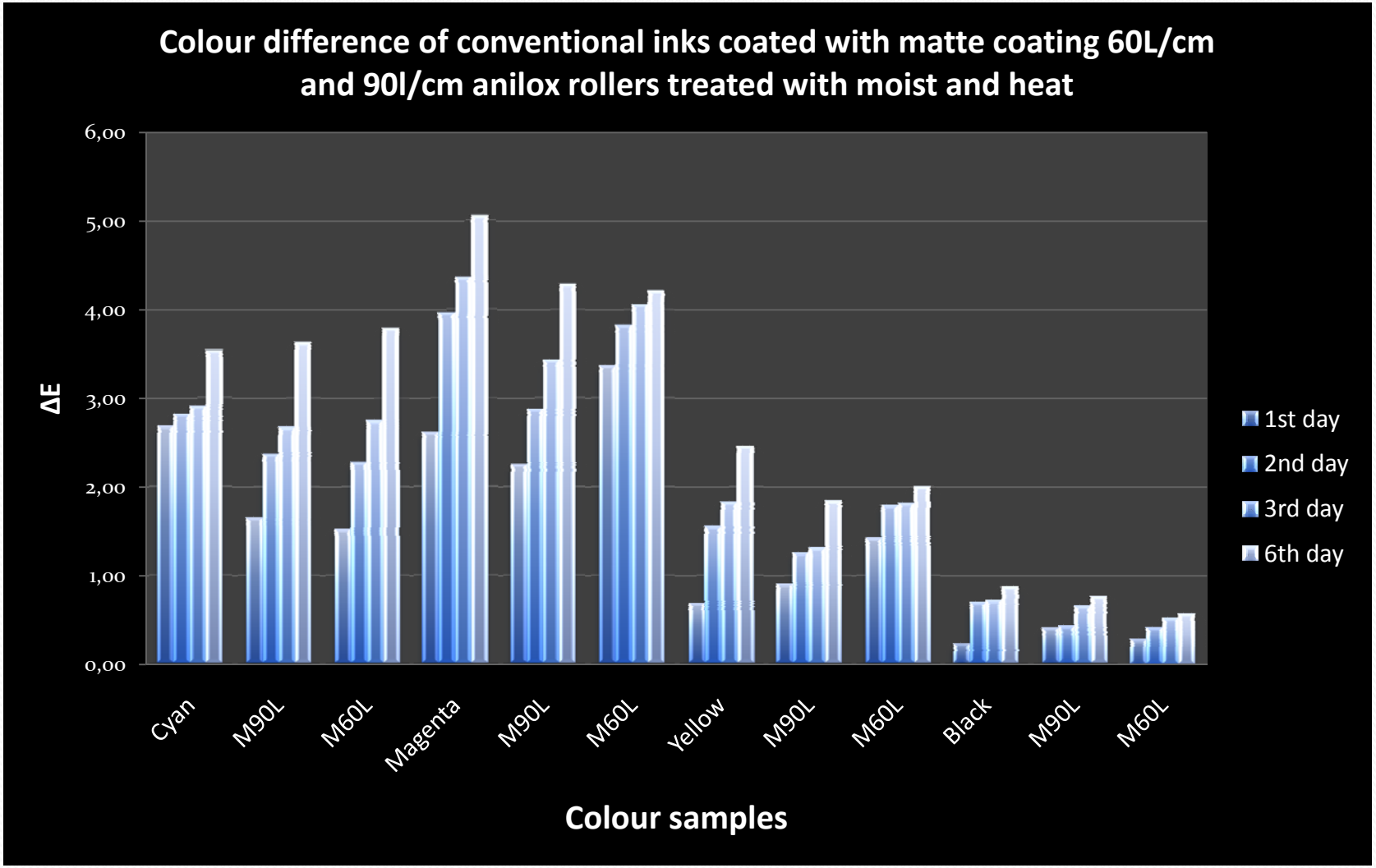
Results


Colour difference of non coated samples conventional and hybrid inks treated with moist and heat
6,00
5,00
4,00
3,00
2,00
1,00
0,00
ΔE
Cyan K
Cyan H
Magenta K
Magenta H
Yellow K
Yellow H
Black K
Black H
Colour samples
1st day
2nd day
3rd day
6th day

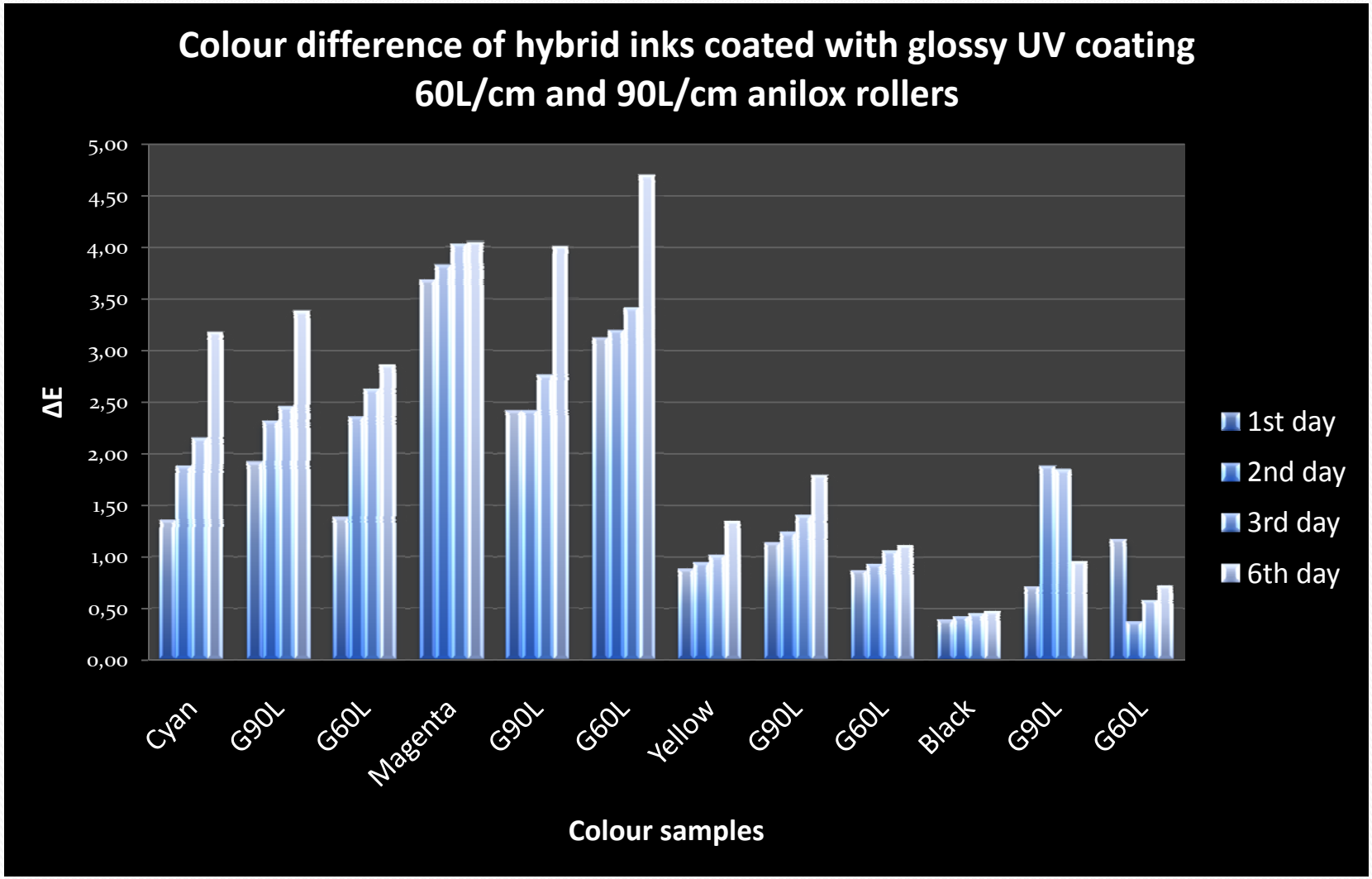
Results


Colour difference of conventional inks coated with glossy coating
60 and 90 L/cm anilox roller treated with moist and heat
6,00
5,00
4,00
3,00
2,00
1,00
0,00
ΔE
Cyan
G90L
G60L
Magenta
G90L
G60L
Yellow
G90L
G60L
Black
G90L
G60L
Colour Samples
1st day
2nd day
3rd day
6th day

Results


Colour difference of conventional inks coated with matte coating 60L/cm and 90l/cm anilox rollers treated with moist and heat
ΔE
6,00
5,00
4,00
3,00
2,00
1,00
0,00
Cyan
M90L
M60L
Magenta
M90L
M60L
Yellow
M90L
M60L
Black
M90L
M60L
Colour samples
1st day
2nd day
3rd day
6th day

Results


Colour difference of hybrid inks coated with glossy UV coating 60L/cm and 90L/cm anilox rollers
ΔE
5,00
4,50
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
Cyan
G90L
G60L
Magenta
G90L
G60L
Yellow
G90L
G60L
Black
G90L
G60L
Colour samples
1st day
2nd day
3rd day
6th day

Summary of results

- Hybrid inks with no coating gave better results then the conventional inks without varnish for all colours.
- Smallest variation between colours :black.
- For conventional inks coated with glossy aqueous coating coated samples gave smaller colour offset during the ageing.
- Matte coated conventional inks also gave a smaller colour change during ageing than the uncoated samples but with variation between amount and colour.
- For hybrid inks larger amount of coating resulted with smaller colour difference for cyan, yellow and black.

Conclusion

- Coatings mainly gave better colour change resistance then the uncoated samples, with variations between amounts of coating and colours.
- Some larger variations between the samples (aqueous coated samples similar behavior –glossy and matte).
- UV coating different changes in colour difference depending on colour
- Hybrid inks with UV coating slightly smaller changes.
- Further investigation in chemical and physical changes.