THE INFLUENCE OF THE SURFACE ROUGHNESS OF AQUEOUS COATED OFFSET PRINT SAMPLES ON THE COLORIMETRIC VALUES

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Introduction

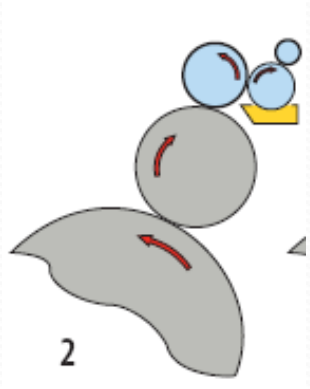
- The increased use of overprint and spot varnish in the graphic arts
- Used for protection and visual enhancement as well for value added printing
- Emergence of new type of varnishes and inks (hybrid, UV)
- A strive for consistent quality control in the area of correct colour reproduction

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.

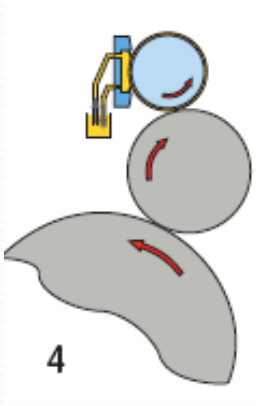
Thickness and amount variation

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

Potential results

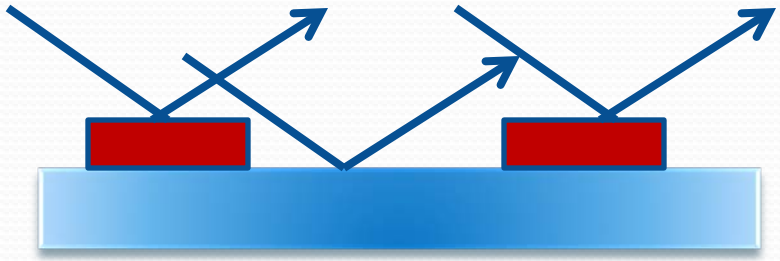
OPTIMIZATION OF PRODUCTION
COST REDUCTION

QUALITY CONTROL OF THE
REPRODUCTION+
PROCESS SIMULATION

ENVIROMENTAL PROTECTION

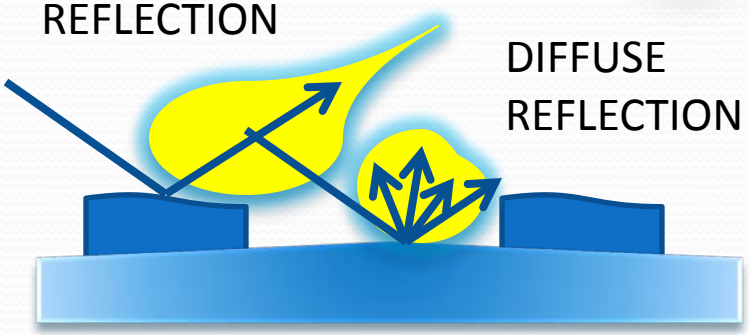
Print surface

SPECULAR REFLECTION

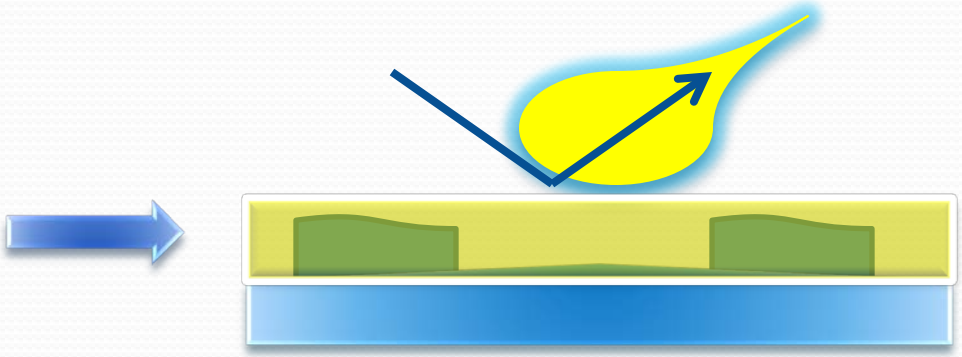


SPECULAR REFLECTION

DIFFUSE REFLECTION

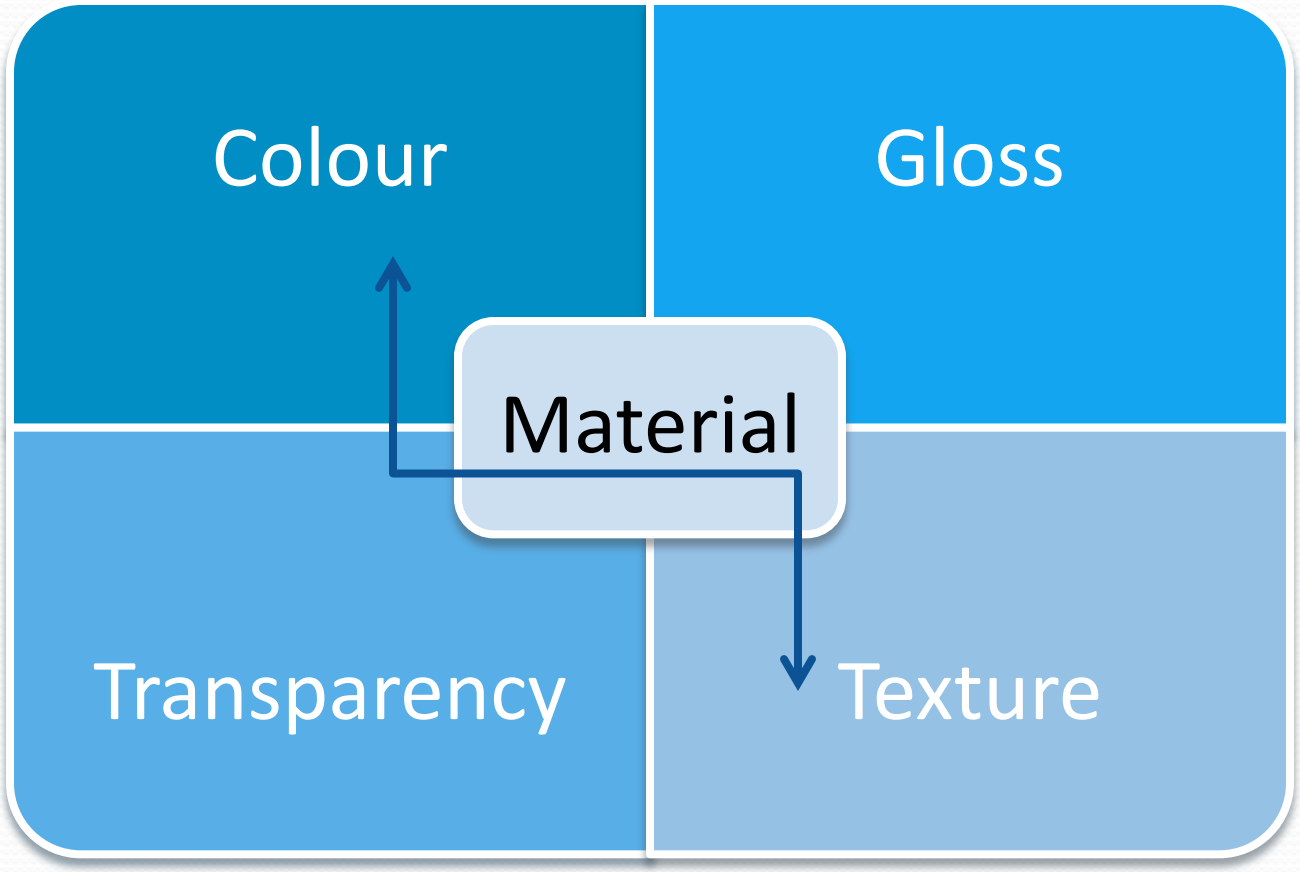


COATING



ADDITIONAL SPECULAR REFLECTION

Optical properties of materials



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

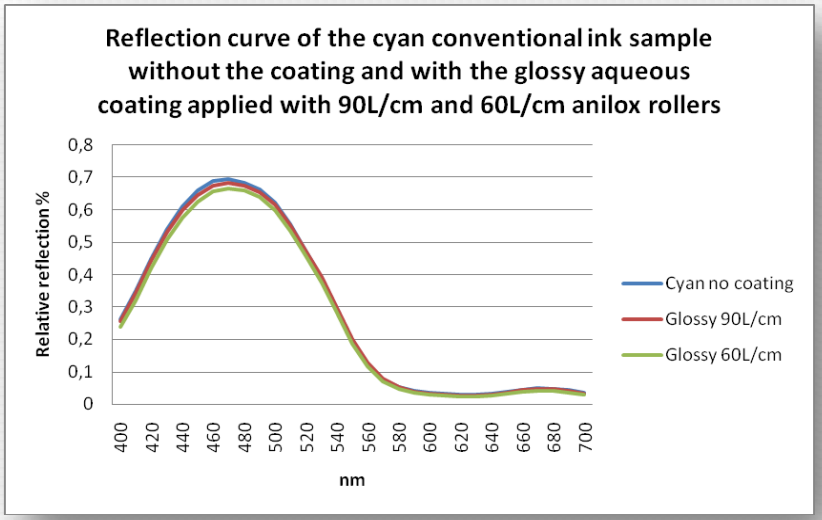
Experimental

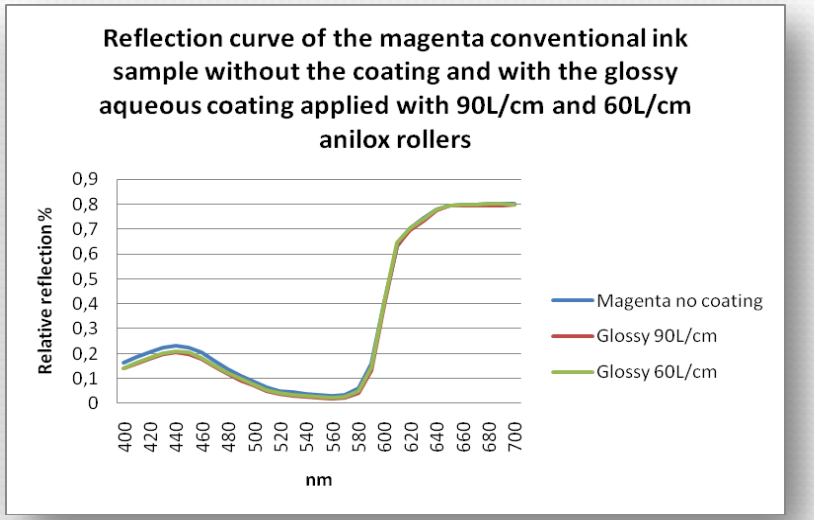
- KBA Rapida 74 4 colour offset machine with additional coating tower (anilox rollers) 60L/cm and 90L/cm
- Techkon SpectrDens,Vecco CP-II AFM scanning microscope and JEOL 646 OLV elektronski mikroskop
- Glossy coated paper Tipe 1 ISO 12647-2 (2004) standard
- Sun Chemical Hartmann World Series printing inks
- Prestofix Hochglanzlack H6055/55 aqueous glossy andPrestofix Mattlack H260/55 aqueous matte coatings

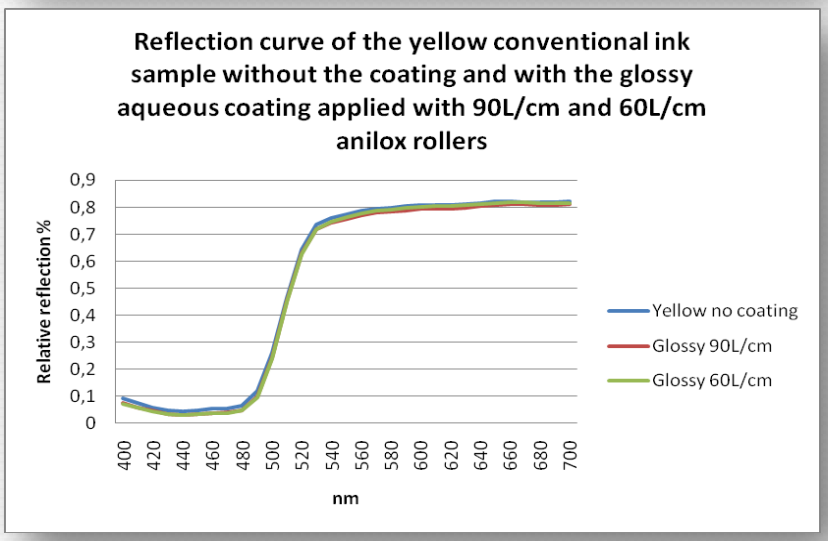
Methods and materials

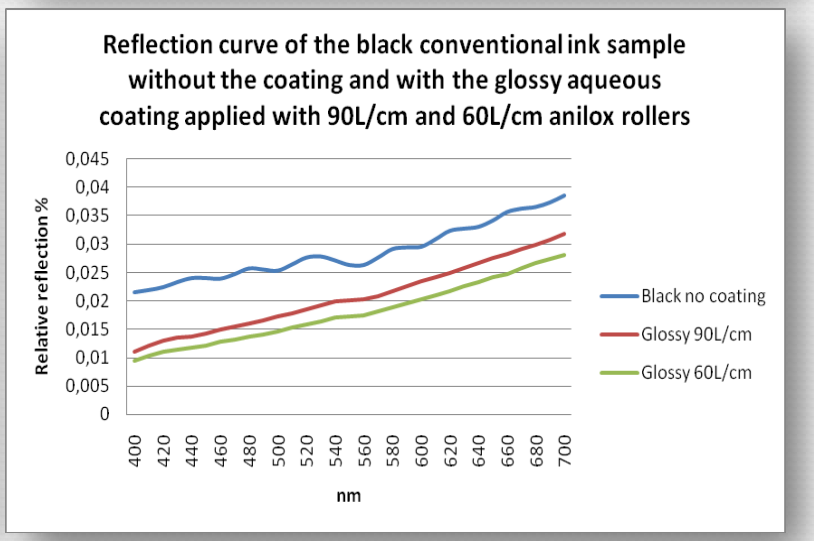
- Techkon SpectroDens $45^0/0^0$, D50, 2^0, 400-700 nm 10 nm measurement step DIN 5033
- AFM Vecco CP-II SPM 80 x 80 µm, 3 positions X i Y direction 6 measurements
- Image Metrology SPIP software for roughness analysis
- The prints were sampled by simple random sampling methodology from the OK sheets (print values by inking standard)
- CMYK 100% tone value patches
- Coating quantity in g/m^2

Results glossy coating

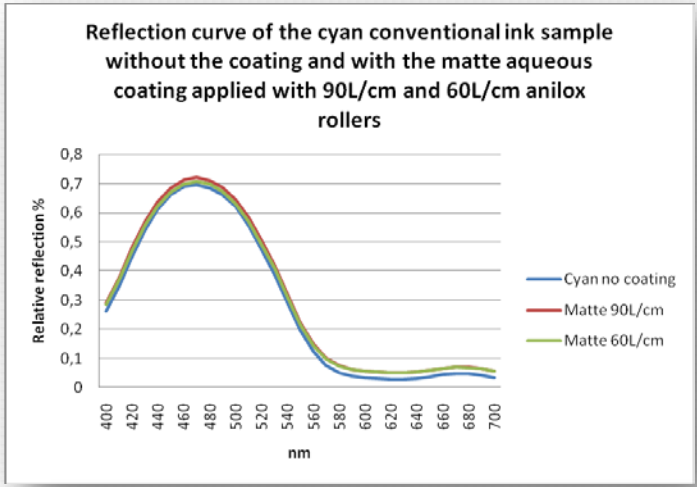


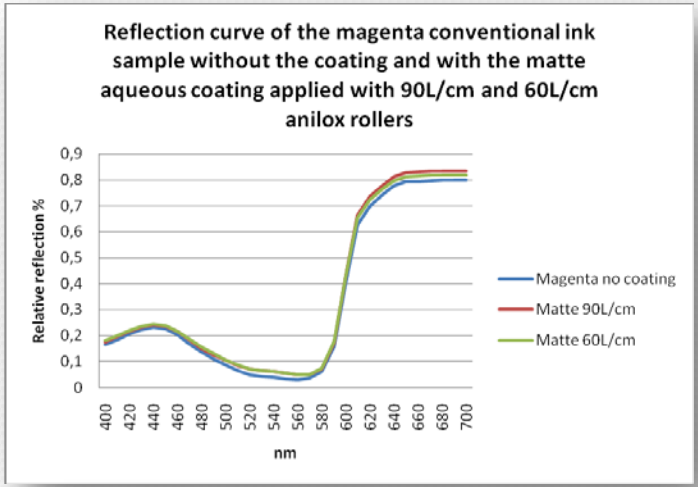


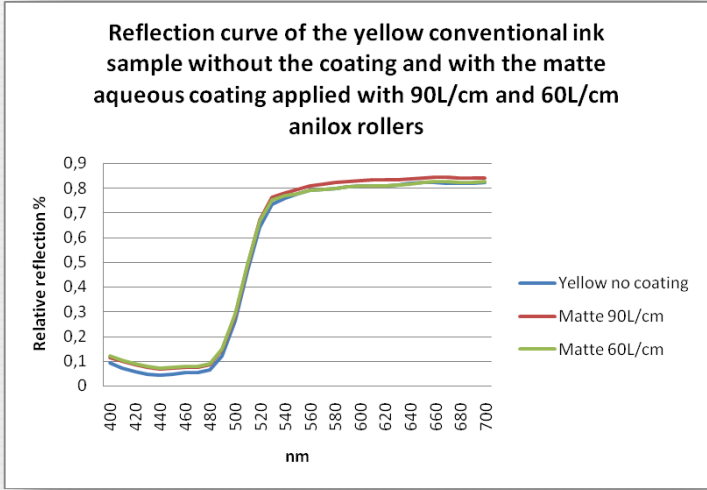


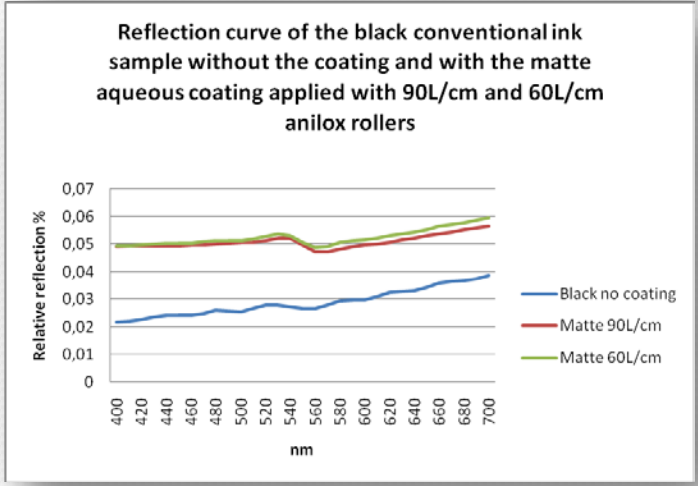


Results matte coating

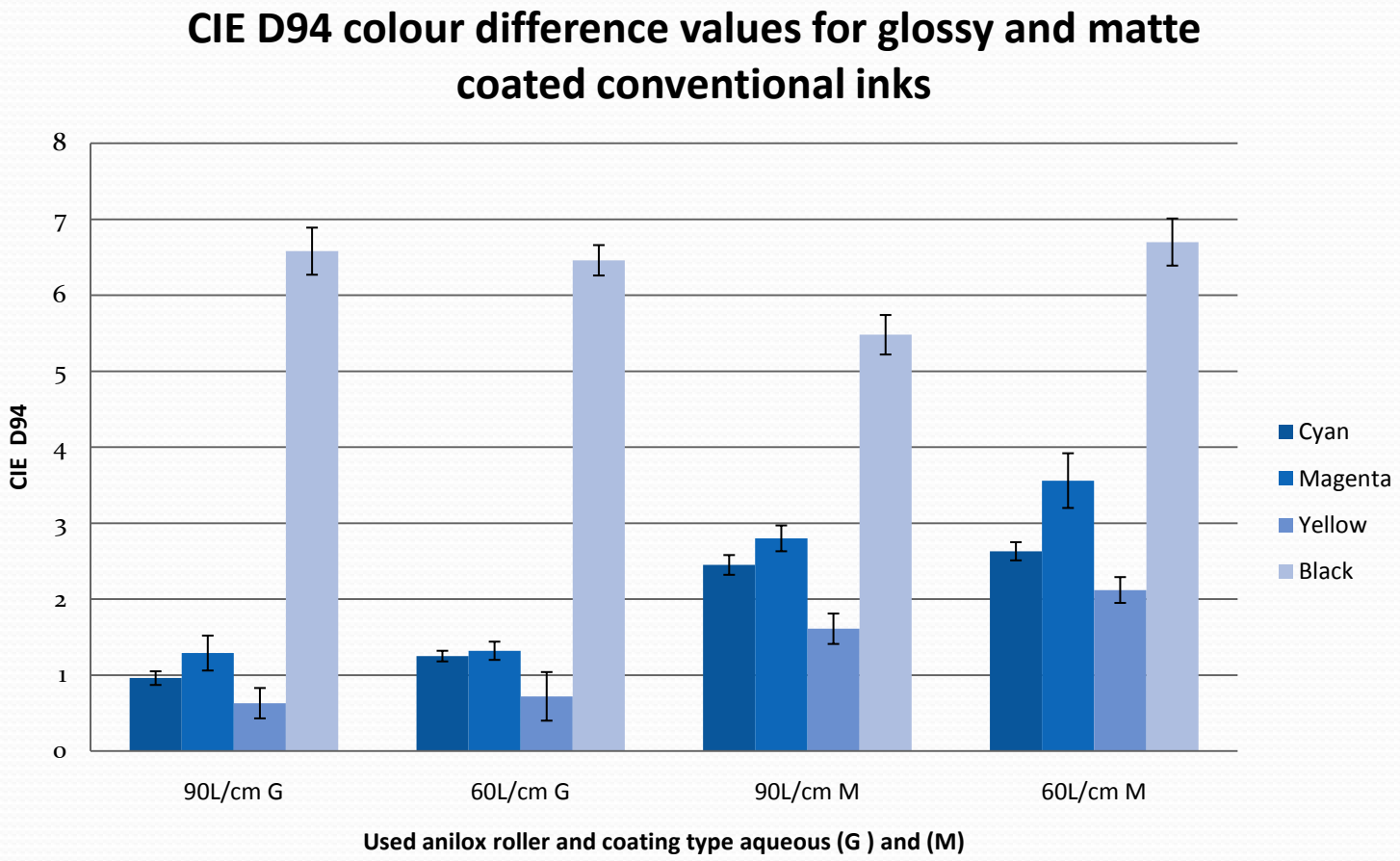








Results glossy coating colour difference

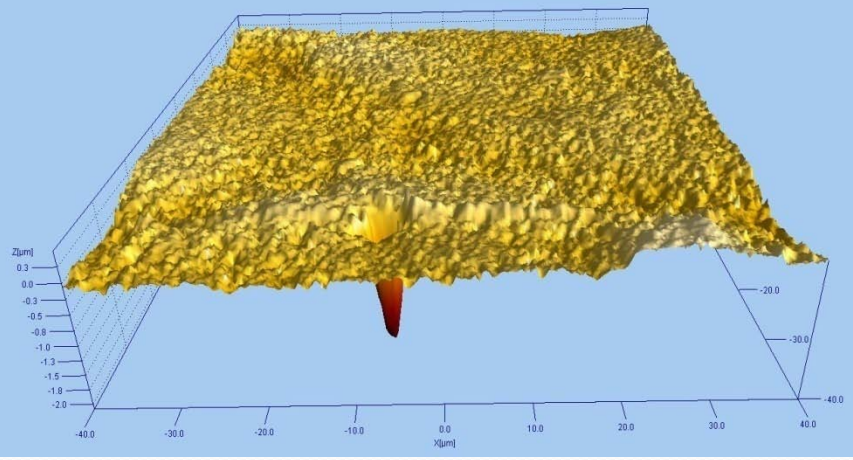


Surface roughness determination

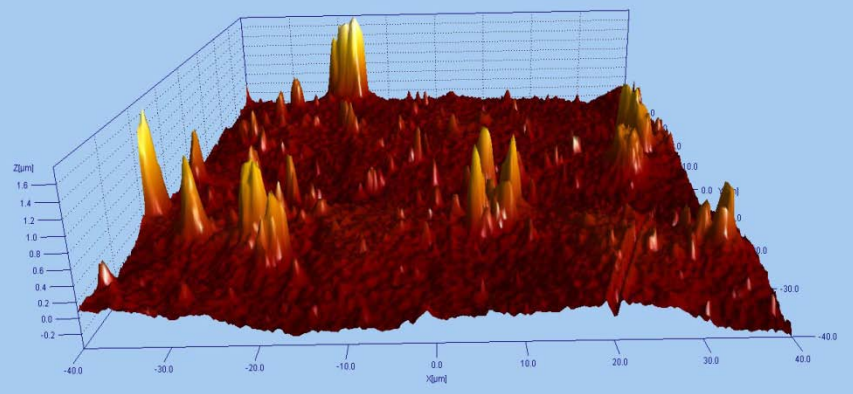
- Sa parameter – average surface roughness ISO/DIS 25178-2:2010 and ASME B46.1 in nm

$$S_a = \frac{1}{MN} \sum_{k=0}^{M-1} \sum_{l=0}^{N-1} |z(x_k, y_l)|$$

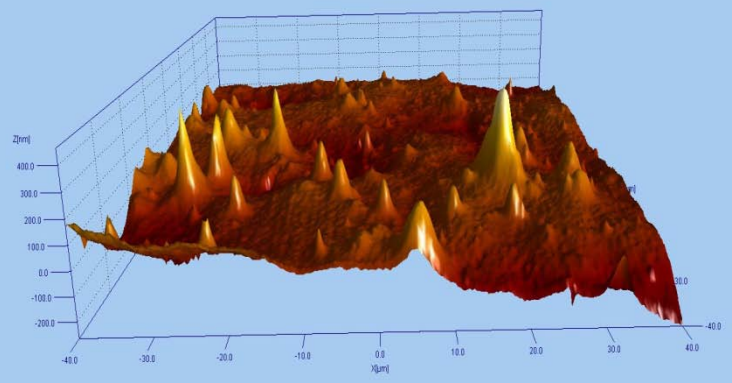
Glossy paper no ink no coatings S_a=99,11 nm



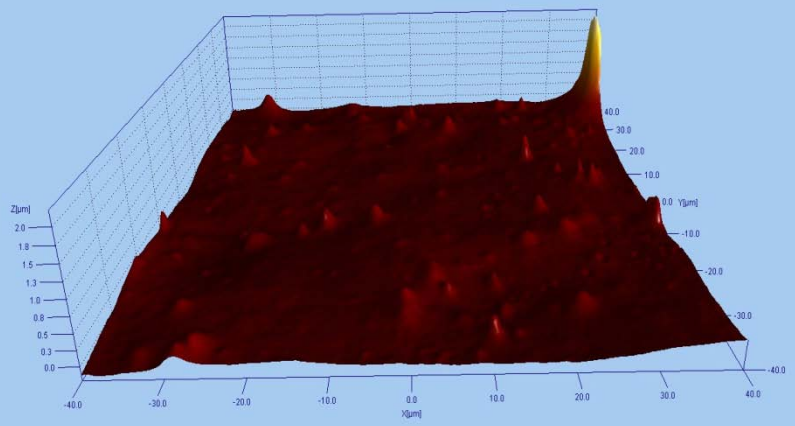
Glossy paper ink no coatings S_a=100,52 nm



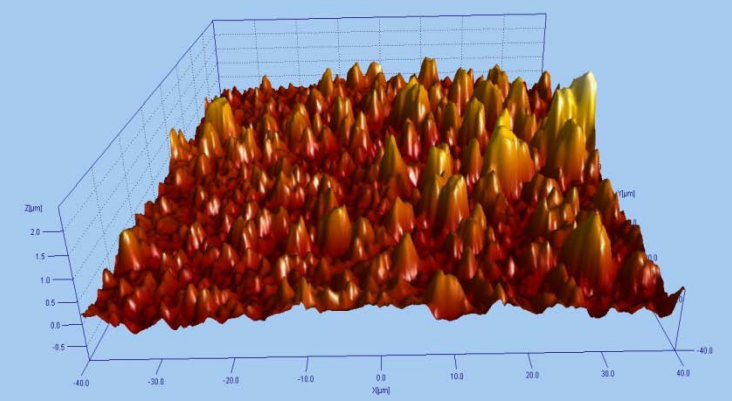
Ink glossy coating 60L/cm coatings S_a=47,93 nm



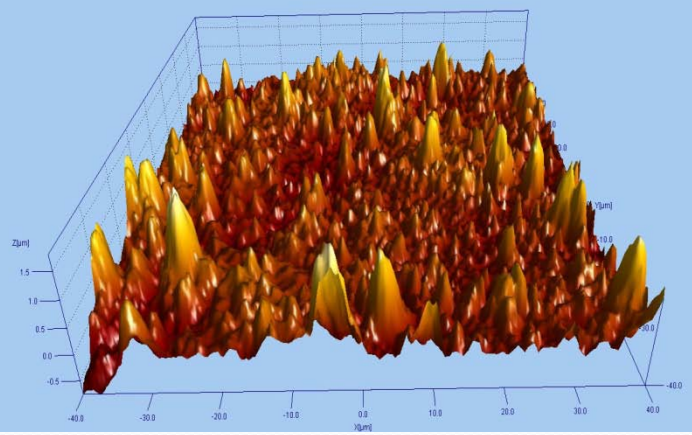
Ink glossy coating 90L/cm coatings S_a=66,41 nm



Ink matte coating 60L/cm coatings S_a=244,07 nm

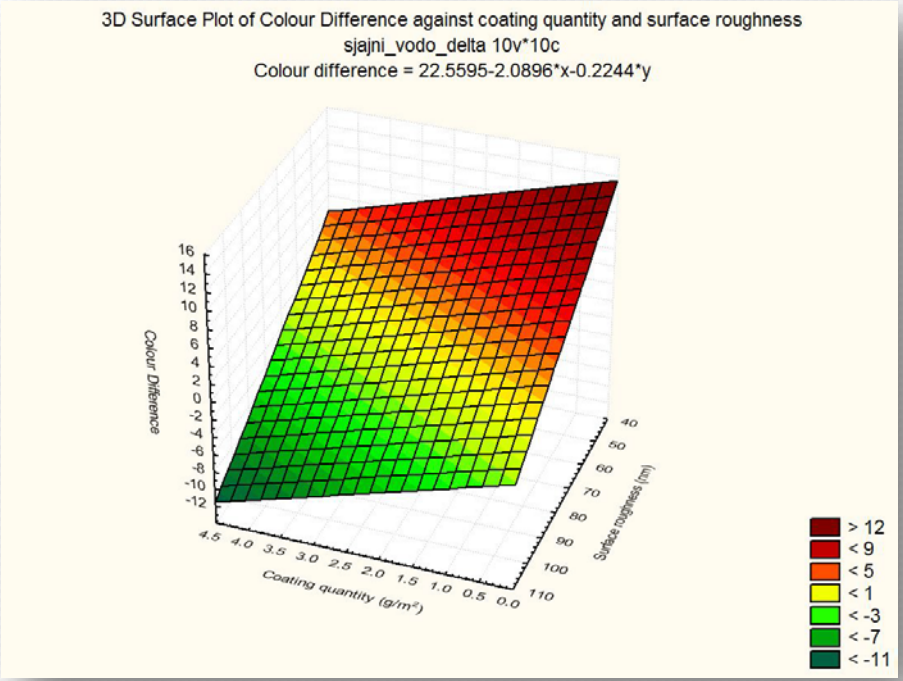


Ink matte coating 90L/cm coatings S_a=229,42 nm



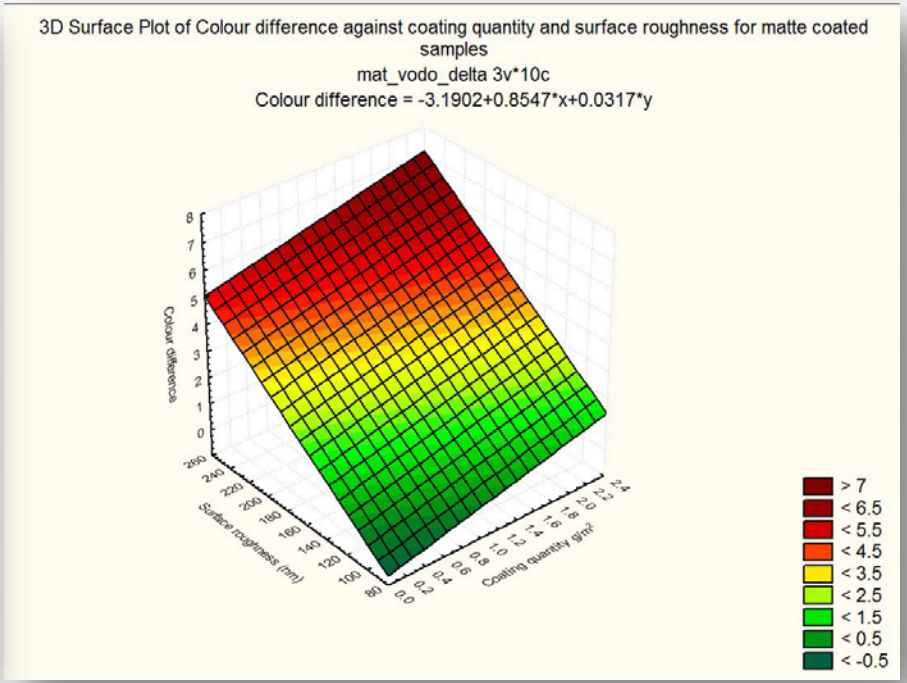
Analyis

Glossy coated sample



R=-0.95

Matte coated sample



R=0.99

Conclusion

- The higher amount of coating (60L/cm anilox roller) yielded higher average colour difference values.
- The higher amount of coating for glossy lowered the average surface roughness values.
- The higher amount of coating for matte raised the average surface roughness values.
- Colour difference for glossy coating resulted in darker more satured samples, matte coating in lighter less saturated colours.
- Changes of colour difference in comparison to surface roughness show a linear type of correlation.