

IMAGE ANALYSIS BASED METHODS FOR CHARACTERIZATION OF PAPER STRUCTURE AND PRINT QUALITY

STSM Report

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STSM Reports



1. Characterization of paper surface topography and print nonuniformity
 - KCL, Finland (May 23. – 31. 2005)
 - Host: Dr. Kari Juvonen
2. Paper structure and print quality evaluation by DOMAS
 - TU Dresden, Institute of Wood and Paper Technology, Germany (June 19. – 29. 2006)
 - Host: Prof. Dr. Harald Grossmann

KCL – Laser profilometry



Confocal laser profilometer NanoFocus μ Scan

- Non-contact measurement
- Laser point sensors
 - ✓ Confocal point sensor
 - ✓ Autofocus
 - ✓ Holographic sensor
- X/Y stage, sample table
- On- / off-axis camera
- PC & software



Sensors		Resolution z (μm)	Resolution x,y (μm)	Working distance (mm)	Measuring range in z-direction (mm)	camera (optional)
Confocal point sensor	CF 4	0.02	1	4	1.0	off-axis (BMT5)
	CF 13	0.02	1	13	1.0	

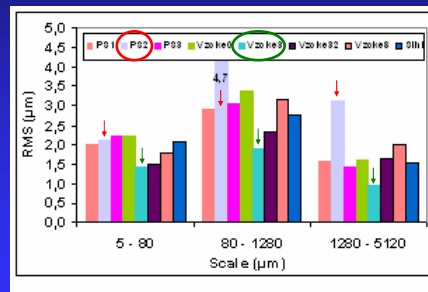
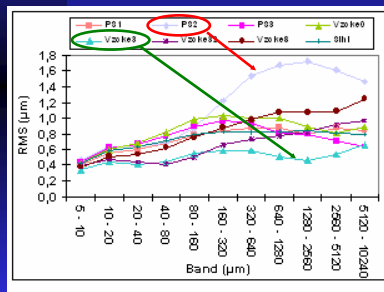
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Line measurements



Sample	Code
Newspaper papers	PS1, PS2, PS3
Inkjet printing papers	Vzoke, Vzoke 32, Sihl
Multipurpose graphic papers	Vzoke8, Vzoke0

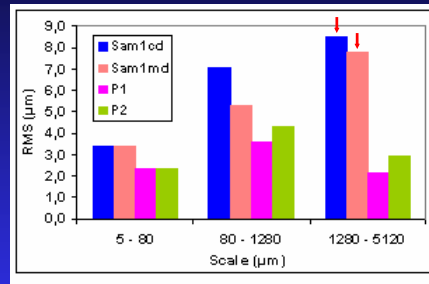
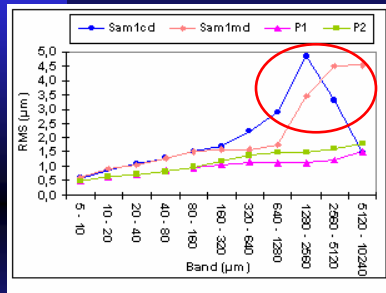
160 mm profile, 1 μm resolution,
0,5 mm/s scanning speed \rightarrow
approx. 6 min measuring time



RMS roughness at different wavelength bands (left) and scales (right)

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Line measurements



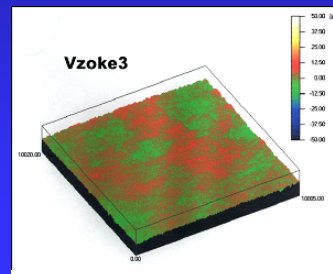
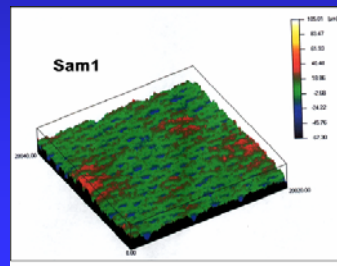
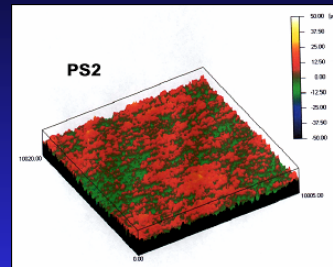
RMS roughness at different wavelength bands (left) and scales (right)

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Area measurements

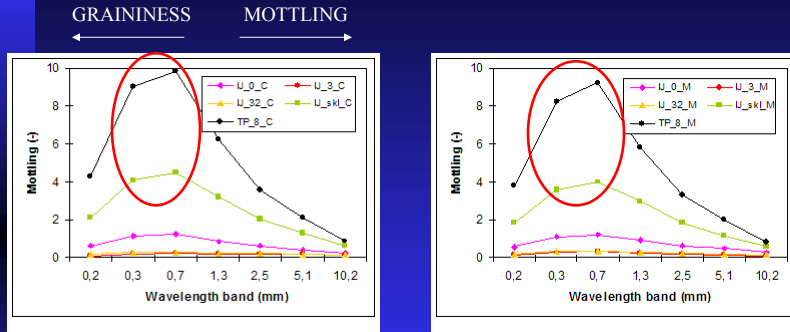


Sample area: 10 x 10 mm
 Resolution: 5 µm (X), 20 µm (Y)
 Scanning speed: 3 mm/s
 Measuring time: approx. 40 min



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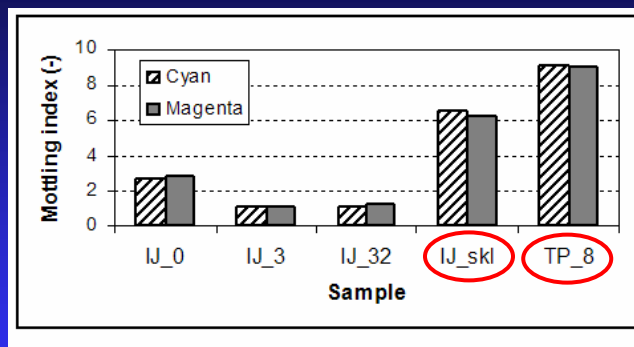
KCL – Print nonuniformity



Mottling for cyan (left) and magenta (right) ink-jet prints at different bands

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Mottling index



Mottling index for cyan and magenta ink-jet prints

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TU Dresden – PTS-DOMAS system



DOMAS module	Areas of application	DOMAS provides optimisation potentials for				
		Incoming-control	Control or production	Product development	Product optimization	Quality control
Dirt specs	Optical properties of pulps, paper/board	•	•	•	•	•
Stickies	Recycled fibre pulps	•	•	•	•	•
Heliotest	Gravure papers		•	•	•	•
Missing dots	Gravure papers		•	•	•	•
Filler analysis on paper surface*)	Uncoated papers, e.g. SC		•	•	•	•
Coat thickness analysis*)	Coated papers		•	•	•	•
Blackening	SC papers		•	•	•	•
Bleeding & Wicking	Inkjet papers		•	•	•	•
z-distribution of filler	All papers		•	•	•	•
Sheet formation	All papers		•	•	•	•
Analysis of paper structures	All papers		•	•	•	•
Analysis of pin holes	All papers		•	•	•	•
Print unevenness	All print processes		•	•	•	•

*) Modules soon available. Additional utilizations are in preperation.

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Tested samples and applied modules



Group	Sample	Code	Applied DOMAS module(s)
A	Newsprint papers	PS1, PS2, PS3	Formation
	Inkjet printing papers	Vzoke, Vzoke 32, Sihl	
	Multipurpose graphic papers	VzokeB, Vzoke0	
B	Label paper No. 1 - base paper	L1_bas	Formation
	coated paper	L1_coat	
	finished (coated and calendered) paper	L1	
	Label paper No. 2 (finished)	L2	Regular structures
	Graphic paper (finished)	GR	
	Offset prints on label paper No. 1 - base paper	L1_bas	
	coated paper	L1_coat	Mottling
	finished paper	L1	
	Offset prints on label paper No. 2 (finished)	L2	
Offset prints on graphic paper (finished)	GR		
C	Coated board No. 1	B1	Mottling
	Coated board No. 2	B2	
	Coated board No. 3	B3	

Formation & Structures

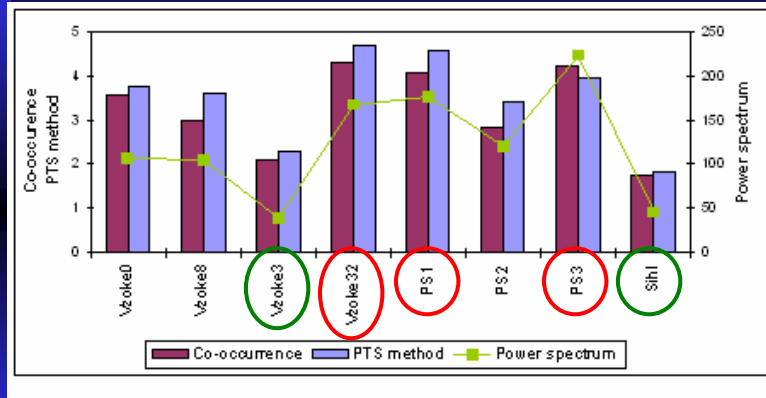
- Sample area: 62 mm x 62 mm
- Transmission mode scanning
- Resolution: 210 dpi

Mottling

- Sample area: 62 mm x 62 mm
- Remission mode scanning
- Resolution: 420 dpi

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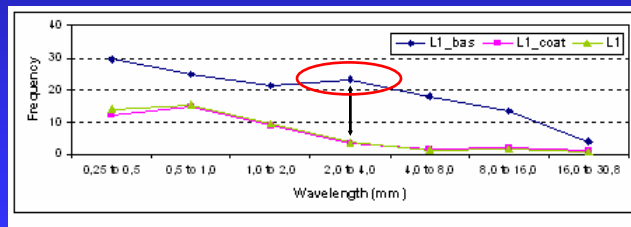
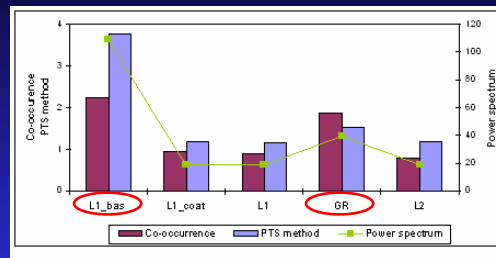
Paper formation



Formation of *group A* samples

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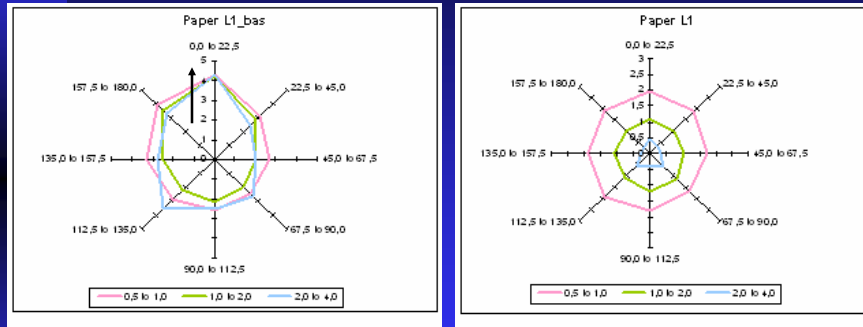
Paper formation



Group B samples' formation (top) and flocs' size distribution (bottom)

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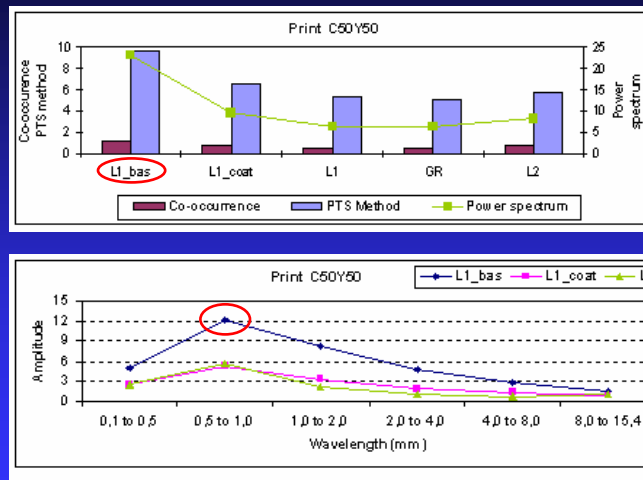
Paper formation



Flocs' orientation of label base (left) and coated & calendered (right) paper

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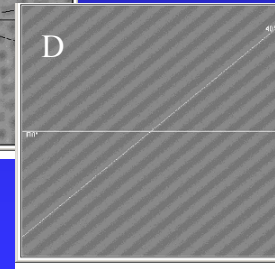
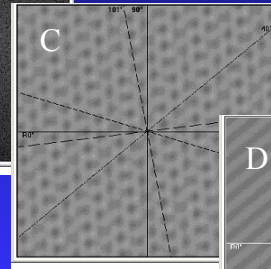
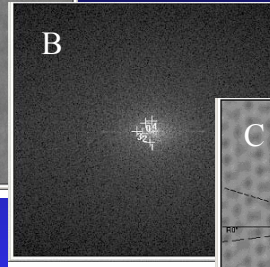
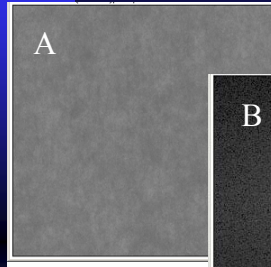
Print mottling



Group B printed samples' mottling (top) and inhomogeneities' size distribution (bottom)

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Regular structures in paper



A – Label base paper original image

B – FFT image with five detected structures

C – Inverse FFT image with structure lines

D – Re-transform of the strongest structure line (40 deg.)

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Acknowledgements



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Thank you for your attention!

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