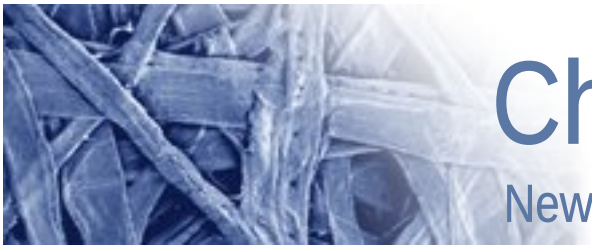


Characterisation Newsletter

Number 06, August 2009

News from PFI

New Project:
PROFIT: Profitable bioenergy and paper production through innovative raw material handling and process integration. The project period is 2009-2013. *Read more...*

New PhD students:
•Tuan-Anh Nguyen will work with barrier and tie-layer properties in the Sustainbarrier project. Tuan-Anh is from Vietnam, and has a master degree in polymer chemistry from Chungnam National University in Korea.
•Collin Hii Ching Tyn has started as a PhD-student in the Enpap project. His PhD-study will focus on reducing the energy consumption for drying during newsprint production. Collin is from Malaysia and has completed his MSc in paper technology at the Helsinki University of Technology (HUT), Finland.

Three-dimensional characterisation

Modern technology is facilitating our understanding of structures and their properties. This is particularly the case with research on fibre, paper and composites, where we see remarkable advances in their corresponding characterisation. We are moving forward from well-established 2D methods to comprehensive 3D assessments of a given structure. Acquisition of 3D bulk and surface data comprises several equipments such as AFM, laser profilometry, X-ray microtomography, in-situ serial sectioning, focused-ion-beam and transmission electron microscopy tomography. Such tools are complementary and yields a detailed description at several scales, which is most valuable.
Proper characterisation is a complex process and needs multidisciplinary expertise. Cooperation is thus a key word. PFI has been active in initiating and promoting cooperation among several research groups worldwide. Such initiatives have resulted in the development of several methods for structural three-dimensional characterisation. Some of them are presented in this issue.

Upcoming events

2nd Nordic Wood Biorefinery Conference, Helsinki 2 - 4 Sept., 2009. *Read more...*

Iarigai Conference 2009: Advances in Printing and Media Technology, Stockholm 13 - 16 September, 2009. *Read more...*

Polysaccharides as a source of Advanced Materials Conference, Åbo Finland, 21-24 September, 2009. *Read mode...*

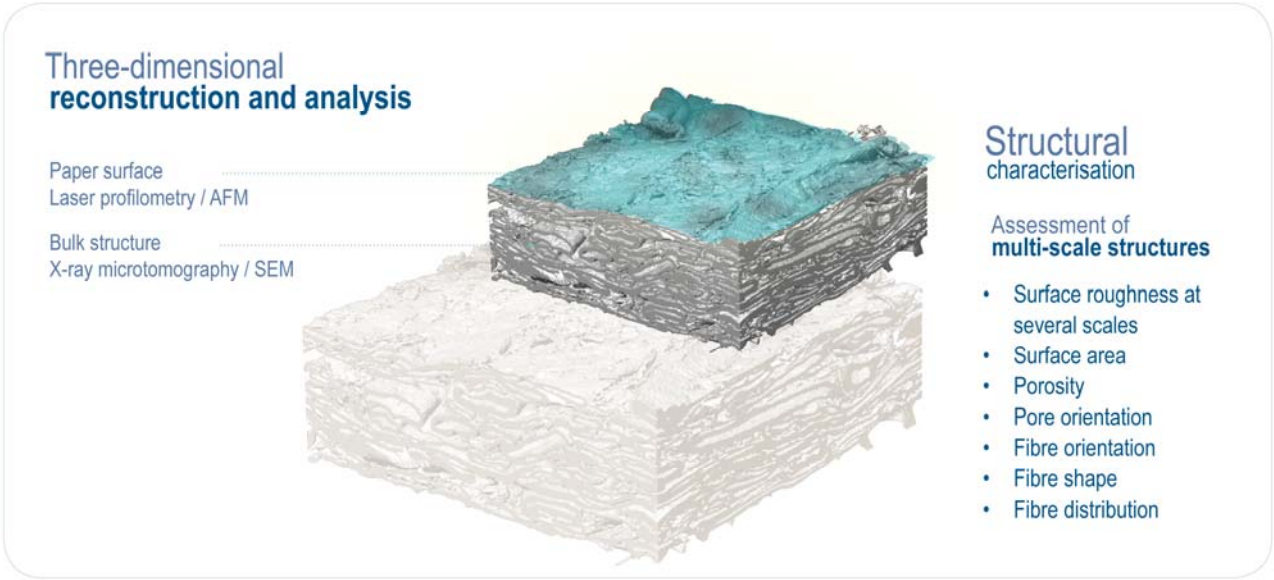
Recommended links

PFI:
www.pfi.no
INNVENTIA:
http://www.innventia.com

Next issue, January 2010

- Wood fibre composites

Selected analysis method



Editor

Contact: Dr. ing. Gary Chinga Carrasco
Postal address: PFI, N-7491 Trondheim, Norway
Email: gary.chinga.carrasco@pfi.no
Phone: +47 73550925
Fax: +47 73550999

Papir- og fiberinstituttet AS
Paper and Fibre Research Institute
PFI

Characterisation Newsletter

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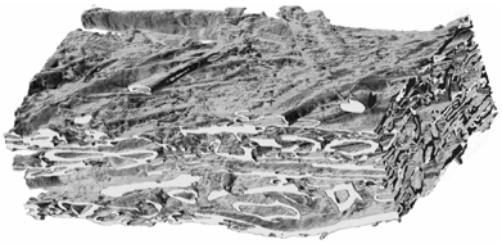
X-ray microtomography

Comparison of 3D structural characteristics of high and low resolution X-ray microtomographic images of paper

Abstract

There are some paper properties, such as optical and transport properties, where an understanding of its three-dimensional (3D) structure is strongly desired. The 3D structure of porous materials, such as paper and board can be visualised and characterised by using X-ray micro-(computed) tomography (X-μCT) and image analysis. The purpose of this study was to try and identify the best resolution to characterise the 3D structure of paper by comparing 3D images from monochromatic synchrotron radiation X-μCT in phase contrast mode with those from polychromatic radiation X-μCT in absorption mode. It was seen that both types of resolution can show expected trends for the measured structural properties from different paper samples. Low resolution images are perfectly adequate for comparative studies. Due to the fact that more accurate physical measurements are achievable, the high resolution images are more useful for research into paper structure and its influence on the properties of paper, such as optical and transport properties.



The higher level of detail can give more detailed measurements and clearer differences between samples. They are also more reliable and less affected by noise. The disadvantage is a low availability and a higher cost. The lower cost of the low resolution technique enables the imaging of several replicates, improving the representational value of the small imaged volumes.

The figure shows a high-resolution 3D image of a newsprint sample. Reproduced from Holmstad et al. (2005).

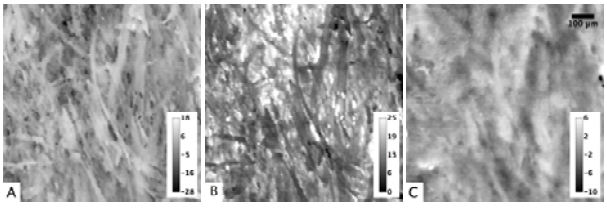
Reference: Holmstad R, Gregersen O W, Aaltosalmi U, Kataja M, Koponen A, Goel A, Ramaswamy S. Nord. Pulp Pap. Res. J. 20(3): 283-288 (2005)

Complementary analysis techniques

New advances in the 3D characterisation of mineral coating layers on paper

Abstract

The surface characteristics of a large set of commercial LWC paper grades are explored. The quantification of the 3D structure is revealed by atomic force microscopy (AFM), laser profilometry (LP) and X-ray microtomography (X-μCT). This comprehensive study demonstrates the suitability of different and modern methods for assessing critical coating layer properties, thus identifying the right tools for specific structural analyses. Based on the assessment of the top and bottom surfaces of 25 commercial LWC samples, three main conclusions can be drawn: i) the facet orientation polar angle is a function of roughness, ii) skewness did not describe the surface details affecting the gloss of the commercial LWC samples assessed in this study and iii) surface roughness at wavelengths below approximately 1.0 mm does not affect the paper gloss significantly. This is important knowledge for the understanding of LWC paper surface structure and its properties.



The figure shows a X–μCT assessment of LWC paper. A tomographic image has been decomposed into a topography map of the base paper surface (A), a thickness map of the coating layer (B) and a topography map of the coated surface (C). The calibration bars define the greylevels in microns. Reproduced from Chinga-Carrasco et al. (2008).

Reference: Chinga-Carrasco G, Kauko H, Myllys M, Timonen J, Wang B, Zhou M, and Fossum J.O. J. Microscopy 232(2): 212-224 (2008).

Contact Address

Postal address: PFI, N-7491 Trondheim, Norway
Telephone/fax: +47 73 55 09 00/ +47 73 55 09 99
e-mail: firmapost@pfi.no
Internet: www.pfi.no

Papir- og fiberinstituttet AS
Paper and Fibre Research Institute
PFI