Polarized Light Microscopy for Fiber-Fiber Bond Area Measurement Revisited

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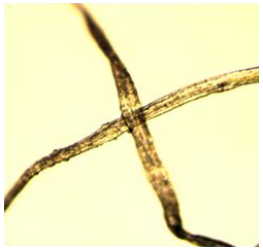
CD-Laboratory for surface chemical and physical fundamentals of paper strength

Introduction

Paper strength mainly depends on two factors

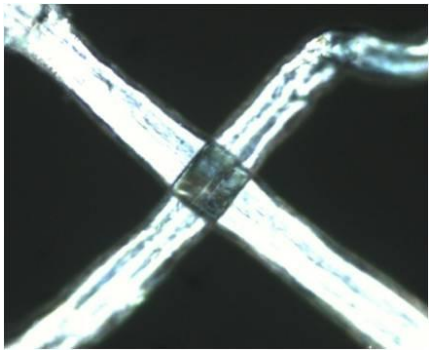
- Strength of the single fiber 
- Strength of the fiber-fiber-bond 
  - size of the bonded area
  - bonding force per area

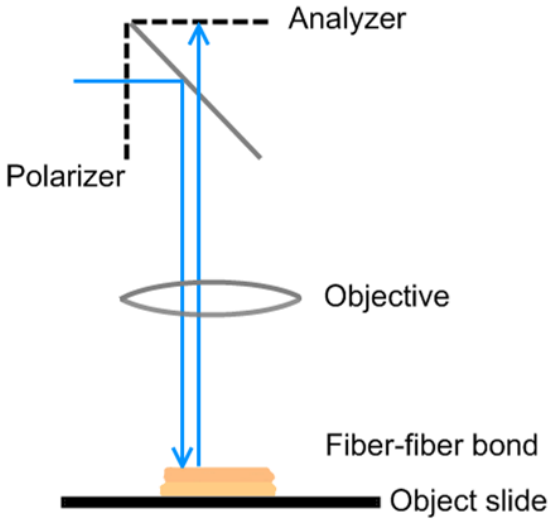
Measurement of bonded area is

Basis for better understanding of fiber-fiber bond strength

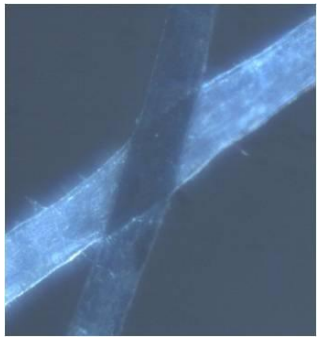
Bonded area measurement: Polarized light microscopy

- Non-destructive method required
  - Polarized light microscopy



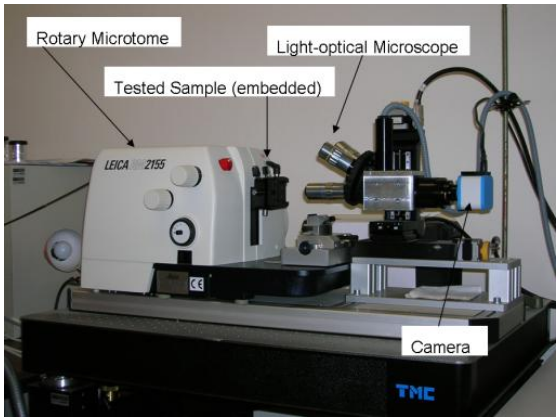


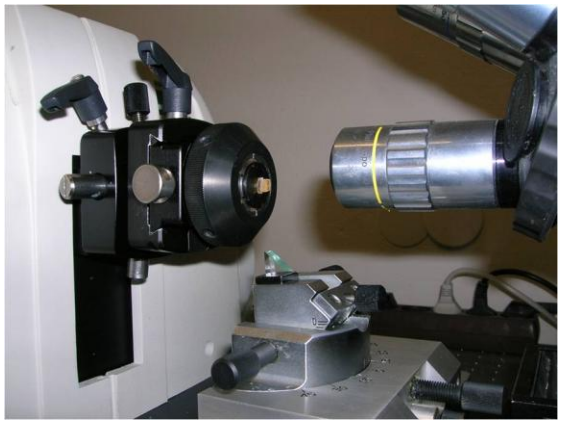
  - Dyeing of lower fiber

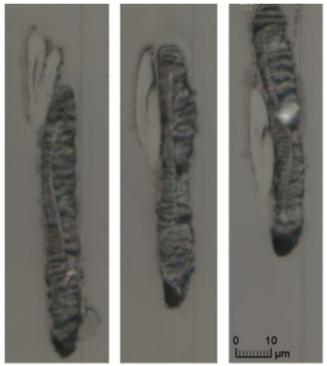


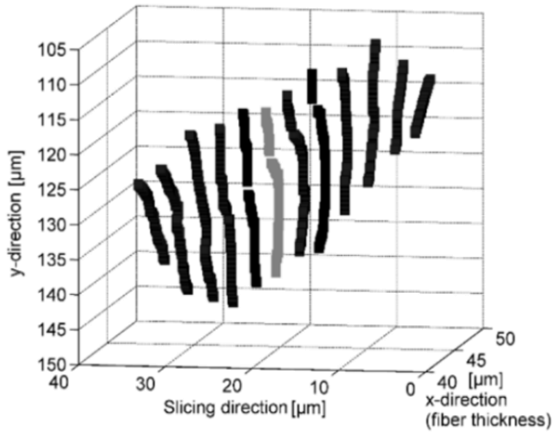
Bonded area measurement: Microtomy

- 3D microtome serial sectioning technique

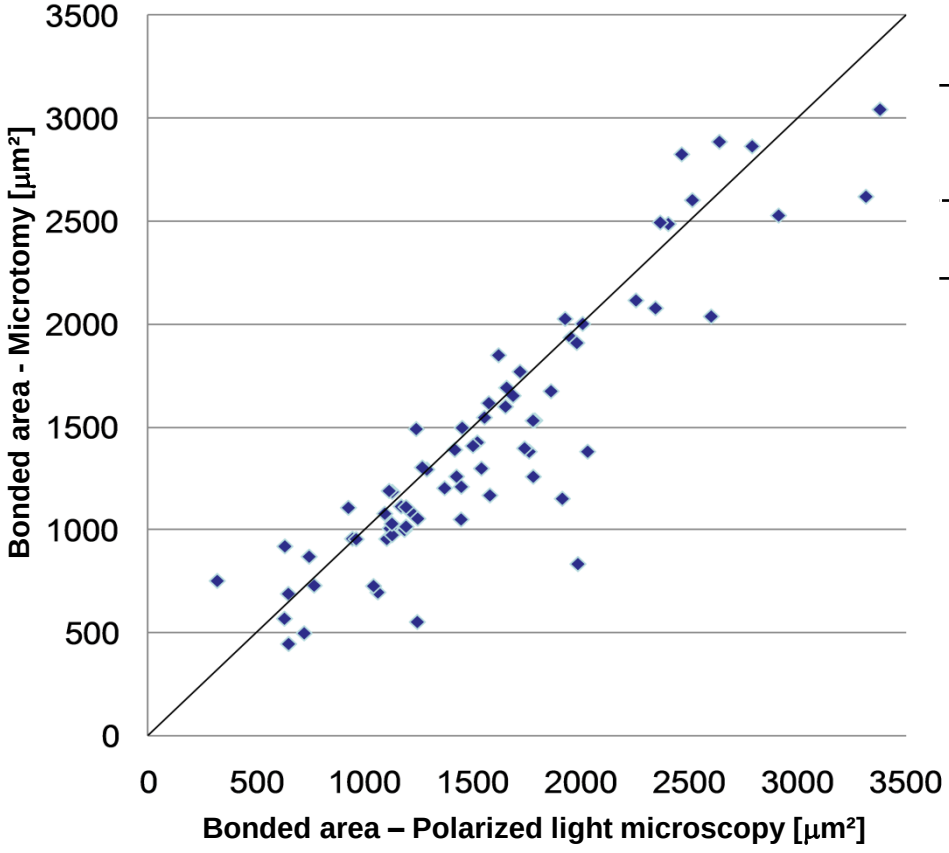






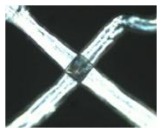


Results unbeaten pulp

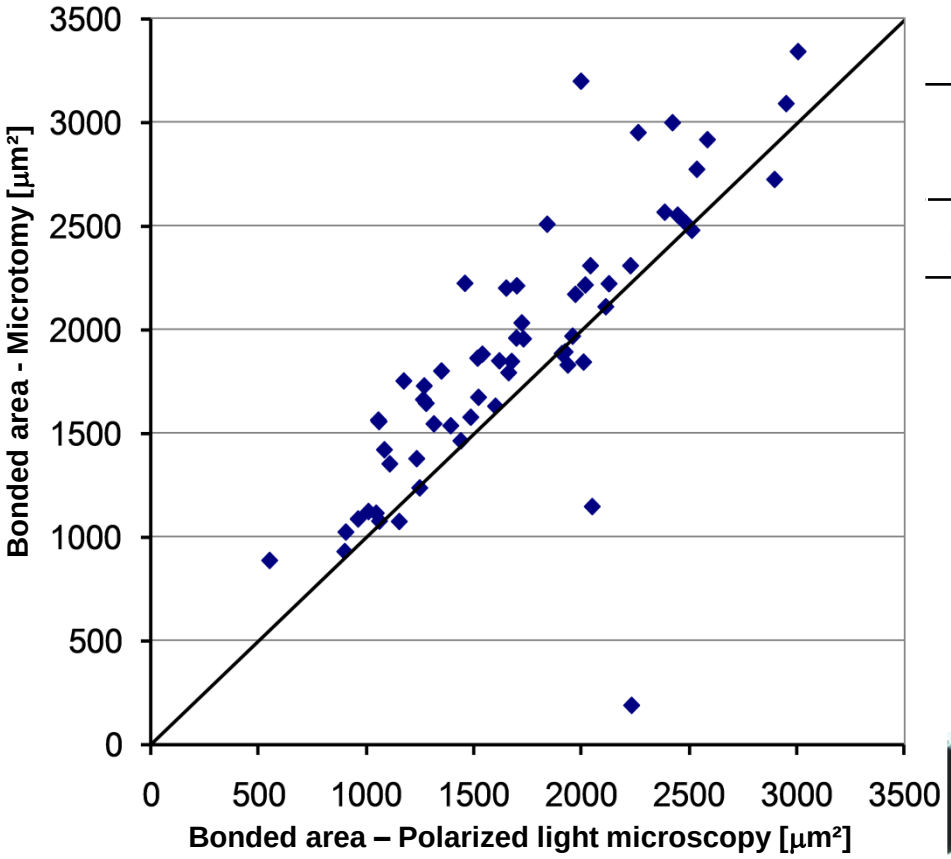


	Polarized light microscopy	Microtomy
Bonded area	1563µm²	1433µm²

Average deviation: -12,6%

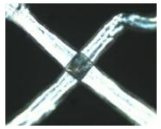


Results beaten pulp (9000PFI)



	Polarized light microscopy	Microtomy
Bonded area	1825µm²	2082µm²

Average deviation: +15,8%



Conclusions

Polarized light microscopy is a suitable tool for measuring the bonded area of single fiber-fiber bonds

- Non-destructive method
- Basis for specific bonding strength measurements

- Deviations between polarized light microscopy and microtome
  - -12,6% for unbeaten pulp
  - +15,8% for beaten pulp

Progress in Paper Physics Seminar

September 4-8
Graz 2011

We hope to see you
in Graz 2011

http://ppps2011.com