



MECH 493 project: Water Transport in Paper

Background and research goal

The desire to improve the performance of drying systems in paper machines, the design of more accurate microfluidic paper-based analytical devices (μ PAD), the enhancement of chromatography kits and many other functions provide strong motivations for detailed studies of paper and water interactions. Studying the water transport in paper during wetting and drying will lead to a better understanding of these multi-phase systems, which is necessary for designing and improving systems using the transport of moisture in paper.

There are many parameters affecting water transport in paper such as fiber orientation, porosity, paper type, mechanical loading, impurities/obstacles etc. (Fig. 1). In the current study we focus on the effect of the paper structure on water transport during wetting and drying. First, the effect of fiber orientation on water transport will be carefully studied for both wetting and drying. Then hydrophobic obstacles will be created in paper, and the effect of these obstacles on water transport will be investigated. An optical method including image processing will be employed to measure the moisture distribution in paper.

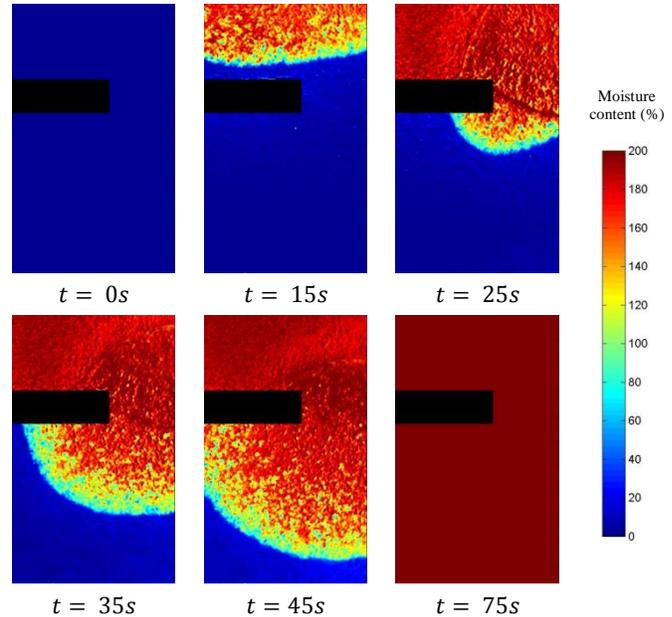


Fig. 1 Moisture content of a paper sample during a wetting experiment for paper with randomly oriented fibers showing the effect of an obstacle (indicated by the black bar), field of view: 0.7 mm by 1.6 mm.

Tasks to be performed by the student

1. The student will prepare the test samples.
2. The student will assemble/fabricate the test setup.
3. The student will use the optical method for data acquisition.
4. The student will post-process the acquired data to calculate the moisture content distribution.
5. The student will analyze, describe and discuss the results.

Skills/Background

- Good background in fluid mechanics and heat transfer
- Ability and motivation for experimental research
- MATLAB knowledge

Facilities and team

The student will work closely with Prof. Green's and Prof. Stoeber's PhD student Farzad Forughi, who is working on paper drying and moisture content measurement and has extensive experience in this field. The student will work with experimental facilities in the Laboratory for Microfluidics and Nanofluids Research (LaMiNaR) in PPC-308 and elsewhere on campus.