

EFFECT OF MOISTURE ON ADHESION AND FRICTION BETWEEN TWO FIBERS

LABORATORY : Institut Lumière Matière
IN COOPERATION WITH : ILM (Institut Lumière matière)

LEVEL : M1 / M2
TEAM(S) : LIQ@INT

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KEYWORD(S) : matériau / Physics / Simulations Numériques

SCIENTIFIC CONTEXT :

Building insulation is a significant contemporary challenge aimed at reducing energy consumption while maintaining reasonable living comfort. Glass wool is commonly used for this purpose, and its ease of use, durability, and adaptability to varying temperature and humidity conditions are crucial current concerns.

In particular, it has been demonstrated that the bending and unfolding properties of a fiber or a bundle of fibers can vary depending on the amount of absorbed moisture [Benusiglio et al., *Soft Matter* 2012, 8(3342)]. When a cluster of fibers is mechanically stressed, several mechanisms may come into play: the fibers may bend and/or slide relative to each other. If water condenses on the fibers, capillary bridges form between the fibers and alter these mechanisms

MISSIONS :

During this internship, we propose to conduct numerical simulations to determine the effect of a small liquid meniscus between two fibers on their adhesion and friction. Depending on the candidate's skills, we will use the software Surface Evolver for this purpose. This software calculates and minimizes the surface energy of the considered geometry. The goal will be to implement the geometry we wish to study (two crossed fibers) within these existing codes and to evaluate how the surface energy varies as a function of an imposed deformation, thereby deducing the corresponding forces. A study will be conducted based on the volume of liquid, the contact angle in the small meniscus, and the elasticity of the fibers. The aim is to compare the obtained results with the experimental data from an ongoing thesis on the subject.

We are, therefore, seeking a candidate with skills in physics, materials science, or mechanics, ideally with an interest in numerical methods or programming. Knowledge of Python would be a plus.

OUTLOOKS :

This internship, located at iLM, will be carried out in collaboration with Saint-Gobain Research.

BIBLIOGRAPHY :

*<https://kenbrakke.com/evolver/evolver.html>

** <https://github.com/fdmatoz/PyMembrane>