ESRF | The European Synchrotron

Master student traineeship proposal

Title: *Elastocapillarity in natural fibers for sustainable material science*

Abstract:

Natural fibers like flax or hemp in combination with bio-based polymer resins are a promising alternative to hard-to-recycle and difficult-to-dispose glass or carbon fiber reinforced composite materials. Imperfect resin infiltration and void defects caused by the complex two-phase flow pattern lead to material weakness limiting their technical application.
While the basic physics (moisture absorption, elasticity, capillarity) of flow in soft porous media are all known, their interplay is not predictable analytically and the attempt of full numeric simulation may be computationally excessive. We use time-resolved X-ray computed microtomography to better understand the rich dynamics of liquid infiltration into soft and fibrous porous material not only in composites, but also other functional textiles in medical care or athletic clothing.

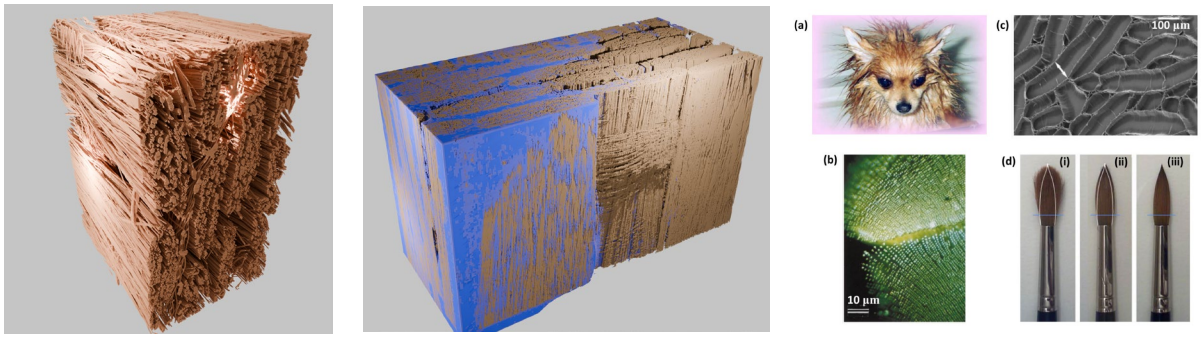

Figure 1: a) 3D rendering of flax fiber bundles, b) snapshot of water filling carbon cloth, c) examples of elastocapillarity

Scientist in charge: *Robert Fischer*

Beamline(s)/Host Group: *ID19/X-ray imaging group (XIM)*

Traineeship supervisor(s): *Robert Fischer, BL scientist*

Access to Instruments/labs/computing/software:
Internship/thesis can include (tbd by student and supervisor):
potentially attending inhouse or user beamtime, big-data image processing and analysis in Python using ESRF HPC resources, high-speed visible light photography in preparation of X-ray beamtime, prototyping and testing of sample setups (3D printing)

Starting date and Duration: *tbd, 6 months (supervisor absent in August)*

Contact : robert.fischer@esrf.fr