3D printing (Melt electrowriting) with bioderived polymer for drug coated wound dressings

Master/Semester project

(Section: Microengineering, Bio Engineering, Materials Science, Robotics)

Melt electrowriting is a quickly advancing additive manufacturing technique which utilizes a large electrical voltage to stretch a polymer melt extruded through the nozzle into fibers down to micron range and precisely deposit them into desired patterns. The obtained product is often termed as a scaffold in literature. These scaffolds are flexible, light and easy to handle. The properties of the produced structures are tailorable by altering the deposition pattern, fiber diameter and the material used for printing.

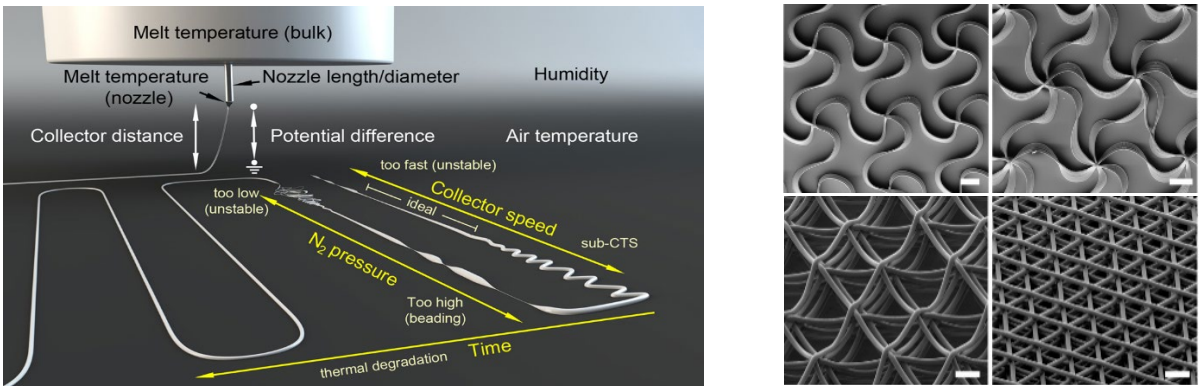

Figure 1. *Overview of the principle and parameters involved in MEW (left)*. Scaffold designs which will be potentially explored *(right).*

A large variety of polymers have been processed using this technique with poly caprolactone (PCL) being the most utilized due to ease in processability and very limited degradation of the polymer at its melting temperature. PCL has been processed into a large variety of designs or patterns (Figure 1A). Depending on the chosen design, the scaffolds have different mechanical properties and induce a different biological response.

At LMIS1, we have MEW printers which are capable of printing polymers with a melting temperature range from 30-250 °C. Our current projects involve printing of PCL and shape memory polymers. The goal is to expand MEW processability to bioderived materials.

This student project will contribute towards establishing 3D printing protocol using commercially available bioderived polymer filaments (poly hydroxy alkanoates (PHA)). PHA is a bioderived polymer which degrades without the release of microplastics in the environment. The aim will be to process PHA based polymer for MEW and fabricate various micro-fiber structures with tunable mechanical properties

Possible tasks:

- Characterization of filament and printed materials using FTIR, DSC, SEM, etc.
- Parametric optimization of melt electrowriting.
- Coating of printed materials with drug/polymer composite.
- Study the drug release behavior.

Contact: Biranche Tandon *(biranche.tandon@epfl.ch)*

[1] Robinson *et al* (2019) Advanced Functional Materials, volume 29, Issue 44.
[2] Hochleitner *et al* (2016) BioNanoMaterials, volume 17, Issue 3-4

École polytechnique fédérale de Lausanne

Microsystems Laboratory 1
(Prof. J. Brugger)

EPFL STI IMT LMIS1
(Batiment BM)
Station 17
CH - 1015 Lausanne

Phone :
E-mail : biranche.tandon@epfl.ch
Office : BM 3.109