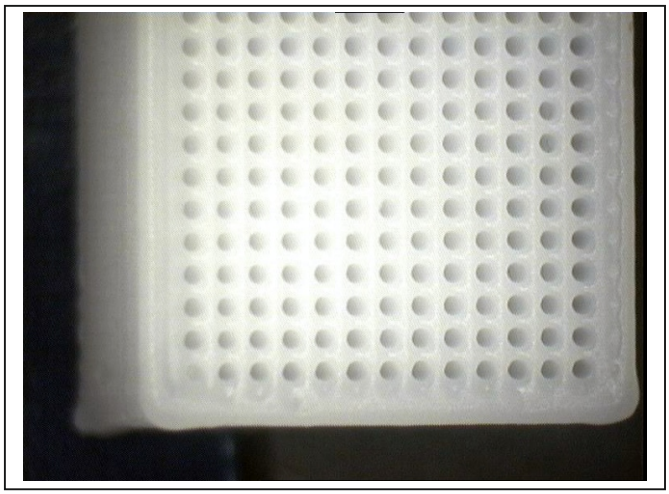
Polycaprolactone Scaffolds

Polycaprolactone (PCL) is a biodegradable polyester with a low melting point of around 60°C. PCL is degraded by hydrolysis of its ester linkages in physiological conditions (such as in the human body) and has therefore received a great deal of attention for use as an implantable biomaterial. It is being investigated as a scaffold for tissue repair via tissue engineering.

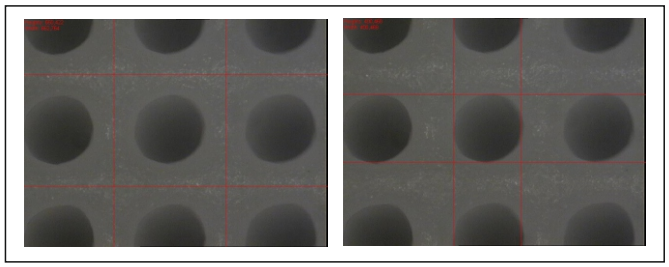
Pneumatic Printing

Pneumatic printing from cartridges is the most straight forward way to create PCL scaffolds. PCL is available at different molecular weight, the print parameters need adjustment accordingly.



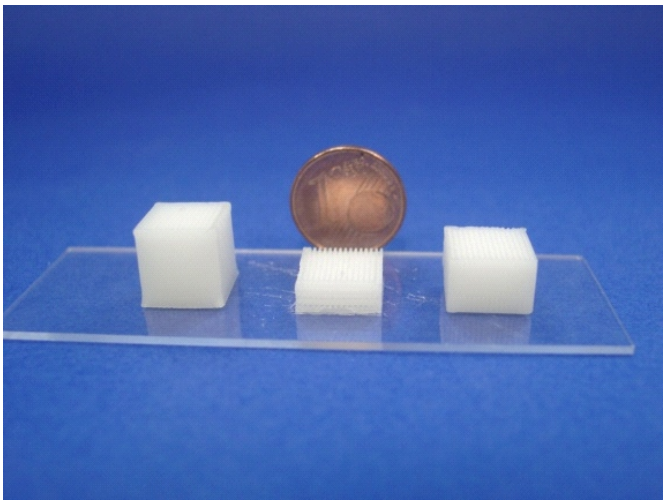
The GESIM BioScaffolder 3.1 can be equipped with cartridge heaters and shielded dispense nozzles. The picture shows a cubic PCL scaffold structure.

Edge length:	10 mm
Layer height:	50 µm
Number of layers:	200
Nozzle diameter:	250 µm



The microscopic images show a pore diameter of 400 Micrometers (right) and a center-to-center distance between adjacent pores of about 650 Micrometers. The minimum strut width is in the range of 100...200 Micrometers.

Cubes of PCL at a molecular weight of 14,000. The cubes have a dimension of 10 mm by 10 mm. The height is 10 mm, 3 mm and 7 mm (Left to right).



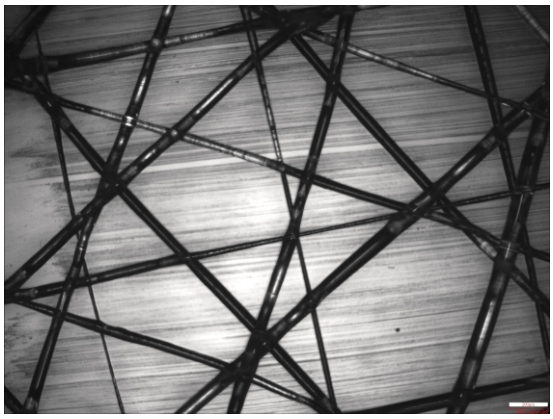
June 2015

Melt Electrospinning (Under development)

Melt electrospinning (MES) uses an electrical charge to draw very fine (typically in the micrometer range) fibres from a liquid or melt polymer. Electrospinning shares characteristics of both electrospraying and conventional solution dry spinning of fibers. Depending on the experimental setup arbitrary and regular patterns can be achieved.

The optional module for BS3.1 comprises a high voltage generator. Further particular substrate supports and dispense nozzles will be required for the regular deposition of thin fibres accordingly to the gcode provided by the scaffold generator.

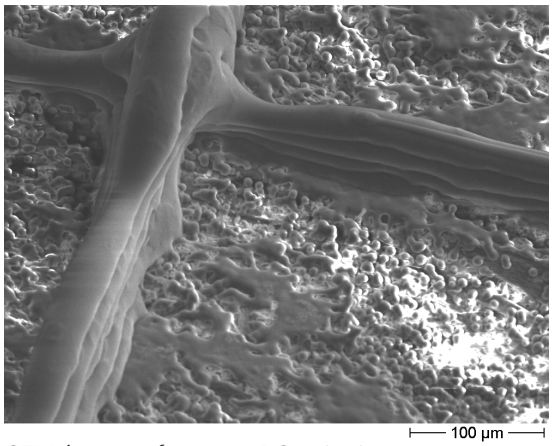
Preliminary results:



Multilayer PCL scaffold deposited by MES

The spun scaffold consists of stacked layers, rotated at 30 degree each one. Printing was done with PCL 14,000 at 100 °C and 10 kV.

The strut width of the bottom layer is 20 microns, the top layer strut width is 100 microns.



SEM image of a spun PCL strut

PCL 14,000, 15 kV, 100 °C, strut width is between 20 and 40 microns.

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