Revealing Fibre Architecture

Electro-spun fibre scaffolds have become essential across biomedical and industrial applications due to their tuneable properties, including fibre diameter, alignment, and porosity. Polycaprolactone (PCL), a biodegradable polyester, is frequently electro-spun to create fibrous networks suitable for applications such as tissue engineering, wound healing, and drug delivery. Accurately characterising the morphology and distribution of these fibres is vital for evaluating their functional performance.

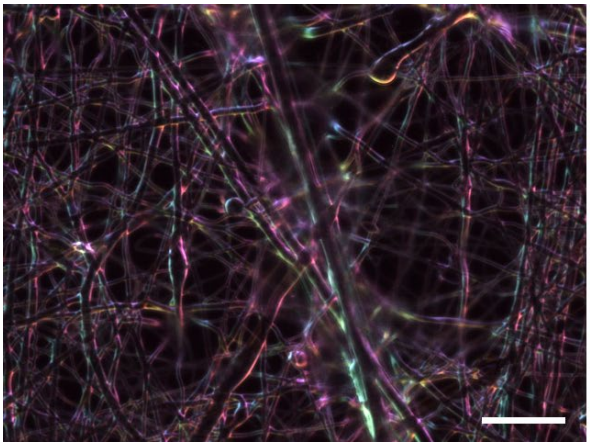
In this comparison, both HaloMicroscopy and Scanning Electron Microscopy (SEM) produced visually similar images of the fibrous mat, clearly resolving individual strands and network texture. However, SEM requires vacuum conditions and extensive sample preparation, including coating, whereas HaloImaging is performed under ambient conditions with no modification to the sample.

Structural Visualisation of Electro-spun PCL Fibre

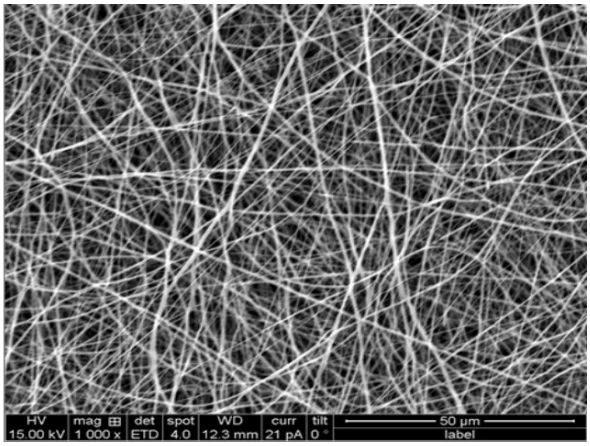
The sample imaged with HaloElement in this study is an electro-spun PCL mat composed of randomly oriented fibres forming a continuous fibrous network. The image clearly resolves individual strands and their intersections, capturing the overall texture and structure of the mat.

An SEM image from the literature is included for comparison, representing the typical appearance of electro-spun PCL under high-resolution surface imaging. Despite differences in imaging method and source, the HaloImage closely matches the structural features seen in the SEM image, including fibre alignment and network layout.

Comparison of electro-spun PCL fibre mats using HaloMicroscopy (this study) and SEM (literature):



HaloImage of electro-spun PCL fibres showing detailed network structure captured under ambient conditions without any coatings, with clear visualisation of fibre alignment and intersections. (Scale bar = 20 µm)



SEM image of electro-spun PCL fibres with as sputter coated gold coating showing a dense, randomly oriented network.
Image from K.S. Athira *et al.,* J. Polym. Biopolym. Phys. Chem., 2014.

This comparison demonstrates that key structural features of electro-spun PCL fibres can be rapidly and reliably visualised, making it well suited for use in Quality Control (QC) settings. The ability to assess fibre continuity, alignment, and overall network uniformity without sputter coating metal films on the sample or elaborate preparation enables fast screening of multiple samples during production. As electro-spun materials continue to scale, such efficient visualisation methods can play a critical role in maintaining batch-to-batch consistency and supporting streamlined QC workflows. Further, HaloMicroscopy operates equally well in liquids allowing for the visualisation of these fibre mats with live cells or tissue engineering applications.