ESRF	**Experiment title:** **Spider silk for nerve regeneration: why do Schwann cells prefer certain silk types?**	**Experiment number**: SC-5005
Beamline: ID13	**Date of experiment**: From: 18.11.2020 to: 21.11.2020	**Date of report**: 01.03.2021
Shifts: 9	**Local contact(s)**: Manfred Burghammer	*Received at ESRF:*

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Report:

Nanobeam X-ray diffraction (nanoXRD) experiments on different spider and *Bombyx mori* silk samples were carried out in remote mode at the ID13 beamline in the context of experiment SC-5005 (M.Burghammer local contact). Due to COVID-19 no presence beamtime was possible and the in-situ tensile tests had to be skipped. The beamtime was also shortened for this reason.

Nevertheless, with the excellent support by the beamtime staff and the local collaboration partner, the experiment went very well and a great variety of silk fibers could be measured. The samples included differently pretreated *Nephila edulis* dragline silk (native, Ethanol and UV treated and autoclaved), *Nephila inaurata* dragline silk (native and laser modified), *Avicularia avicularia* attaching silk, *Phidippus regius* silk, *nuctenea umbratical* silk, *Loxosceles latea* silk, as well as *Bombyx mori* (native and degummed). All silk samples were mounted on a frame with a Si_3N_4 membrane.

By using fast scanning and short exposure times of 50 ms we could successfully limit beam damage. Also, in later SEM measurements, no sign of beam damage could be observed. This is very promising also for experiments planned in the future. For all the mentioned samples we performed fly scans on in average two different positions. Both SAXS and WAXS measurements could be realized with different measurement parameters.

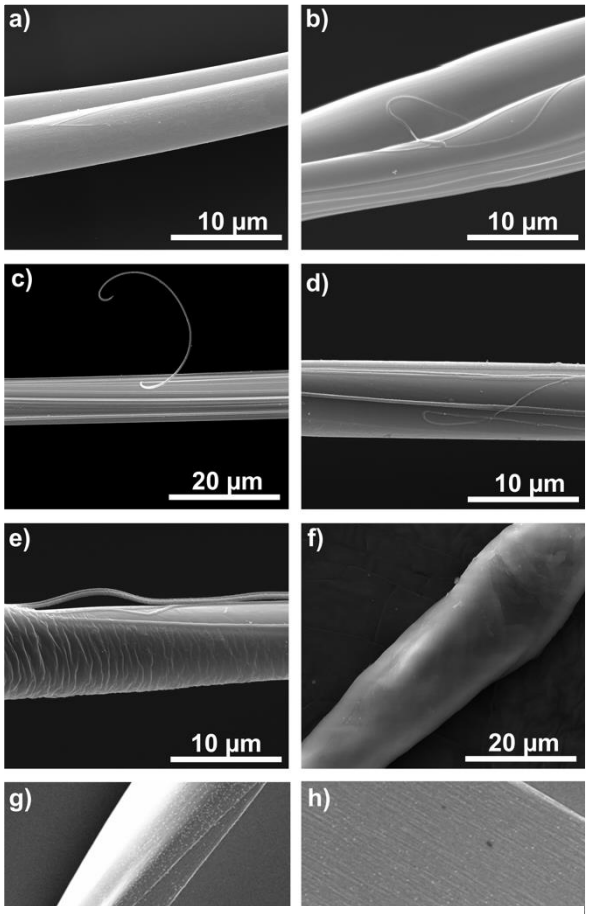

Figure 1. *SEM images with gold sputtered samples and 20 kV (10 kV for g,h) of a) Nephila edulis (autoclaved), b) Nephila edulis (Ethanol treated), c) Nephila edulis (UV treated), d,e) Avicularia avicularia, f) Nephila inaurata, g,h) Loxosceles latea. Images were recorded after the nano XRD measurements. No beam damage was observed.*

In addition, Christian Riekel (directly at ESRF) and our group (at BOKU) carried out some SEM measurements of the samples after the beamtime. Images of some are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

First steps in data evaluation show that the beamtime was very successful and a broad set of data could be gained.

As an example, data from a measurement of *Nephila edulis* dragline (autoclaved) is shown in Figure 2. Due to the low scattering intensity in individual points, we summed up intensities along the fibers, but still kept the spatial resolution perpendicular to the fiber axis (see lines in Figure 2b). In the caked scattering images (intensiy displayed versus Q on the horizontal axis and versus azimuth Φ on the vertical axis) show clear diffraction peaks in the WAXS range and also streaks in the SAXS range. Slight differences can be observed at different positions in the fiber.

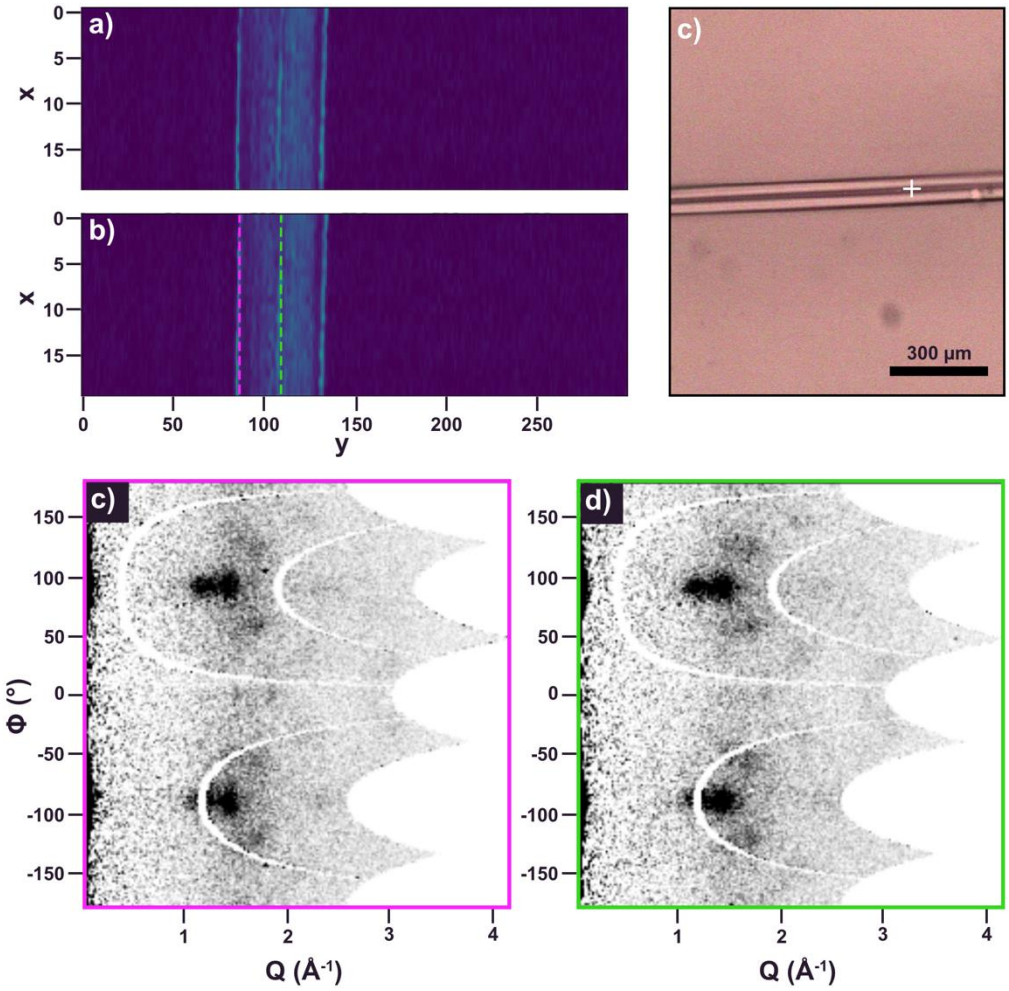

Figure 2. *Some first steps of data evaluation. a) Fly scan overview of sample Nephila edulis dragline autoclaved where clearly two adjacent silk fibers can be distinguished. b) Map from a) with dashed lines, along which the scattering intensities were summed up. c) Microscope image of sample mounted in the beamline, where white cross indicates one measurement position. c,d) Caked scattering patterns after normalization to incident Beam Intensity I_0 and background subtraction (color of the frame refers to area in b)).*

Since one aim of our project is to identify properties of the different silks which are responsible for the attractiveness of them to Schwann cells, we will correlate the individual results of different silks in our ESRF beamtime with their performance in cell culture. More detailed evaluation is ongoing and a publication for a scientific journal is being prepared.