ESRF	**Experiment title:** Local chitin fibre orientation in cricket cuticle and its relation to performance of insect mechanoreceptors	**Experiment number**: SC-1893
Beamline: ID13	**Date of experiment**: from: 06.11.2005 to: 10.11.2005	**Date of report**: 14.02.2007
Shifts: 9	**Local contact(s)**: Dr. Christian Riekel	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

O. Paris[1]*, R. Seidel[1]*, Gourrier[1]*, George Jeronimidis[2]

[1]Max Planck Institute of Colloids and Interfaces, Department of Biomaterials, Potsdam, Germany

[2]Centre for Biomimetics, School of Construction Management and Engineering, University of Reading, UK

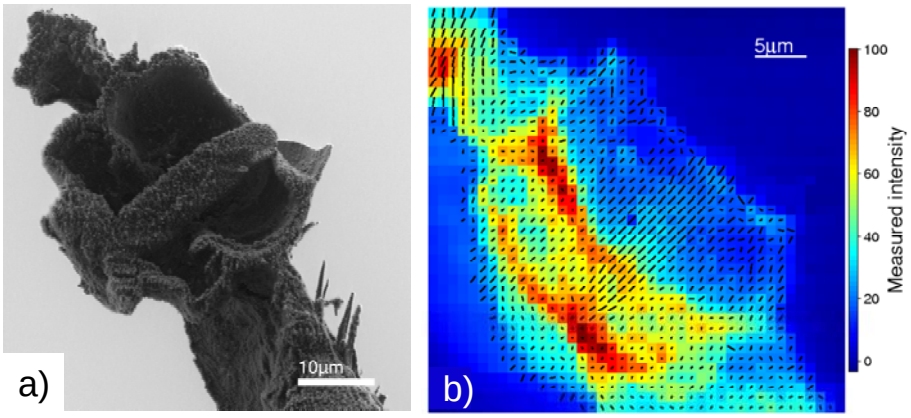
Report:

Paper in press: Micron (2007), doi:10.1016/j.micron.2007.02.004

Robin Seidel, Aurélien Gourrier, Manfred Burghammer, Christian Riekel, George Jeronimidis and Oskar Paris *Mapping fibre orientation in complex-shaped biological systems with micrometre resolution by scanning X-ray microdiffraction*

Abstract

A fully automated procedure to extract and to image local fibre orientation in biological tissues from scanning X-ray diffraction is presented. The preferred chitin fibre orientation in the flow sensing system of crickets is determined with high spatial resolution by applying synchrotron radiation based X-ray microbeam diffraction in conjunction with advanced sample sectioning using a UV micro-laser. The data analysis is based on an automated detection of azimuthal diffraction maxima after 2D convolution filtering (smoothing) of the 2D diffraction patterns. Under the assumption of crystallographic fibre symmetry around the morphological fibre axis, the evaluation method allows mapping the three-dimensional orientation of the fibre axes in space. The resulting two-dimensional maps of the local fibre orientations - together with the complex shape of the flow sensing system - may be useful for a better understanding of the mechanical optimization of such tissues.



The Figure shows an SEM image (a) and the corresponding microbeam diffraction map (b) from a cricket flow sensor that was cut just in the middle by a UV micro-laser. The color code in (b) displays the total intensity of the 040 chitin reflection within the detector plane, and the black lines indicate the local orientation of the chitin fibres obtained from the automated analysis of the 2D diffraction patterns.