



	Experiment title: Microdiffraction analyses of keratin fibres	Experiment number: SC640
Beamline: ID13	Date of experiment: from: 10/11/99 to: 14/11/99	Date of report: 1/3/00
Shifts: 12	Local contact(s): Martin Mueller	<i>Received at ESRF:</i>

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Report:

In this study, we have investigated the effects of a mechanical stretching on the molecular structure of hard α -keratin fibres such as human and horse hair, using X-ray microdiffraction on ID13 beamline. Our interest was twofold:

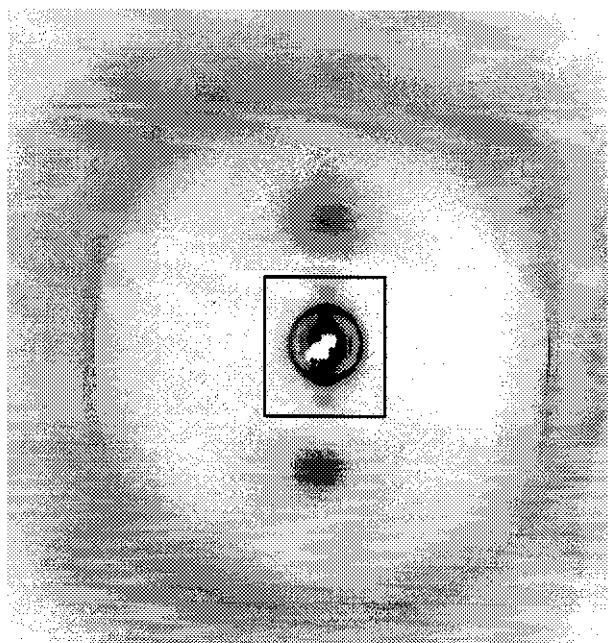
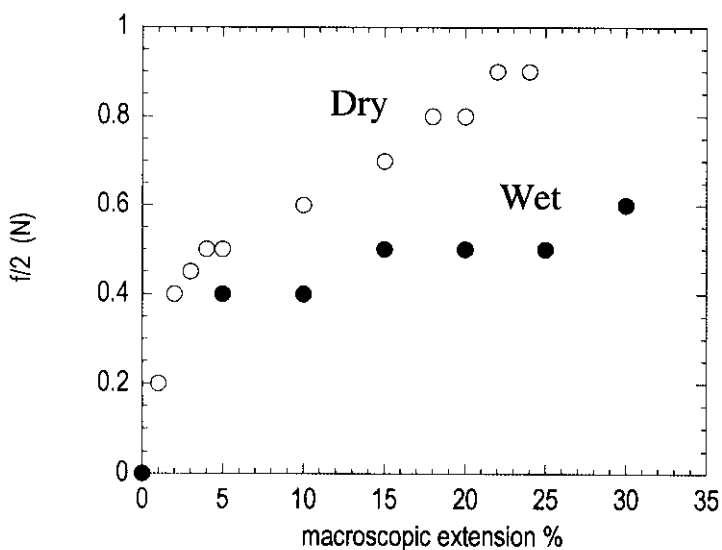
- First, we wanted to observe precisely the α -helix to β -sheet transformation which is supposed to occur upon stretching the keratin fibre.
- Second, we wanted to assess the effect of water on the mechanical properties of a composite material such as keratin fibres.

We had chosen a specific setting in order to collect both SAXS and WAXS diffraction features between 3 to 100 Å. This allowed us to correlate the modifications of the various levels of structure. At the end of this report is shown a typical diffraction pattern of natural hard α -keratin fibre (human hair). The fibre axis is horizontal and the centre of the pattern has been enlarged (box).

During this study, we have performed force-extension measurements using our own stretching setup. The various scattering features were followed by scanning perpendicular to the fiber axis with a 10 μm in diameter beam at an energy of 13 keV. Our aim was to take into account the various structural zones that had been observed in keratin fibres during our last study on ID13 beamline [1].

Our results are consistent with a mechanical unravelling of coiled coil domains which can be delayed by wetting the fibre. Plasticizing effect of water has been observed at all available structural scales and is perfectly visible on stress/strain curves (see below).

New results were obtained which give a new insight on the behaviour of the two phases (matrix and microfibrils) with and without water. An article based on this study is in preparation.



[1] B. Busson, P. Engström and J. Doucet, "Existence of various structural zones in keratinous tissues revealed by X-ray microdiffraction", *J. Synchrotron Rad.* (1999), **6**, 1021-1030