Stretching experiments on wood and silk with controlled humidity content

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Biological materials are hierarchically structured on many different length scales. On the mesoscopic scale, a composite structure with crystalline regions embedded in a softer disordered matrix is found. The matrix is accessible to water. The water content of biomaterials strongly influences their mechanical properties. In the case of wood, this is of major importance for the use of wood as construction material.

We investigate the structural changes of cellulose fibres [1], wood [2] and silk fibres [3] under mechanical stress *in situ* by means of synchrotron radiation X-ray microdiffraction. In our sample chamber for stretching experiments, we can control the water content of the sample by varying the humidity of the air in the chamber. Our results allow for developing microscopic models for the different deformation mechanisms of dry and wet biomaterials. In this context, the soft, water-accessible matrix plays a crucial role.

References

[1] – K. Kölln, I. Grotkopp, M. Burghammer, S. V. Roth, S. S. Funari, M. Dommach, M. Müller, *J. Synchr. Rad*. **12**, 739-744 (2005).

[2] – I. Grotkopp, Influence of water on the mechanical properties of wood investigated using X-ray and neutron scattering, PhD thesis, Kiel, 2006

[3] – T. Seydel, K. Kölln, I. Krasnov, I. Diddens, N. Hauptmann, G. Helms, M. Ogurreck, S.-G. Kang, M.M. Koza, M. Müller, *Macromolecules*, in press.