1.4.17. DETERMINATION OF THE SPATIAL RESOLVED RELATIVE INNER SURFACE DENSITY BY USING ORIENTATION ANGLE DEPENDENT X-RAY REFRACTED BEAM IMAGING

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The refraction effect is caused by local changes of the light propagation speed which occurs by the passing of light from one medium into another. Thus the effect will be observed on material borders. Thus X-ray refracted beam imaging is a proper method for testing lightweight materials with low absorption contrast like composite materials or ceramics. The X-ray refracted beam imaging is showing the relative inner surface density C of the material. M. Hentschel et al. developed the method of refracted beam imaging. The method was derived from the Small Angle X-ray Scattering method (SAXS), a well known method in colloid chemistry. An example of a SAXS measurement is shown in fig. 1. The main intensity of the scattered beam can be observed perpendicular to the fibre orientation. The transmitted beam is blanked out.

To obtain the spatially resolved information about the relative surface density C, a special setup was developed (see fig. 2). The X-ray beam is collimated to a fan beam by using a Kratky collimator. By hitting the object the primary beam will partially be refracted. At the flat panel detector the refracted and the transmitted beam will be acquired simultaneously. The object will be scanned line wise.

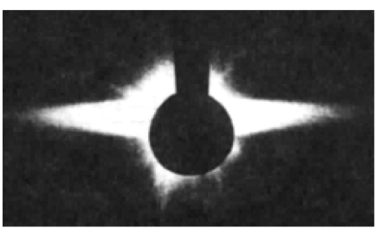

Fig. 1. SAXS measurement of an SiO_2 fibre
[M. Hentschel et al., Acta Cryst.(1987). A43, 506-513]

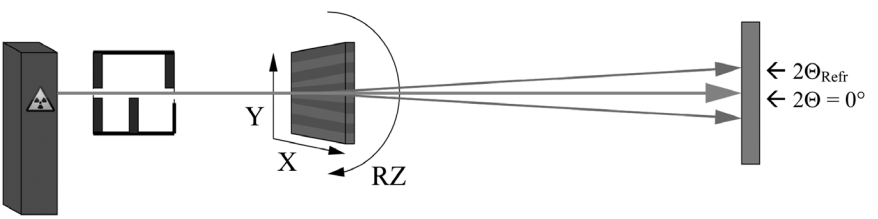

Fig. 2. Setup for spatial resolved refracted beam imaging

In fig. 1 the orientation dependent distribution of the refracted beam is depicted. As our setup is performing line wise scans, any orientation dependent information is suppressed apart from the information about the single orientation selected. To obtain some information about the orientation of the observed inner structures, the sample has to be rotated. The resulting images will be merged for an descriptive visualization of the relative inner surface densities of the structure borders. The method, results and discussion will be presented.