Supporting Information:

Relationship between performance and microvoids of aramid fibers revealed by 2D SAXS

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Schematic diagram of 2D SAXS full fitting method

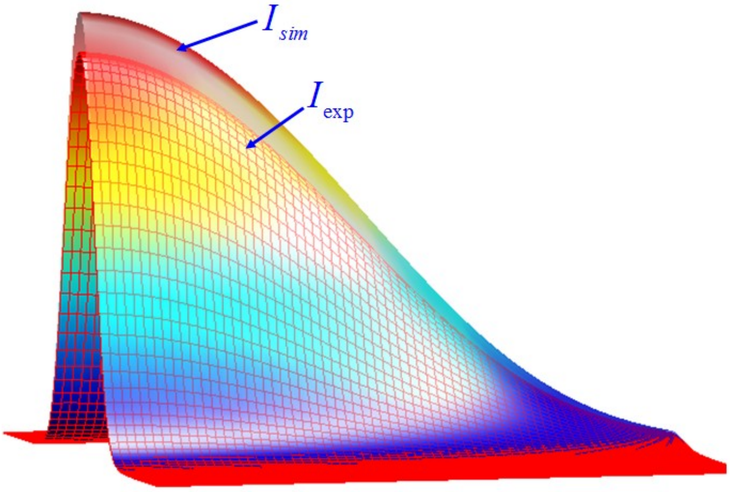

Figure S-1. Schematic diagram of 2D full pattern fitting. Regulating the parameters involved in the model and making the simulated 2D SAXS pattern gets closer and closer to the experimental 2D SAXS pattern. (Intensity is shown on a logarithmic scale).

Thickness of the fiber exposed on the small point of X-ray source

Winding a fiber onto a frame is an effective way of sample preparation (Hermans *et al.*, 1959), which may measure the thickness of the fiber. But for the present research, the fiber is a little loose and the X-ray spot size is relatively small at the location of sample stage. Therefore, the thickness of the fiber exposed on the small point of X-ray source fluctuates inevitably.

The thickness of the sample could also be measured by the primary beam attenuation factor, using the values measured by the ionize chamber before as well as after the fiber. But this comparison need a prerequisite, that is, each bundles of the fiber is assumed to has the same absorption coefficient per volume. In the present research, the aramid fiber has different performance, therefore, we are not very confident that each fiber has the same absorption coefficient per volume. Additionally, the thickness of the fiber only affects the intensity of the scattering, but not the shape of the scattering pattern. If we do not discuss the content of the scatterer, it is reasonable to ignore the thickness of the sample. Therefore, the values acquired by the ionize chambers were only used to calibrate the air background scattering.

Smearing effect of the point spread function and beam profile

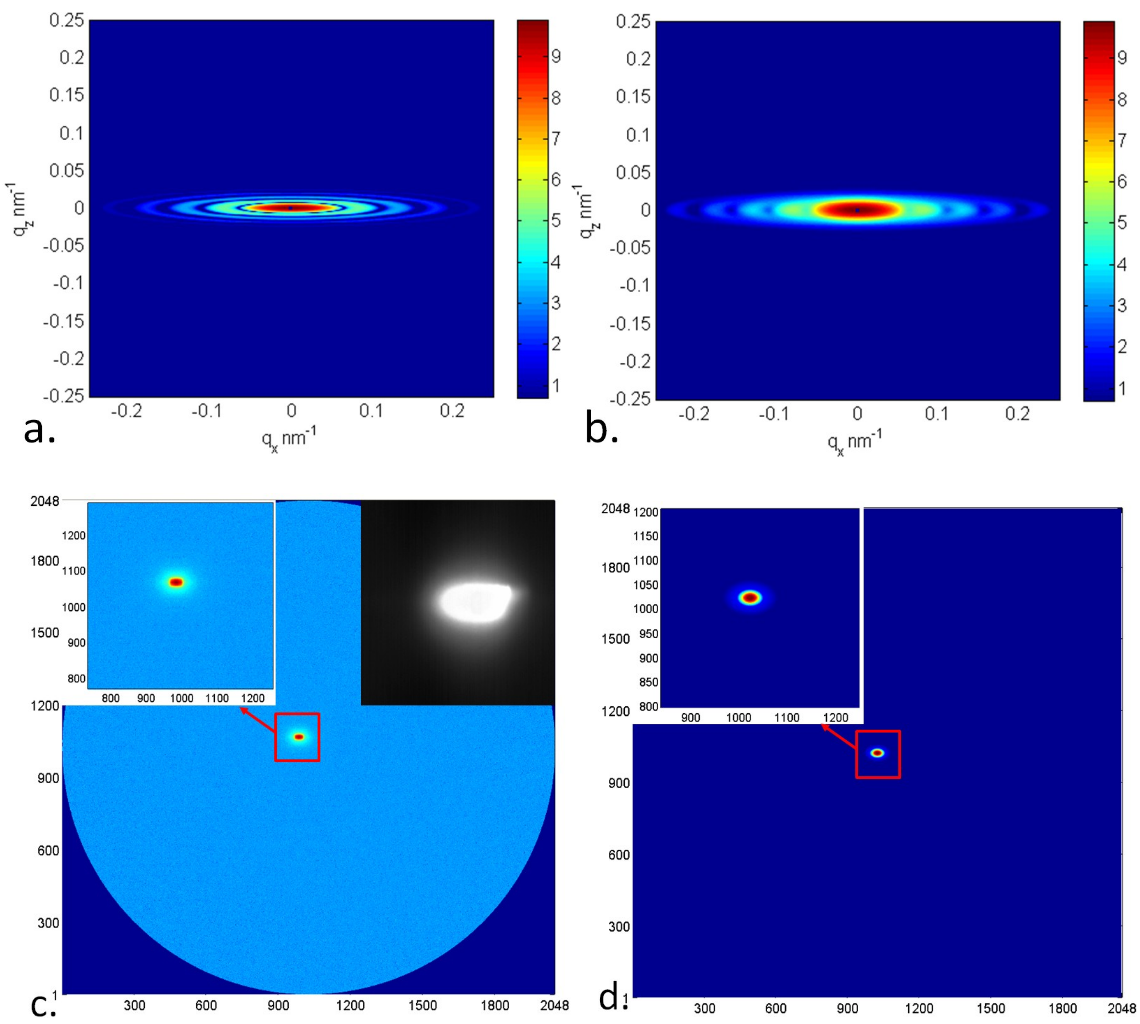

Figure S-2. 2D SAXS scattering pattern (a) without and (b) with smearing of the PSF and the non-ideal point light source. c) is the beam profile recorded by the CCD and the inserted figure is acquired by an X-ray camera Marcam™. d) is the simulated beam profile with the parameters listed in Table 2 in paper. Intensity is shown on a logarithmic scale.

The real beam profile exposed on the CCD is depicted in Fig. S-2c, where the left inserted figure is the enlarged view of the real beam profile, and the right is the beam profile acquired by an X-ray camera Marcam™. It must be mentioned that the real beam profile and the experiments we have conducted were not acquired at the same time, so the beam profile changed more or less. Therefore, a simple comparison between the real beam profile and the calculated beam profile which has convoluted with the PSF, as depicted in Fig. S-2d, was conducted instead of a 2D Gaussian fitting. As shown in Fig. S-2c and Fig. S-2d, the shape and size of the calculated beam profile got very close to the real one, which indicates that the value to describe the beam profile and PSF is reasonable.

The scattering curves were sliced along the meridional and the equatorial direction, as shown in Fig. S-3a and S-3b, from which we can see that the smearing has more effect on the meridional direction than on the equatorial direction.

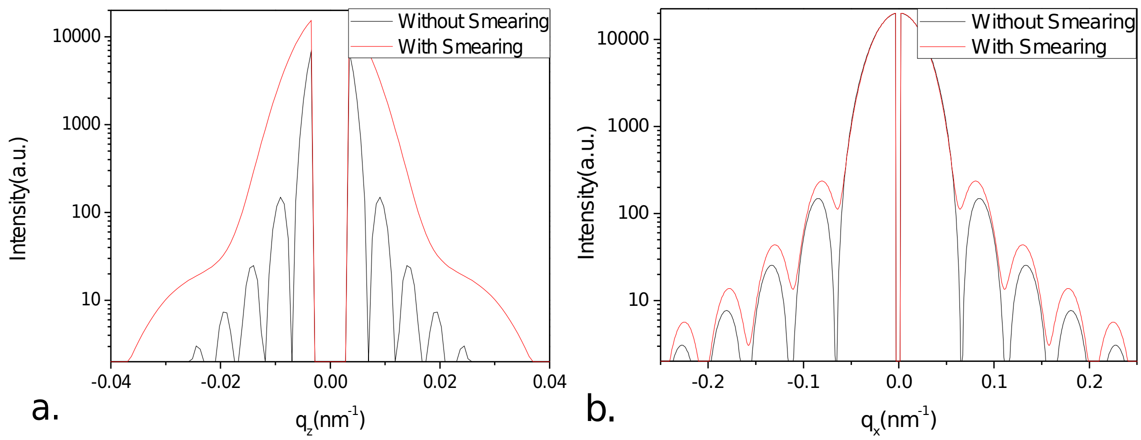

Figure S-3. Slice along (a) the meridional and (b) the equatorial without or with PSF.