Supplementary Material

β *radiographs*

Figure 9 shows two β-radiographs recorded for the uncompressed (a) and the compressed paper (b). The color code indicates the basis weight for each pixel in the radiograph. The mean values obtained for each sample agree well with the nominal basis weight of 100 gm^{-2} of this paper type. The variation in each of the radiographs is quantified with power spectra according to the method of Norman and Wahren (1974). The resulting spectra, given in Figure 10, show the normalized variations of the area weight as a function of the distance between two locations, denoted as wavelength. Marked variations above 10 mm indicate variations at the floc scale. At wavelengths below 1.2 mm, i.e., at distances that can be probed within the field of a view of our μ-CT scans, also marked variations occur (Figure 10(c)). Though the variations found in the compressed (gray and black lines) and uncompressed sample (green lines) are rather similar, there is a trend to slightly larger variations in the compressed sample.

Moreover, further information regarding the influence of the cutout size on local microstructure descriptors is provided in Figures 11 and 12. These figures show the distribution of local microstructure descriptors for cutout sizes of $30\mathrm{\mu}m, 60\mathrm{\mu}m, \ldots, 330\mathrm{\mu}m$. In particular, this additional information complements Figure 8, where mean values and quntiles of the distributions are visualized.

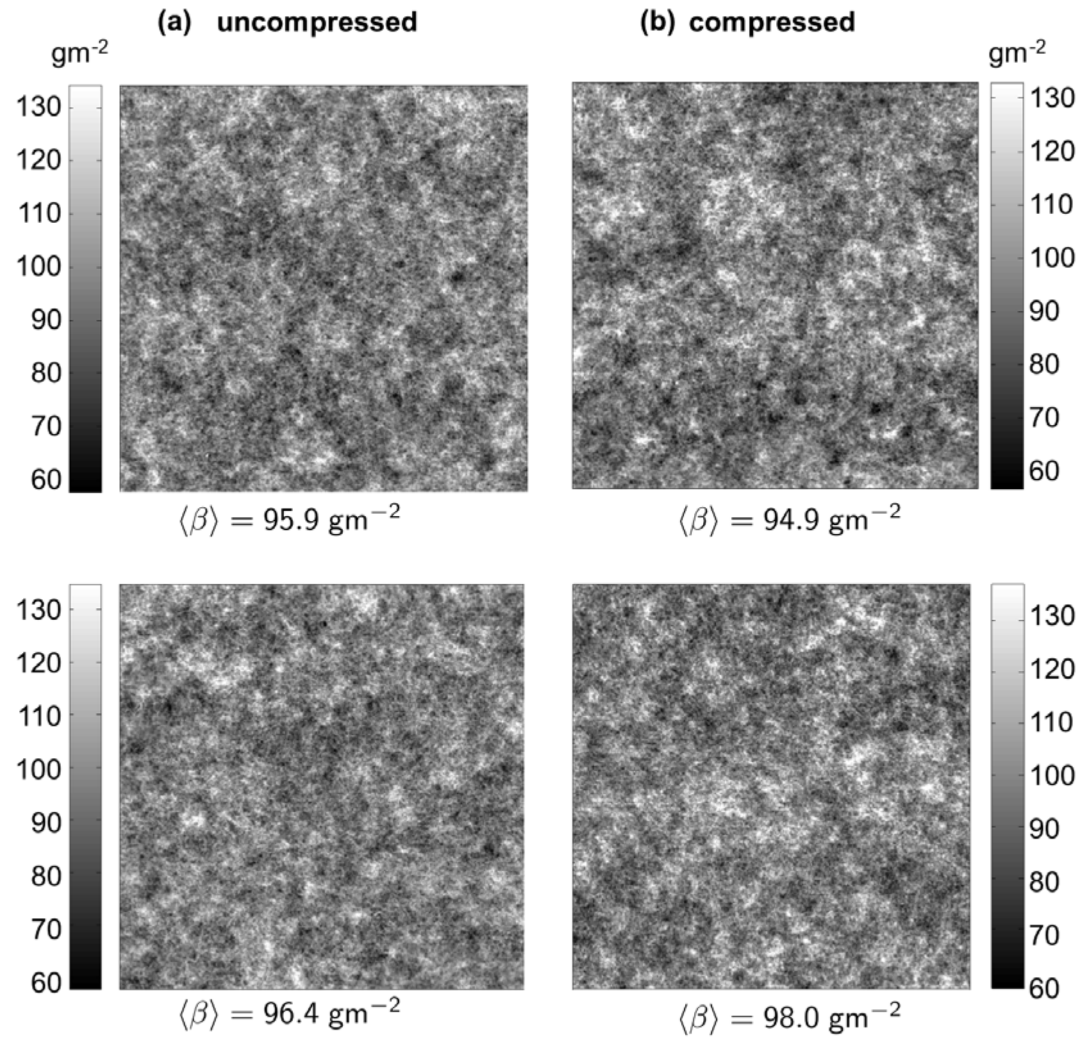

Fig. 9. β-radiographs of two uncompressed (a) and two compressed samples (b) with the mean basis weight $\langle\beta\rangle$. Each radiograph comprises an area of 10×10 cm^2. The greyscale bar indicates the local basis weight.

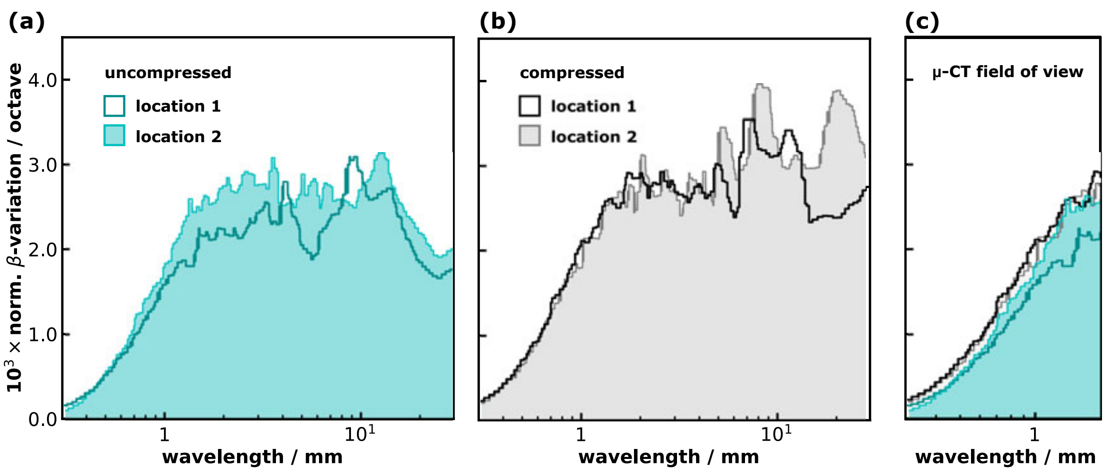

Fig. 10. Power spectra obtained from β-radiographs shown in Figure 9 of the two uncompressed (a) and the two compressed samples (b). Marked normalized variations exceeding 1000/octave in β at wavelength above 1 cm indicate variations in the basis weight on the centimeter scale. (c) Close-up view on the power spectrum in the wavelength range monitored with the μ-CT field of view.

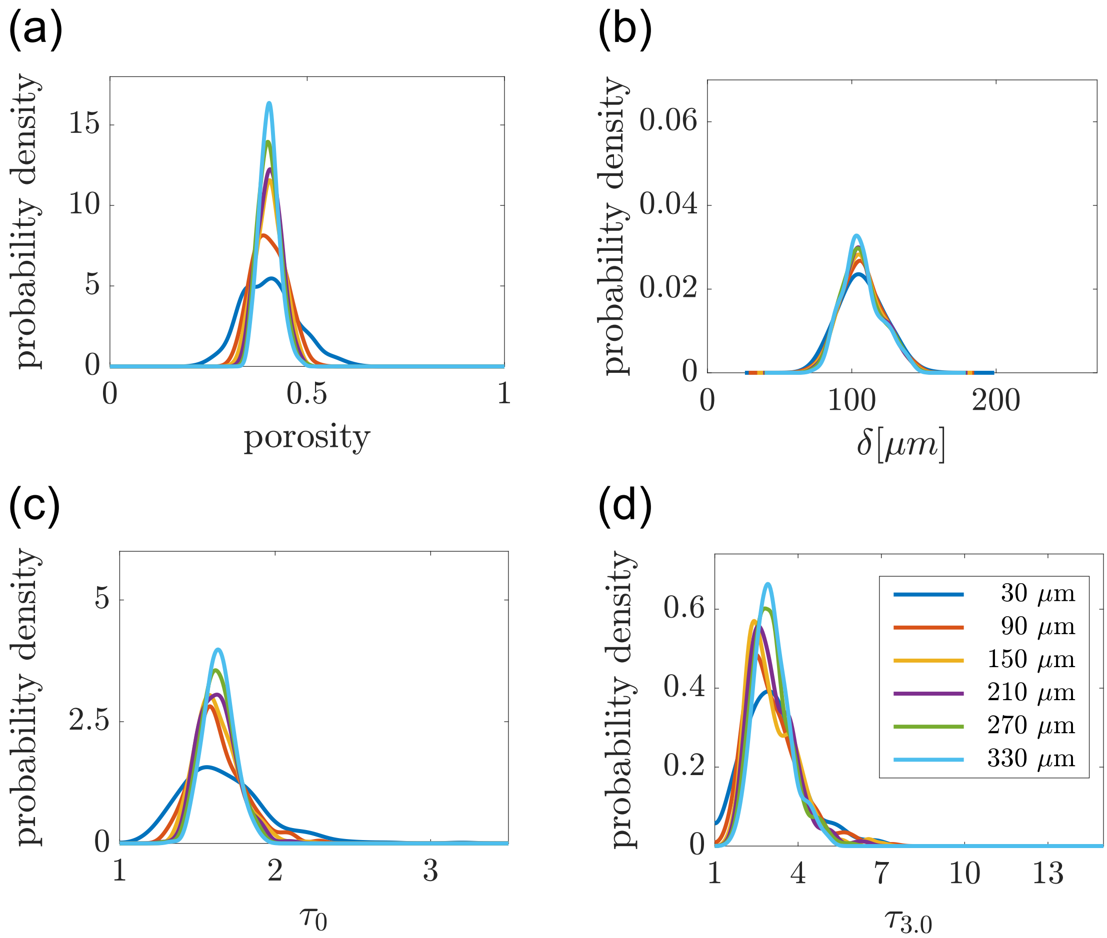

Fig. 11.: Univariate distributions of local porosity (a), local thickness (b), local tortuosities τ_0 (c) and $\tau_{3.0}$ (d) computed from all cutouts of the uncompressed sample. The cutout sizes of 30 μm, 90 μm, $\ldots$, 330 μm are considered.

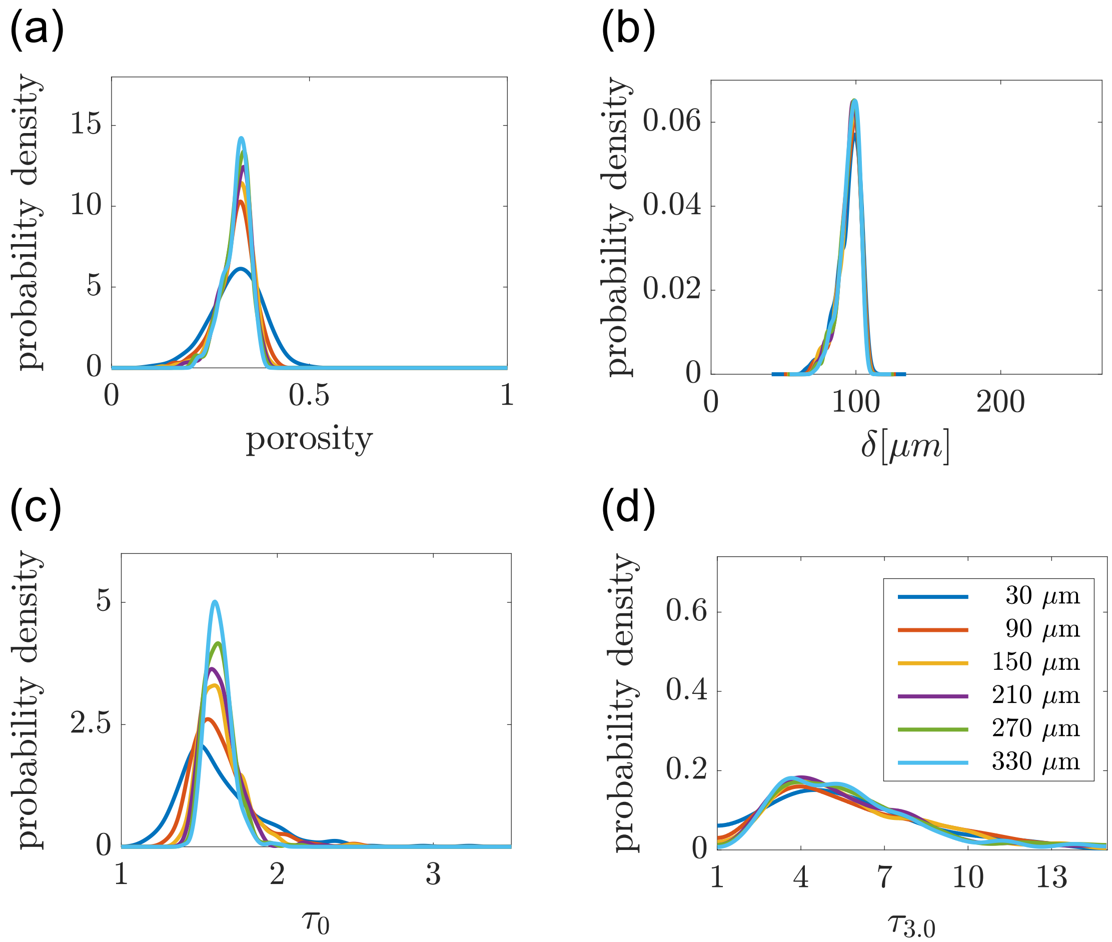

Fig. 12. Univariate distributions of local porosity (a), local thickness (b), local tortuosities τ_0 (c) and $\tau_{3.0}$ (d) computed from all cutouts of the compressed sample. The cutout sizes of 30 μm, 90 μm , ..., 330 μm are considered.