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Initial investigations of hydrating cellulose thin films using GISANS

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Due to its nanoscale architecture, cellulose nanofibrils (CNF) are used in functional materials as building blocks for high-strength materials [1], barrier coatings and functional coatings in thin films for organic electronic applications. One crucial question is the relation between packing of the CNF, porosity and nanostructure in the range from some nm (fibril diameter) to several hundred nm (fibril length) inside the thin film. The CNF might be of globular morphology or more elongated, depending on the film thickness and surface charge. The knowledge of the nature of porosity of the thin film is crucial for subsequently functionalizing the pores by filling with functional polymers. In order to approach a determination of the CNF nanostructure inside the thin film , we performed grazing incidence small angle neutron scattering (GISANS) at KWS-1 (JCNS ,Garching). The thin film was prepared by airbrush spray coating [2]. We used TEMPO CNF with a surface charge of 1000 µmol/g. The CNF was dispersed in deuterated water; the dispersion was subsequently sprayed on a cleaned, hydrophilic silicon substrate. Using an environmental cell, we investigated the uptake of deuterated water in the 200 nm CNF thin film. We present here initial GISANS results on the nanostructural changes during hydration and drying of the CNF thin films. [1] Håkansson et al., Nat. Commun. 5, 4018 (2014;[2] Roth, J. Phys.: Condens. Matter 28, 403003 (2016)

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