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Multi-scale Characterization of Cellulose TEMPO-Nanofiber Suspension YIMIN MAO, Dept. of Materials Sci. and Eng., Univ. of Maryland, College Park; NIST Center for Neutron Research, National Institute of Standards and Technology, KAI LIU, BENJAMIN HSIAO, Chemistry Department, Stony Brook University — Cellulose nanofiber (CNF) suspensions were characterized at multiple length scales. CNF suspension was prepared by applying 2,2,6,6-tetramethyl-1- piperidinyloxy (TEMPO) oxidation method to dry wood pulp. TEMPO method was able to produce fine fibers with a cross section dimension being in the order of magnitude of several nanometers, and length being several hundred nanometers. The surface was negatively charged. Charge density was characterized by Zeta-potential measurement. Both small-angle X-ray (SAXS) and small-angle neutron (SANS) methods were employed to examine fiber dimensions in solution. Data fitting indicated that newly-developed ribbon model was able to capture the essence of CNFs geometry, which is also computationally economic. The rectangular-shaped cross section was consistent to cellulose's crystal structure; and was able to provide insights into how cellulose crystals were biologically synthesized and packed in nature. Multi-angle dynamic light scattering (DLS) was used to study CNF's diffusion properties. A strong scattering-angle dependence of auto-correlation function was observed. The characterization is useful to understanding suspension quality of CNF, and can provide guideline for follow-up research aimed for a variety of applications.

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