



PREPARATION AND TOUGHENING OF NANOFIBRILLATED CELLULOSE NANOPAPER

Houssine Sehaqui,^a Andong Liu,^c Qi Zhou^{a,b} and Lars Berglund^{a,c}

^aDepartment of Fibre and Polymer Technology, Royal Institute of Technology, SE-100 44 Stockholm, Sweden, ^bSchool of Biotechnology, Royal Institute of Technology, AlbaNova University Centre, SE-106 91 Stockholm, Sweden, ^cWallenberg Wood Science Center, Royal Institute of Technology, SE-100 44 Stockholm, Sweden

Nanofibrillated cellulose (NFC) refers to high aspect ratio fibrils that are extracted from plant resources by a high shear homogenization mechanical treatment. NFC are obtained as a water suspension and have typically a diameter of 5-50nm, a length of few microns and a high surface area exceeding 300m²/g. The surface of the fibrils is rich of hydroxyl groups that forms interfibrils strong interactions through hydrogen bondings which makes NFC a good starting material for strong films (also termed nanopaper) and composites preparation. Nanopaper based structures from NFC have generated huge interests in the last years due to their high strength and stiffness, optical transparency and possibility for surface functionalization. Diverse applications have been proposed for these new materials such as loud speaker membrane,¹ foldable substrate for electronic displays² and batteries.³ In this work, we present a method for preparation of large and smooth nanopaper sheets. This procedure is successful also for the preparation of hybrid nanopaper structures of cellulose nanofibers combined with inorganic nanoparticles as demonstrated for cellulose/montmorillonite nanopaper with as much as 50 percent by weight of inorganic content.⁴ Furthermore, we show how combining a soft cellulose derivative matrix together with NFC can lead to high ductility and toughness nanocomposites with far more superior properties than the neat matrix. Utilization of the presented materials is discussed.