

BIOHYBRID CELLULOSE NANOFIBERS BY ELECTROSPINNING MICROFIBRILS FROM BACTERIAL CELLULOSE

R. T. Olsson,¹ R. H. Krämer,² A. López–Rubio,³ S. Torres–Giner,³ M. J. Ocio,³
J. M. Lagaron³

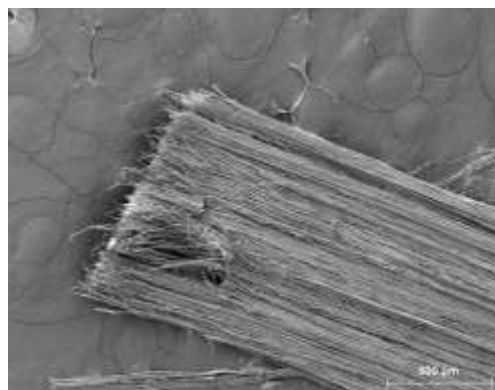
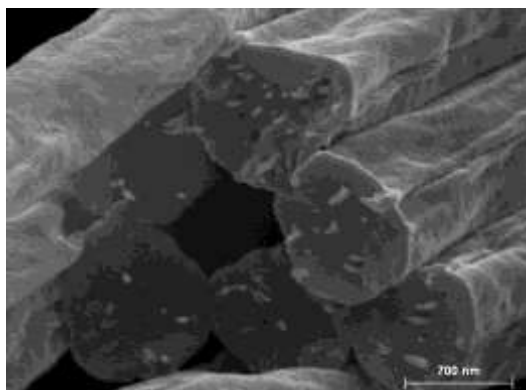
¹School of Chemical Science and Engineering, Fiber and Polymer Technology,
Royal Institute of Technology, SE-100 44 Stockholm, Sweden

²Materials Flammability Group Building and Fire Research Laboratory, National Institute of Standards and
Technology, Gaithersburg, MD 20899-8665, USA

³Novel Mat. & Nanotechnology Lab, IATA–CSIC, 46100 Burjassot, Valencia, Spain
Contact e-mail: rols@kth.se

ABSTRACT

Acidic hydrolysis and selective dissolution of the amorphous segments holding the cellulose microfibrils in their natural configuration allowed for isolation of the load-bearing cellulose crystals (CMF) from bacterial cellulose fiber networks. The CMF solutions were solvent exchanged into solvents suitable for electrospinning of the CMF filler into submicron–sized engineering polymer biohybrid fibers. The electrospun fibers were collected as mats, or aligned fiber yarns on a rotating spool. Microscopy studies of fractured CMF–PMMA fibers revealed well-distributed bundles of microfibrils present in the electrospun fibers, and that the CMF aligned along the core of the electrospun fibers in absence of surface protruding CMF. The absence of aggregates of CMF fibrils was a remaining from the liberated CMF state immediately after aqueous extraction. The preservation of this state during the solvent exchange procedure, in combination with the rapid freezing of the material phases during the composite formation favored the dispersion of the CMF. [1]



Optimization of the CMF–polymer matrix solvent compositions allowed for electrospinning of hybrid fibers with significant contents of microfibrils with respect to matrix material. The highest contents reached an impressive 20 wt.% fibril content in solid fibers of PMMA. X–ray diffraction confirmed that the targeted quantities of cellulose microfibrils (1–20 wt.%) in the thermoplastic matrix. The thermal stability of the composite fibers was improved for cellulose contents up to ca 7 wt.% as compared to the pristine constituents.

The presentation will focus on the obtaining the crystalline cellulose from the source, as well as the morphological and physical characterization of electrospun fiber systems of CMF. This novel strategy for dispersion of cellulose crystal rods possibly allow for the preparation of more mechanically robust nanofiber systems, which may find use in biomedical applications such as functional wound dressings.

The Knut and Alice Wallenberg Foundation (Sweden) and Project MAT2006–10263–CO3 (Spain) are gratefully acknowledged for their financial support.

References:

- [1] Olsson et al. *Macromolecules*, 2010, 43, 4201.