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# Fundamental understanding of nanocellulose properties and nanocellulose-polymer interactions for diverse applications

Anna Olszewska is working as a research scientist aiming for Ph.D. at the Department of Forest Products Technology, Aalto University School of Chemical Technology. Her research goal is to design high-performance materials to replace those that are based on non-renewable resources by learning from nature and using biological components. The bio-component of choice here is nanocellulose (NFC). Nanocellulose has come to public attention mostly due to its great mechanical properties combined with low weight, renewability and biodegradability. Another advantage of nanofibrillar cellulose is that their production does not interfere with the food chain, therefore, they can be considered as socially sustainable raw materials. However, before the nanocellulose can be fully utilized in creation smart and environmentally friendly new high-tech products, it is of great importance to understand the physical and chemical behavior of that still rather new material. Anna's work focuses on fundamental understanding nanocellulosic materials at interfaces by studding their interaction with water, polymers, and polysaccharides to name just few. In her work she is using ultrathin and free standing films made from nanocellulose. By applying Quart Crystal Microbalance with Dissipation (QCMD) and Atomic Force Microscopy (AFM) it became possible to monitor nanofibrils interactions. In her latest work anionically modified NFC and cationic charged block copolymers were studied in order to create highly performing nanocomposite where the majority fraction was constituted from hard and reinforcing NFC fibrils while the block copolymer micelles with rubbery soft core were acting as an energy dissipating domain and they were in minority fraction of the composite (Fig.1). That smart design with a delicate interplay between soft/hard domains allows maintaining the stiffness and strength of the material, while increasing the strain-to-failure. The work will be published in Biomacromolecules and has been done in collaboration with Prof. Olli Ikkala's group from Aalto University.

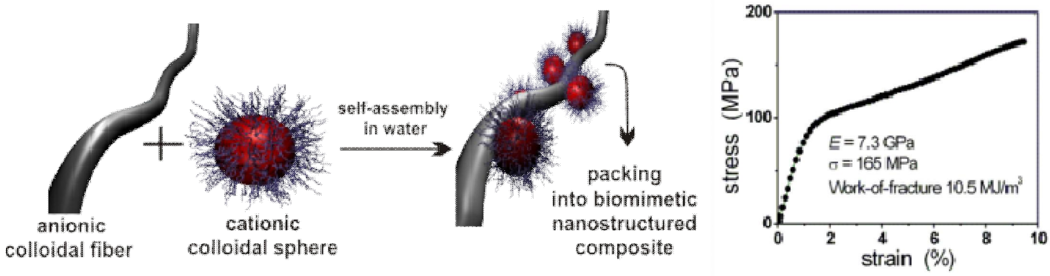


Figure 1. Complexation micelles with anionic nanofibrillated cellulose and their subsequent packing into biomimetic Hard/Soft, and composites and stressstrain curve.