NanoTextSurf Newsletter 1

Second NanoTextSurf workshop in Sweden

The project is progressing according to the scheduled. Promising results were achieved in all four different application areas; membranes, protective textiles, friction pads and abrasive materials. The work is now moving from laboratory scale studies to pilot scale trials. Technical improvements in the existing open access pilot lines have already been executed and novel application procedures in our surface treatment pilotline were tested for these applications. As the series of the dissemination activities of the NanoTextSurf the latest results of the project were disseminated in April at Stockholm University, Sweden. About 30 participants interested in topics were participating the event.

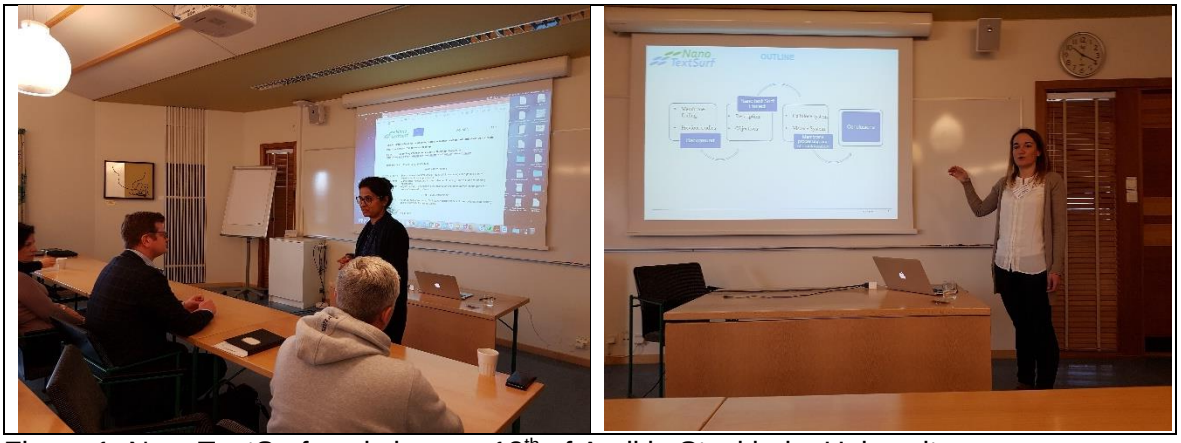

Figure 1. NanoTextSurf workshop on 12th of April in Stockholm University.

The first two presentations were focused on presenting scientific results from cast and foam coating experiments where bionanomaterials were applied on membranes or nonwovens in laboratory scale. The target of the experiments were to keep the original properties of commercial membranes improving antifouling behaviour or capturing ions from the filtered liquids or water by using bio-based coatings. Commercial substrates were successfully functionalized with nanocelluloses via cast coating method. Surface modifications led to improvements of permeability and mechanical properties. Reduced protein fouling tendency was achieved by Cellulose NanoCrystal (CNC) and TEMPO Cellulose NanoFribrils (TEMPO-CNF). Further characterization and studies are needed for a better understanding of the protein-surface interaction as well as for ions adsorption.

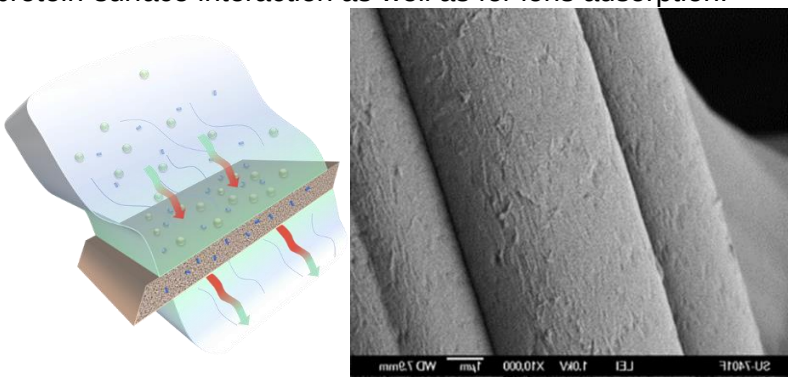

Figure 2. A barrier layer that allows some molecules, ions or small particles to pass through the membrane while some others are stopped (principle of filtering with a membrane or filter, left). Cast coating nanocellulose creates nanotextured surface on cellulose non-woven fabrics (right, the SEM picture of the nanotextured surface).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760601.

Different nanocelluloses, industrial microfibrillated cellulose (MFC) or Tempo Cellulose NanoFibrils (TEMPO-CNF) were successfully foamed with different anionic surfactants. The suitability and efficiency of the used surfactant was defined with the bubble size and amount of bubbles in the foam and most importantly detecting stability of the foam bubbles as the function of time (Figure 3). Viscous fabric was foam coated with TEMPO-CNF. The foam coated substrate was sucessfully tested as a filtration membrane to retain copper ions. The adsorption capacity of coating layer was on the level of 25 mg Cu^{2+} / g coating.

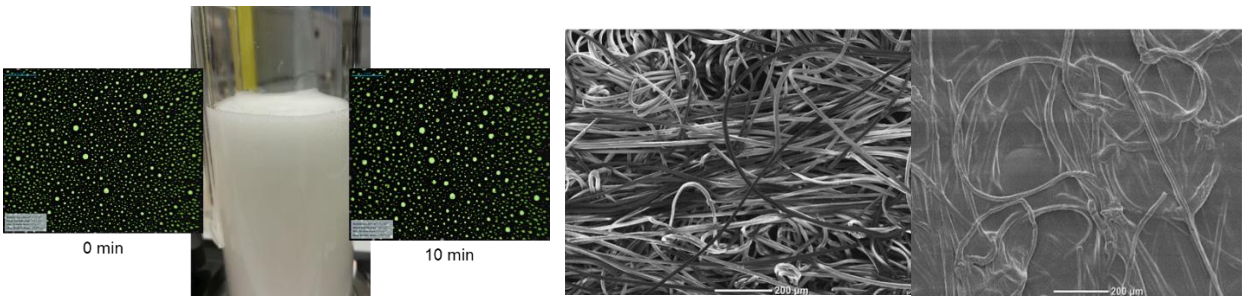

Figure 3. Foam characterisation with the Dynamic Foam Analyzer Krüss DFA100 (left). The SEM pictures of viscous fabric without and with 10 g/m^2 TEMPO-CNF coating layer applied with the foam coating in laboratory scale (middle, right).

The technological developments to tackle the challenges to apply and dry cast coating layers from dilute nanocellulose dispersions in continuous application processes were presented. Nanocellulose films were studied with a small pilot unit via casting on the steel belt. It was possible to cast nanocellulose films on the steel belt and drying was enhanced with the infrared dryer. The more favourable properties of the new steel belt surface and the higher belt speed due to enhanced drying led to better wetting due to the higher shear thinning achieved in the slot die. The dry cast film were peeled off by hand.

Figure 4. Pull off and winding of nanocellulose film in dynamic conditions (left). Casted Films from nanocelluloses (middle, transparent film from TEMPO-CNF and right, translucent film from industrial MFC).

A Master Thesis work was presented, where technologies to measure the thickness of the applied coating layer were compared. Three non-contact methods, NIR spectroscopy, IR thermography, and optical confocal displacement sensing were used to measure thickness of nanocellulose coatings, both in dry and wet state. The film thickness of cast coated layers were studied on metal belt, membrane and plastics by using nanocellulose formulations of industrial MFC or TEMPO-CNF with plasticisers. The optical confocal technique worked with the best accuracy especially for MFC material, but that does not limit the utilization of other techniques for thickness measurements of nanocellulose films. Suitability of a technique for in-process measurements depends on a variety of factors, such as

nanocellulose quality, cost, desired accuracy, space restrictions, process speed, etc. and there cannot be a single device, which can fulfil all the requirements. Therefore, a combination of multiple techniques could potentially be used to create a robust online control system equipped with feedback loops for the production to ensure nanocellulose films of uniform quality in future.

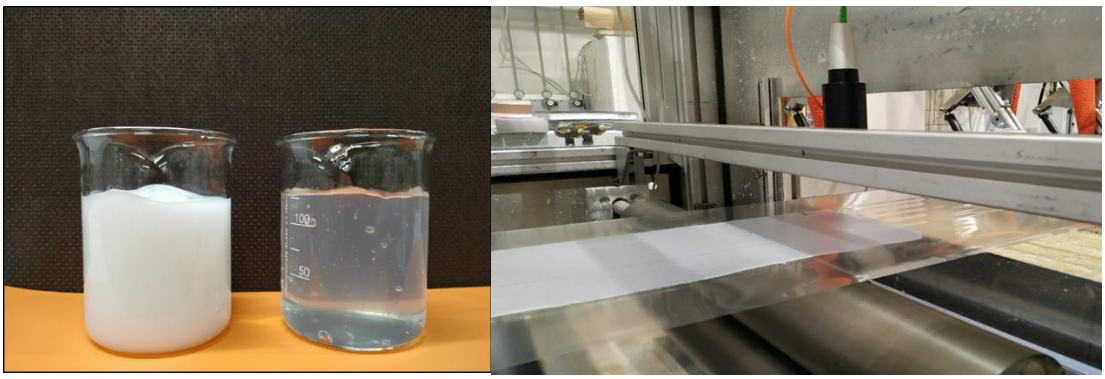

Figure 5. Used industrial MFC or TEMPO-CNF materials (left). On line measurement based on optical confocal technique for measuring film thickness of cast coated layers on plastic in pilot scale.

The presentations in multiple earlier events and conferences were targeted at scientific communities in Universities and research institutes in Sweden, Norway and Austria or industrial and scientific communities in Germany, France, Portugal, Brussels and Slovenia. Scientific results were presented in international conferences and in Finland the project was introduced to a health and safety policy makers including representatives from different ministries and organisations studying or preparing environmental, health and safety guidelines and regulations. The latest workhop was arranged after the review meeting.

Figure 6. Project group in review meeting in April.

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More information: http://www.nanotextsurf.eu/