Working group 3
Cellulose Foams and Films

September 2013

Leader: **Thomas Heinze** (D)
Deputy Leader: **Ellinor Bævre Heggset** (NO)

Member countries:
Germany, Norway, Portugal, France, Austria, Sweden, UK, Netherlands, Denmark, Romania, Hungary, Italy, Switzerland, Spain, Island

Key tasks/ activities:
Consider a wide range of uses of foams and films as well as exploring new opportunities for these materials, such as bioelectrical systems

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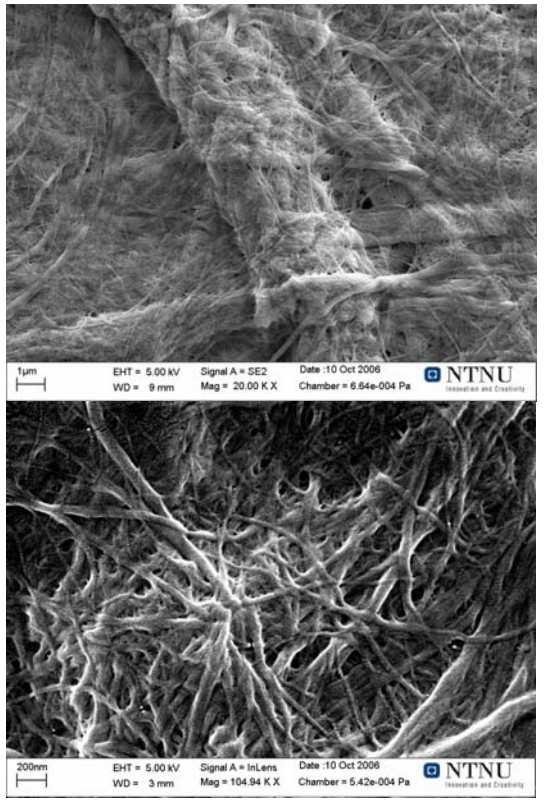
Paper and Fibre Research Institute (NO)

Dr.Ing., Prof Kristin Syverud, PhD Ellinor Heggset

Previous work at PFI:

- Coating of paper or paperboard with nanocellulose
  - ✓Good oxygen barrier
    - Films from nanocellulose gives oxygen barriers comparable to the best fossile-based barriers
    - In next generation oxygenproof liquid boards, nanocellulose can replace aluminium/EVOH as the oxygen barrier
  - ✓Gives increase strength to the packaging
    - Reduction of the total amount of material consumed
  - ✓Gives improved surface properties to the packaging
    - Better printability
  - ✓Challenges
    - Not so good water barrier
    - Brittle material



The fibrils have the ability to form films

Hult, Iotti and Lenes (2010): Efficinet approach to high barrier packaging using microfibrillar cellulose and shellac, Cellulose

Syverud, K. and Stenius, P. (2009): Strength and permeability of MFC films, Cellulose

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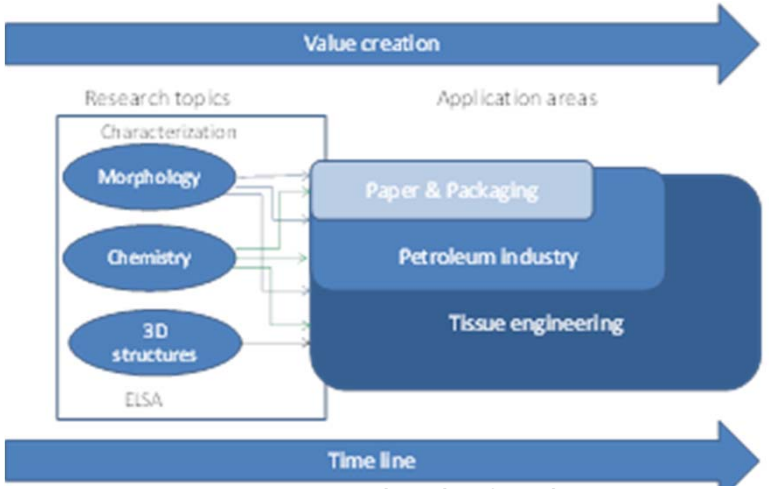
Ways forward / how can PFI contribute to WG3:

✓PFI is leading a new project; NORCEL – The NORwegian nanoCELlulose Technology Platform (Autumn 2013-2018)

✓The project is funded by the Research Council of Norway, and is a nationally coordinated project with participation from research institutes, universities and industry

✓One of the objectives is to obtain more knowledge on engineering of nanocellulose and nanocellulose systems

✓Further, this knowledge will contribute to obtain more expertice in applications as paper and packaging and as materials for tissue engineering



***The NORCEL project**. Sketch of project structure. Generic competence is built up through the research topics. The competence is directed towards the applications having increasing complexity.*

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KU Leuven (BE)
Wim Thielemans

Aim

- Creation of multifunctional films and foams based on cellulose that provide functionality which either doesn't exist yet or has poor performance in existing materials, or provides a unique combination of functionalities not yet attained in existing materials
- Create scalable technology for production to make the new commercially viable (minimal cost) and possible (technology available)

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Ways forward

- Scaled-up production
- Added functionalities (inclusion of other nanoparticles, polymers, reactive compounds)
- Surface modified nanocellulose foams and films

Expertise to contribute

- Scale-up engineering expertise
- Polysaccharide surface chemistry
- Colloid physics (e.g. interactions and rheology) and chemistry

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CARTIF Technology Center (ES)
Cecilia Sanz-Montalvillo

Aim

Development **cellulosic** films & foams **microwavable & biodegradable** useful for **food active packaging,** solving an industrial requirement to answer a consumers demand.

The material developed should:

- **avoid components permeability** from packaging to food according with EU legislation.
- be used by **packaging machines** used by the food industry.
- have a **competitive price** in relation to actual packaging used.

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CARTIF Technology Center (ES)
Cecilia Sanz-Montalvillo

Ways forward

- Promote the use at industrial level of the films & foams developed.
- Test the packaging materials and the quality of the food packed.
- In future project calls put together our industrial partners with high level researchers in order to developed the materials required by the market.

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University of Copenhagen (D)
Søren Barsberg

Aims

- Molecular level analysis/understanding of regenerated cellulose (foams, film, fibres etc.)
- Relationship between spectroscopic observables (IR, Raman, NMR) & cellulose molecular/ultrastructural organization (order, crystallinity, -C6O6-OH conformation, etc.)
- Structural modelling for exploring such relationship (e.g. electronic structure methods, MD)

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University of Jena (D)
Thomas Heinze

Aim

- New cellulose solvents for film- and foam production
- Preparation of cellulose derivatives bearing efficient crosslinkers for advanced applications
- Preparation of bioactive materials for packaging and other applications

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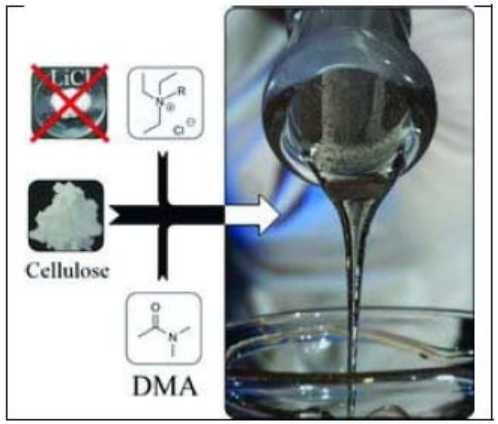
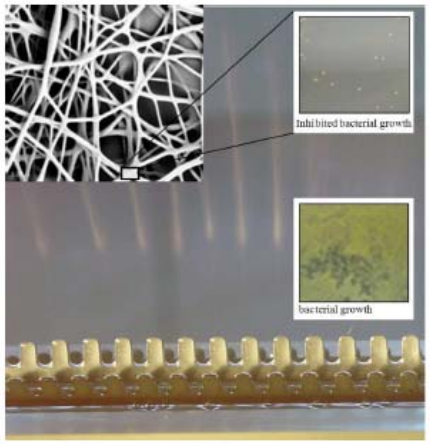
University of Jena (D)
Thomas Heinze

Ways forward

- Utilization of new cellulose solvents (e.g. novel ammonium salts)
- Decoration of cellulose with moieties capable of click- or Diels/Alder reactions
- Electrospinning of bioactive cellulose derivatives
- Upscaling of syntheses



M. Kostag et al., DOI: 10.1002/marc.201300497



K. Roemhild et al., marc.201300588