WP1: Next Generation Packaging Composites - Origins, Activities and Goals

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Work package 1: Next Generation Packaging Composites

Objectives were to understand/ develop

1. water-borne biopolymer-based coating systems that combine high solids content and competitive barrier properties
2. hybrid nanocomposite films containing both cellulose whiskers and nanoclays for advanced packaging applications,
3. a computational model to identify the key interactions between biopolymer, plasticizer and clay that give rise to the excellent barrier properties of dispersion coatings and self-supporting films
4. a gas permeation model which can be used to deliver the desired mass transport properties of industrially produced nanocomposite coatings and reliably describe critical structure-property relationships.

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Fellow No.	Reseracher	Reserach projct	Host institution
ESR1	Yana Petkova-Olsson	Rheological properties and microstructures of coating dispersions and their impact on the architecture of the dry coating layer.	Karlstad University
ESR2	Nikita Siminel	Using nanoscale computational models to probe the barrier properties of dry, clay-based coatings.	Sheffield Hallam University
ESR3	Jon Trifol Guzman	Novel hybrid PLA based nanocellulose/nanoclay composites for food packaging applications.	Danish Technical University
ESR4	Çağlar Meriçer,	MFC-PLA multilayer films as sustainable gas barriers for packaging applications.	University of Bologna
ER1	Kalina Malinova-Tonigold	The development of printable, high barrier, mineral based coatings for packaging applications.	IMERYS & Chesapeake

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Current trend:

- Renewable packaging materials
- Biodegradable packaging materials

Still most packaging plastics and coatings are non-renewable and non-biodegradable.

Use of fillers may enhance the barrier properties of the bioplastics, especially in the case of layered silicates

- Ordered structures of platy fillers
- Layered structures
- Nano materials

Another additive that has shown promising results in lowering OTR and WVTR of barrier films is nano-fibrillar cellulose (and similar grades) that can be produced from wood.

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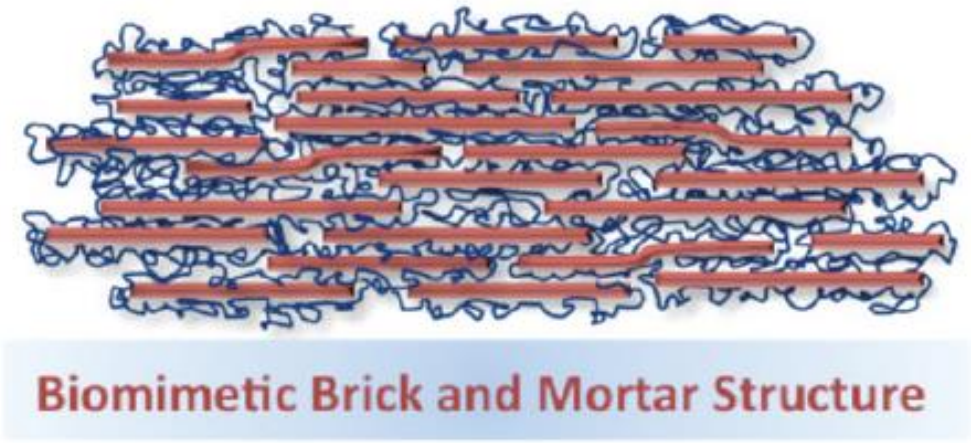
The ideal structures are mimicking naturally occurring biological nano composites with highly ordered layer-by-layer structures.



[A. Walther, I. Bjurhager, J.-M. Malho, J. Pere, J. Ruokolainen, L. A. Berglund, O. Ikkala; *Nano Lett.* **2010,** *10*, 2742–2748]

Work-package 1: Next Generation Packaging Composites

In this work-package we have learned about

- How regular starch can be made temperature responsive and by that be used in order to create different structures just by changing temperature.
- How swelling of the nano clay galleries can be controlled with corresponding improvements in barrier properties
- How nano-fibrillar cellulose and cellulose nanowhiskers can be incorporated in PLA films resulting in improved barrier and thermomechanical properties
- How the barrier properties of PLA can be improved by a bi-layer structure. PLA has otherwise a oxygen transmission rate between PS and PET

…. and much more.

The next presentations will give you some highlights from WP 1.