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# HIERARCHICAL MATERIALS BASED ON NANOCELLULOSE AND POLY(LACTIC ACID)

Manon Guivier<sup>a</sup>, Giana Almeida<sup>a</sup>, Sandra Domenek<sup>a</sup>, Chloé Chevigny<sup>a,\*</sup>

<sup>a</sup> *Université Paris-Saclay, INRAE, AgroParisTech, UMR SayFood, Palaiseau, France*

\* [chloe.chevigny@inrae.fr](mailto:chloe.chevigny@inrae.fr)

Nanocelluloses have shown excellent gas barrier properties which makes them of the highest interest for food packaging applications [1]. However, the nanocelluloses swelling, in presence of water vapor, thwarts their good gas barrier properties [2]. Consequently, the use of nanocelluloses in food packaging, while extremely promising, is still a challenge. A multilayer architecture starting with an hydrophobic layer of poly(lactic acid) (PLA) could be a solution to protect nanocelluloses. Different studies have been devoted to the use of nanocelluloses as fillers in a PLA matrix [3], but here, a new architecture was developed by depositing layers of nanocelluloses on PLA.

The coverage of PLA films by nanocelluloses was achieved by using a first layer of chitosan. The surface organization of the nanocellulose layers was studied by AFM (Fig.1, a, b and c). The cellulose nanocrystals showed orientation (Fig.1a), which was confirmed by FFT treatment of the images. Concerning the food packaging-related properties, dry and wet O<sub>2</sub> barrier properties were studied on films with different nanocelluloses layer thicknesses (see Fig.1d). Results are very promising, with our samples' O<sub>2</sub> permeation several orders of magnitude lower than PLA, and staying so at high humidity (80% RH).

The multilayer architecture is very efficient to obtain highly performing food packaging films and the protection of the nanocellulose layer by PLA allows to keep this performance over a large range of relative humidity [4].

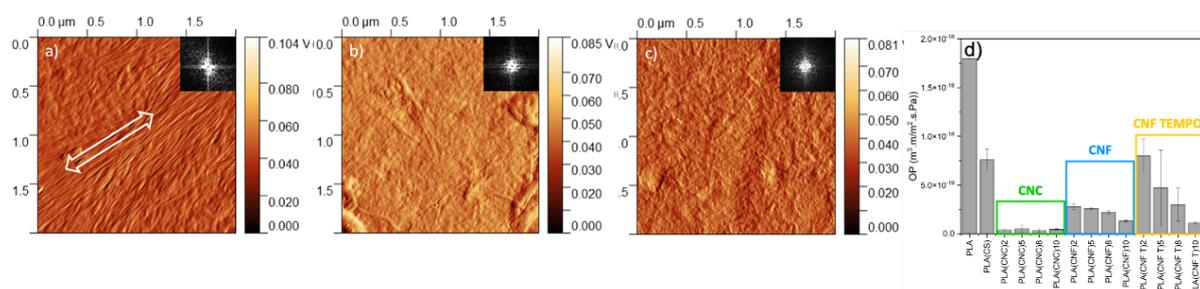


Figure 1 : AFM images of the sample surfaces coated with 10 deposits of CNC (a), CNF (b) and CNF TEMPO (c), and dry Oxygen permeabilities of uncoated and coated-PLA (d).

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