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HIERARCHICAL MATERIALS BASED ON NANOCELLULOSE AND POLY(LACTIC ACID)

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INTRODUCTION

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.

RESULTS AND DISCUSSION

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 O₂ barrier properties were studied on films with different nanocelluloses layer thicknesses (see Fig.1d). Results are very promising, with our samples' O₂ permeation several orders of magnitude lower than PLA, and staying so at high humidity (80% RH).

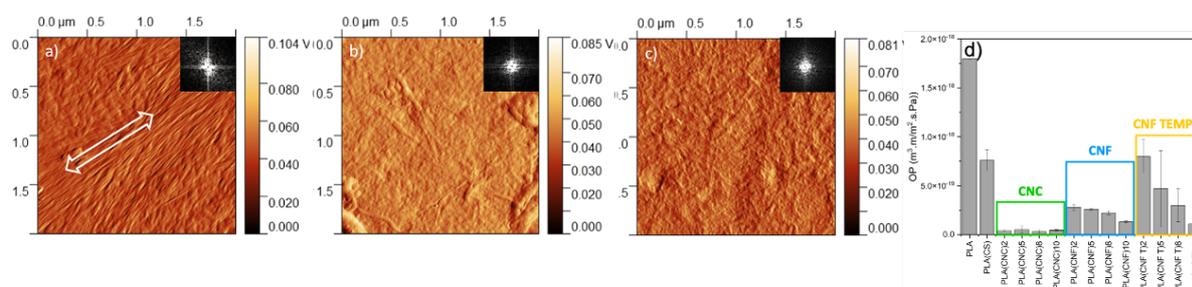


Figure 1. AFM images of the sample surfaces coated with 10 deposits of CNC (a), CNF (b) and CNF TEMPO (c), and dry Oxygen permeabilities of uncoated and coated-PLA (d).

CONCLUSIONS

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.

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