

# USING NANO-ADDITIVES TO INCREASE THE OXYGEN BARRIER OF POLYMERS

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The aim of this work is to increase the gas barrier of packaging polymers by using inorganic nano-scale additives. Barrier improvements by an order of magnitude have been reported by Cerisuelo *et al.* by using nanoclay. [1] The effect of nano-additives is expressed by a tortuous path for the permeant molecules, thus increasing the diffusion length. [2]. The primary objective of the work at hand is to assess the barrier properties of nanoclay mixed into in common thermoplastics via hot-melt technique. The aim is to assess applicability of hot-melt technique for give goal and first and foremost to fine tune the hot-pressing and compounding methodology in order to produce samples that are homogenous and thin enough ( $<100\mu\text{m}$ ) for objective barrier measurements. The following results give an assessment about the exfoliation, orientation and dispersion of nanoclay platelets inside the polyamide films. Changes in the mechanical properties are also described.

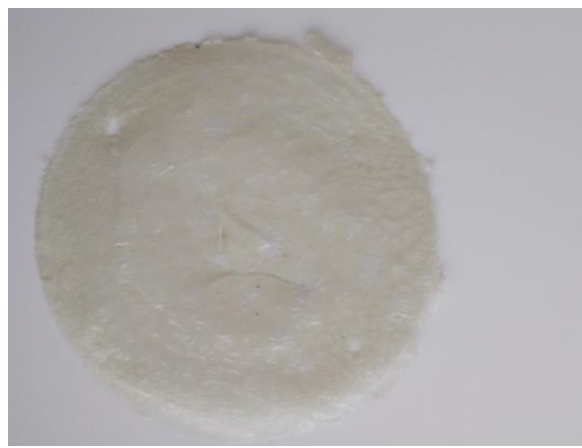


Fig.1 Polyamide-nanoclay film sample

First tests using a twin-screw extruder and subsequent hot-pressing method have revealed the impact of nano-particles on the mechanical properties of polyamide, making the samples too stiff to be removed from the mold without damaging them. Various modifications were introduced to the mold, also different temperature and pressure settings were applied in order to obtain samples that would be sufficiently homogenous and defect-free for oxygen transmission rate (OTR) measurements.

## References

1. Cerisuelo, Josep Pasqual, José Alonso, Susana Aucejo, Rafael Gavara, and Pilar Hernández-Muñoz. "Modifications Induced by the Addition of a Nanoclay in the Functional and Active Properties of an EVOH Film Containing Carvacrol for Food Packaging." *Journal of Membrane Science* 423–24 (December 15, 2012): 247–56.
2. Kim, Seong Woo, and Sang-Ho Cha. "Thermal, Mechanical, and Gas Barrier Properties of Ethylene-Vinyl Alcohol Copolymer-Based Nanocomposites for Food Packaging Films: Effects of Nanoclay Loading." *Journal of Applied Polymer Science* 131, no. 11 (June 5, 2014)



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