Elaboration of biobased PA11/PLA multinanolayer films and impact of confinement of PLA layers on gas and water barrier improvement

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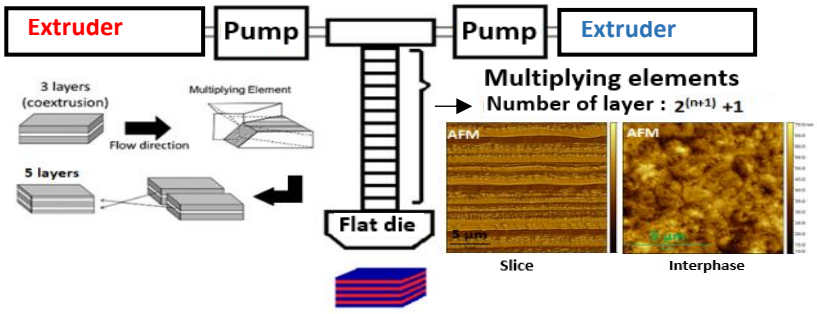
Various industrial sectors, including energy, transport, aeronautics, cosmetics, packaging, and biomedical, are using multilayer polymer films. For applications as food packaging, the barrier properties against small molecules (O_2 and H_2O) are one of the required properties with thermal and mechanical properties. Currently, industrially produced multilayer films contain only few layers (between 2 and 9 layers) due to limitations in extrusion processes. Thanks to new experimental process of co-extrusion, it is possible now to reach several hundred or even thousands of thin layers which led to an improvement of barrier properties. In another hand, bio-based polymers and specifically poly(lactic acid) (PLA) have recently attracted attention to replace petro-based polymer and then to reduce plastics' environmental footprint. However, PLA shows weak mechanical properties which hinders its industrial use. It is already known that the confinement of PLA in thin layers along with a crystalline orientation led to a reduction of the water permeability and to an increase of the barrier properties against gases [1]. In this work, we choose two semi-crystalline bio-based polymers with two distinct glass temperatures, the purpose is to induce confinement effects and to control the orientation of crystals and then to improve barrier and physical properties [2,3]. The originality of this work is based on the use of two bio-based and semi-crystalline polymers. According to the first results, water permeability for the 3 and 129-layer films has decreased, showing improvements in barrier properties. With the multilayer film of 2049 layers, the heterogeneity of the film has hindered the improvement of water permeability.



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