

## Development of Biaxial Oriented Polylactide-based Films for Flexible Packaging

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From single-use plastics pollution, biodegradable packaging is a promising eco-friendly solution. Polylactide (PLA) is accepted with high clarity, high tensile strength, and reliable industrial-scale production, similar to polystyrene and polyethylene terephthalate performances. However, PLA is very brittle, low crystallization rate, and high cost which limit PLA in packaging field. Recently, we successfully prepared the super-tough PLA film under fast biaxial stretching and high draw ratio in which isotropically small lamellae were created. Additionally, the study of biaxial orientation (BO) process was further extended to PLA-based blends (i.e. PLA/thermoplastic starch (PLA/TPS), PLA/silane-modified TPS (PLA/mTPS), and PLA/polyethylene glycol (PLA/PEG)). PLA crystals in BO-PLA/TPS and BO-PLA/mTPS films were obviously enlarged. Meanwhile, silane-modified starch for compatibility improvement in PLA/mTPS blend also provided the more compact lamellae packing. These changes of microstructures led to extremely improved elastic modulus and also prevented retrogradation of mTPS. In the case of BO-PLA/PEG film, the highly transparent and flexible film was obtained, especially PEG with high molecular weight. The presentation will cover microstructural analyses in details for the developed BO-PLA-based films, and also establish the relationship between the structures and physical properties for potential use as flexible packaging films.

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