Mechanical Property Characterizations of Reprocessed Multi-Layer Packaging Blends

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Polyolefin (PO) based multilayer plastic packaging (MPP) has recently attracted extensive attention. However, practical end-of-life treatment strategies for MPP are missing from the community. One primary concern is the performance of recycled MPP material since it consists of many phases of polymers. This study aims to assess the effect of multiple thermal treatment cycles on the mechanical properties of MPP blends. The hypothesis is that the thermal treatment of plastic blends will significantly decrease the mechanical performance of the mixture. A multilayer plastic film consisting of low density polyethylene, maleic anhydride grafted linear low density polyethylene, and poly(ethylene-co-vinyl alcohol) (EVOH) was thermally compounded for six cycles to characterize the impact of thermal compounding on the material mechanical performance. After each compounding, the mixture was ground into pellets for injection molding to manufacture the mechanical testing specimens. The color of the specimens became darker after each thermal compounding. The tensile property results showed no significant decrease in tensile strength for thermal compounding for six cycles. The toughness of the blends, which was characterized as the essential work of fracture, also started to decrease after the thermal compounding for four cycles. The thermal degradation of the mixtures, especially EVOH, was proposed as the possible reason for the blends' color change. The MPP blends maintained the mechanical properties up to four cycles of thermal compounding in this study. Further research characterizing the thermal and morphological properties of the blends is needed