Impact of Melt Filtration on the Flow-index and Thermal Profiles of Recycled PP/$CaCO_3$ Composites

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Abstract:

Post-industrial polymer waste, generated from the extrusion of polypropylene (PP) waste containing mineral fillers such as minerals, presents significant challenges for high-quality mechanical recycling. This study investigates the impact of melt filtration mesh size, ranging from 60 to 150 mesh, during extrusion reprocessing on the melt flow index and thermal behavior of recycled PP/CaCO3 composite formulations. In this process, filter screens are placed inside the extruder, where a higher mesh number corresponds to a smaller aperture size, thereby providing a stronger filtration efficiency of the recycled content. The melt flow index (MFI) was evaluated to assess flow behavior and thermomechanical degradation induced by the equipment. Thermogravimetric analysis (TGA) was conducted to determine filler retention, residual content, and overall thermal stability shifts. Differential scanning calorimetry (DSC) provided insight into changes in melting behavior, degree of crystallinity, and the nucleation efficiency of redistributed calcium carbonate particles. Preliminary findings indicate that finer filtration meshes effectively remove coarse particulate agglomerates and crosslinked gels, improving melting homogeneity. However, the associated increase in processing pressure promotes chain scission of the PP matrix. Optimizing screen pack selection balances contaminant removal with polymer chain integrity for post-industrial PP upcycling to injection molding application.