

Title : Investigation of the Physical, Mechanical and Thermal Properties of Reprocessed Nylon 6,6

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ABSTRACT

Nylon 6,6 is a widely used engineering plastic in the automotive industry due to its excellent mechanical properties and heat resistance. However, when nylon 6,6 undergoes recycling processes, its properties may change. This study aims to investigate the mechanical, thermal, and physical properties of nylon 6,6 after five extrusion cycles and to evaluate its potential for reuse. The results indicate that the melt flow rate of nylon 6,6 increases by more than 50% after two or more extrusion cycles, suggesting a decrease in molecular weight due to thermal degradation. This leads to a reduction in impact strength by more than 50%, a tensile strength reduction of up to 40%, and a 25% decrease in flexural strength after five cycles. Fourier Transform Infrared (FT-IR) analysis reveals the appearance of carbonyl (C=O) peaks in the aldehyde functional group after four extrusion cycles, indicating thermal degradation. Differential Scanning Calorimetry (DSC) analysis shows no significant changes in thermal properties after five extrusion cycles.

In the recycling process, nylon 6,6 that has undergone two extrusion cycles was mixed with virgin nylon 6,6 at 10% w/w and 20% w/w ratios. The mechanical properties of both mixtures were lower than those of virgin nylon 6,6, likely due to significant molecular structure changes in the twice-extruded material compared to material extruded once. As a result, a new formulation was developed by incorporating 5 %w/w of nylon 6,6 extruded once. DSC analysis shows that the specific heat capacity change (ΔC_p) of the new mixture closely resembles that of virgin nylon 6,6, indicating better retention of properties.