

The Study of the Physical, Chemical and Mechanical Properties of Recycled Thermoplastic Polypropylene and Polyamide Materials Used in the Automotive Industry

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Abstract : Thermoplastic materials are widely used in the automotive industry due to their lightweight nature, durability, recyclability and versatility in shaping. They serve various purposes in the automotive sector, including interior and exterior components, vehicle body parts and insulation. The recycling of thermoplastic polymer materials used in the automotive industry helps reduce waste and mitigate environmental impacts. The aim of this study is to facilitate the recycling of thermoplastic materials used in the automotive industry. Recycled materials, such as sprues and defective parts, are generated from thermoplastic polymer materials used in the automotive sector after the injection process. In this study, the physical, chemical and mechanical properties of the recycled parts obtained from the reprocessing of these materials were determined through various tests. Thermoplastic products (PP and PA) that were recycled after the injection process were processed through a grinding unit and then subjected to a second injection process with physical, chemical and mechanical tests applied to the resulting products. This is a result of the initial grinding process. The same procedures were applied to each thermoplastic material through a series of steps first injection, first grinding, second injection, second grinding, third injection, third grinding, fourth injection and fourth grinding, followed by product testing. Subsequently, the test results of the original raw material's Technical Data Sheet (TDS) were compared with the results obtained from the products after the injection process to determine the raw material based on physical, chemical and mechanical changes. The study included tests for Density, Melt Flow Rate, Tensile Modulus, Tensile Stress, Flexural Modulus (Injection Molded), Charpy Notched Impact Strength, Notched Izod Impact Strength, Shore Hardness, Heat Deflection Temperature, Vicat Softening Temperature and UV tests. Additionally, more specific tests such as Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Heat Aging, FTIR, SEM and TEM analyses were conducted to examine structural changes in thermoplastic materials subjected to multiple recycling processes. In the later stages of the study, injection molding process trials will be conducted with raw materials such as ABS, PC, PC-ABS and PE.

Keywords : injection molding, recycling, automotive, polypropylene, thermoplastic

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