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Investigation of Behavior of Aliphatic Polyketone under the Effects of Recycling and UV

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Abstract. One of the important issues and tasks to be solved today is how to reduce the negative effects of plastic use on the environment. This study examines the applicability of polyketone with an aliphatic structure, which can be classified in the group of technical plastics, after mechanical recycling. Samples were reprocessed once and five times under identical injection molding conditions to assess degradation and chemical changes. After recycling, UV radiation tests were performed on both virgin and repeatedly reprocessed samples, along with melt flow index measurements. The effects of UV radiation on polymers range from physical changes, such as discoloration, to chemical modifications, including photooxidative degradation. In some cases, both phenomena must be considered during processing. The aim of the study is to detect the changes that have occurred in the unfilled aliphatic polyketone under the influence of UV radiation. Standard injection-molded specimens were stored in a UV chamber for durations equivalent to one to five years of radiation. The resulting changes, including new chemical bond formation, oxidative degradation, and crosslinking, were analyzed using FT-IR spectroscopy and melt flow index measurements.

1. Introduction

The utilization of plastic waste has been a priority area in the plastics industry in recent years. By transposing the guidelines developed by the European Union into regulations, many specific tasks are assigned to industries that use large amounts of plastic. The EU prescribed recycling ratios broke down into sectors, which must be implemented by a given date [1,2]. As a result, in the packaging, electronics, and automotive industries, an ever-increasing proportion of waste needs to be utilized in its material, i.e., instead of utilizing landfills and incinerators, the production of new products should be prioritized. Mechanical recycling remains the most energy-efficient and sustainable option for managing used plastic [3]. However, to ensure its continued improvement, sustained investment in high-quality infrastructure is essential. Plastic recycling has multiple dimensions, as researchers, engineers, and much of society regard it as an environmental issue. In addition, the manufacturing industry primarily views recycling from a material perspective, while assembly plants using plastic parts focus on maintaining the quality of products made from secondary materials, as customer expectations remain high [4]. Apart from these factors, which often have a strong emotional and economical charge, a very complex field of polymer materials science unfolds in the mapping of this problem, the main pillars of which are polymer blends, filled polymer systems, physical and mechanical property modifications with additives, reinforcing materials or technologies (e.g., multi-