

Rubber toughened plastics from thermoplastic waste and rubber waste

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ABSTRACT

A huge amount of plastic and rubber waste is generated on a daily basis around the world and due to the reason that both rubber and plastic do not degrade naturally and poses a high threat to the environment. Therefore, a viable option for this would be to find a useful application for such rubber and plastic waste generated. Toughening of plastics by adding and mixing rubber has been a recent method of improving the properties of plastic materials. The process of mixing the two types of materials is complex and the properties of the end product depends on several factors. Polystyrene and Styrene butadiene rubber was mixed and the product with the optimum properties was chosen. Moreover, the mixing process parameters were identified and afterwards the mixing of recycled styrene-butadiene rubber and polystyrene was carried out.

KEYWORDS: Polystyrene, Styrene butadiene, toughening

INTRODUCTION

Rubber toughening is a process in which rubber nanoparticles are interspersed within a polymer matrix to increase the toughness of the material. By "toughening" a polymer, the ability of the polymeric substance to absorb energy and plastically deform without fracture is increased. Rubber toughening is a complex process and to toughen a polymer, several factors regarding the polymer and the rubber to be used must be considered. The main objective of the research was to develop a rubber toughened plastic using thermoplastic waste and rubber waste.

METHODOLOGY

Investigating the failure mechanisms of plastics, rubber toughening of plastics, rubber toughening mechanisms were studied initially to get a broader understanding of the phenomenon. Then, analysis and studies were carried into the changes that occur in plastics after rubber toughening and how the rubber particles aid in increasing the impact resistance of plastics and then identified the factors that affect the rubber toughening of plastics and how each factor contributes to the mechanism. It was identified that the mixing

time of the components, mixing temperature and mixing speed were the main factors that affected the properties of the final product. Polystyrene was used as the plastic and Styrene-Butadiene was used as the rubber material. Several samples were made using pure plastic and rubber while varying the mixing parameters. Each sample was tested to obtain important properties such as impact strength, tensile strength, and hardness. After analyzing all the samples, the optimum process parameters were decided. Under such parameters, pure polystyrene was mixed with recycled rubber powder to obtain a product using waste. The properties of that sample were tested to determine its characteristics.

RESULTS AND DISCUSSION

The results obtained from this experiment showed that the optimum rubber toughened plastic is obtained at the 1:1 weight ratio of polystyrene and rubber at 180 °C temperature and 10 mins of mixing time. The sample has one of the relatively highest impact strengths and tensile strengths among the samples.

CONCLUSIONS

Styrene-butadiene rubber can be used to toughen polystyrene plastic. Hence, increasing the toughness and the impact strength of the material makes it suitable for applications involving protection against high impact collisions. Similarly, recycled polystyrene can be mixed with recycled

styrene-butadiene rubber to obtain a product with similar properties which in turn provides an ideal alternative for the huge amount of rubber and plastic waste generated daily.

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