The Development of Rubber/Polyethylene Compounds from Recycled Waste

By

Anne Fernando

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Abstract

In recent years, elastomeric rubber-plastic blends have become technologically interesting for use as thermoplastic elastomers (TPE). They can have many of the properties of rubbers, but they can be processable as thermoplastics.

This project looked into the processing conditions and upscalling of recycled rubber/plastic blends. Recycled elastomers were obtained from commercial sources, and included a mixture of styrene-butadiene rubber (SBR), and natural rubber (NR), with two different mesh sizes. A blend of recycled Linear Low Density Polyethylene (LLDPE) and Low Density Polyethylene (LDPE) was used as the thermoplastic polymer matrix.

In this study, the crumb rubber and polyethylene has been characterised. Then having noted some of their properties, rubber/plastic blends were prepared by melt mixing, in a Haake Batch mixer varying test temperature and residence time.

Four different compatibilization techniques were used to improve the compatibility at the interface between the rubber particles and polyethylene, these were: 1) Titanate Coupling Agent, 2) Silane, 3) IBE (ethylene-co-glycidyl methacrylate) 4) Delinker.

Attempts were also made to assess the extent to which the devulcanization system scissions the crosslinks in the rubber vulcanizate by means of an experimental grade delinker.

Results indicate that the best method of processing was melt blending in a Haake batch mixer compared to a twin screw extruder. A 32% improvement was found for the control blend when blended in the Haake mixer compared with the twin-screw extruder. IBE compatibilized blends and delinked rubber/plastic blends gave better tensile properties when compared with silane and titanate coupling agents compatibilized blends. Delinked, rubber/NR compounds also had superior elongational capability. Recycled elastomers with smaller particle size were observed to improve mechanical properties of resultant blends.

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