

Thesis Title A Study to Develop Thermoplastic Elastomers
 from Natural Rubber and Plastic Blends

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ABSTRACT

The present work involved the study of the preparation and properties of natural rubber (NR) and polypropylene (PP) blends. The aim was to develop thermoplastic elastomers from these blends. Thus, parameters which might affect the properties of blends were studied, viz. grades of PP used, viscosity of NR, mixing method, quality of mixing, composition of NR and PP, crosslinking agents, and moulding temperature and time. The morphology and rheological properties of the blends were also studied together with preliminary study of compounding of the blends for shoe sole applications.

The results obtained indicated that copolymer grade of PP and standard NR (TTR 5L) were necessary for the attainment of good quality blends. Mixing of NR and PP was best done at 175°C by premelting PP first, then adding NR and blending for 5-7 minutes depending on composition of blends. The results also showed that crosslinking of NR/PP blends was necessary since it gave blends with better tensile and elastic properties than the uncrosslinked blends. It was found that DCP is a better crosslinking agent in term of the

properties yielded than HVA-2. However, blends crosslinked with DCP exhibited poor ageing properties. This could be corrected by changing the crosslinking system to a mixture of DCP and HVA-2 in the ratio 1:10. SEM study of NR/PP (60/40) blends revealed that PP was the dominant phase for uncrosslinked, HVA-2 crosslinked and 1:10 of DCP:HVA-2 crosslinked blends, for DCP crosslinked and 10:1 to 1:5 of DCP:HVA-2 crosslinked, the SEM micrographs showed that NR and PP were co-continuous phases. For NR/PP 70/30 blends, SEM micrographs showed that NR was the continuous phase while PP was the dispersed phase. The NR/PP blends prepared also exhibited anisotropy in mechanical properties but the differences in properties in the along and across directions could be reduced by increasing the moulding temperature to 210°C, annealing specimens at 180°C for 7 minutes, or by moulding small pieces of the specimen randomly distributed in the mould, the last method being the most effective.

Compounding study of NR/PP blends for shoe sole application showed that silica was the best filler for improvement of abrasion resistance of the blends. However, more study of compounding of NR/PP blends is required in order to further improve the abrasion resistance of the blends.