Preface

Short natural fibre reinforced elastomer composites are high performance structural materials, in which a rubber matrix is combined with natural fibres. The enhanced mechanical performance of the short fibre reinforced rubber composites is due to the combination of the elasticity of the rubber matrix and the high specific stiffness of the fibre. Now a days, a lot of research is being carried out in the field of short natural fibre reinforced elastomer composites. However, no detailed systematic investigations on mechanical, rheological, dielectric, thermal and transport behaviour of short sisal fibre reinforced SBR composites have been reported till date. Hence a detailed study has been conducted on the aforesaid properties of sisal/SBR composites. The results were analysed and reported in the thesis with special reference to the effect of pretreatment of fibres, chemical modification of fibres, incorporation of bonding agent, fibre concentration and fibre orientation.

The subject matter of this thesis has been presented in eight chapters:

The first chapter consists of a detailed review of the earlier work done in the field of short fibre reinforced rubber composites and the scope of the present work. The review covers the important studies conducted on short fibre composites based on thermoplastics, thermosets and elastomers. Studies on both natural and man made fibres have been covered in this review.

The details of the materials used, experimental techniques and the details of the equipments used in the present work are described in the Chapter 2. Surfaces of the fractured specimen were examined using a JEOL Scanning Electron Microscope. Optical microscopy is used in the analysis of extrudates morphology and restricted equilibrium swelling characteristics were used to analyze the fibre-matrix interface bonding.

Chapter 3 contains the results of the studies on the effects of fibre length, fibre concentration, bonding agent on the mechanical and processing behaviour of the untreated sisal fibre reinforced SBR composites. The effects of fibre aspect ratio, fibre concentration, and incorporation of bonding agent on the short sisal fibre reinforced styrene butadiene rubber composites were evaluated.

The effects of different types of pretreatments (water treatment, salt water treatment, benzene-alcohol mixture treatment, SBR solution treatment and PSMA coating), chemical modification of fibres(mercerisation, acetylation, benzoylation, permanganate treatment and benzoyl peroxide treatment) and incorporation of bonding agent(hexa-resorcinol system) on the mechanical behaviour of sisal-SBR composites are described in the fourth chapter.
The melt rheological behaviour and morphology of sisal/SBR composites were measured using an Instron Capillary rheometer attached to a UTM. The flow properties of the composites, their die swell behaviour and the extrudate distortion are described in chapter 5.

The diffusion and transport of aromatic solvents through sisal/SBR composites were evaluated in order to understand the fibre-matrix interface adhesion. Sorption gravimetric method was used to monitor the diffusion process. The results of these studies are discussed in chapter 6.

The dielectric properties of sisal/SBR composites were measured directly using a 4192 LF Impedance Analyzer (Hewlett-Packard, USA) by varying the frequencies. The dielectric properties are explained in chapter 7.

Chapter 8 explains the dynamic mechanical thermal properties of sisal/SBR composites filled with untreated and chemically treated fibres and bonding agent. Attempts have been made to correlate the visco elastic properties with the strength of interface bonding.

The TGA and DSC studies were undertaken in order to analyse the thermal behaviour of the composites. The results are depicted in Chapter 9. The detailed kinetic investigations on the degradation of the composites were also analysed in this chapter.

Finally the summary, the important conclusions and future outlook are presented in Chapter 10.