Preface

The ever-increasing requirement for high performance polymers has attracted polymer scientists and researchers to focus their efforts in the area of polymer science and technology for the development of new polymer blends. Through the blending of high cost, high performance polymers with low cost polymers or fillers, it is possible to achieve a significant reduction in the cost of the material. Although blending of two or more polymers is done to come up with the right combination of properties in a single product, making it more advantageous, it is not always successful or readily feasible. This may be due to the inherent incompatibility between the polymers which are to be blended. One solution to this problem is to add a ‘compatibilizer’ to the system, which increases the compatibility between the two incompatible and immiscible polymers. Recent studies have extended the work on compatibilized blends by using nanoparticles as an alternative to ‘compatibilizers, for’ immiscible polymer pairs.

This thesis reports the role of nanofillers in compatibilizing the immiscible and incompatible natural rubber/nitrile rubber blend. The present study is based on the preparation method, blend composition and filler loading of incompatible and immiscible NR/NBR blends. The content of this thesis is divided into 9 chapters. Chapter 1, the introduction, describes the general aspects regarding polymer blends, its classification, compatibilization, theory of compatibilization using nanoparticles and the general characterization techniques, with the support of literature survey. The scope and objectives of the present study are also described in this chapter. The second chapter covers the material details and experimental techniques employed in this study.

The compatibilizing action of the nanoparticles depend greatly on the degree of dispersion and distribution of the nanoparticle, which in turn is influenced
by the preparation method. The third chapter discusses the effect of preparation method on the final properties of NR/NBR blend nanocomposites. Chapter 4 mainly discusses the role of compatibilizing action of nanoclay on the NR/NBR blend system, by analysing the morphological, physicomechanical and thermomechanical properties. The localisation of nanoclay influenced by different parameters and their role in enhancing the final properties are also discussed. Chapter 5 deals with the transport properties of the blend nanocomposites, the various factors influencing it and the theoretical comparison of the experimental results.

To know the service performance of a material it is important to know the time dependent properties. Chapter 6 describes, the effect of nanoclay on the time dependent properties like stress relaxation behaviour, based on the filler loading, temperature and nanoclay modification. The results are explained based on two theoretical modelling. The effect of nanoclay addition on gas permeability was also studied and the results are discussed in chapter 7 with a detailed modelling of the NR/NBR blend system as well as of the nanocomposites. The effect of nature of the penetrant also is included in the chapter.

The influence of nanoclay in the viscoelastic properties based on the blend composition, filler loading and nature of filler are discussed in chapter 8. The thermal conductivity of the NR/NBR blend nanocomposite with different nanoclay modification and blend composition is also discussed in chapter 8. The conclusion and the major findings of this research work and future scope are discussed in chapter 9.

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